BOEING

WARNING
DO NOT USE THIS MANUAL OR ANY OF THE RELATED MATERIALS IN ANY WAY IN THE OPERATION, USE OR MAINTENANCE OF ANY AIRCRAFT. THESE MATERIALS HAVE BEEN PREPARED AND ARE PROVIDED SOLELY TO GIVE GUIDANCE ON THE LAYOUT AND STRUCTURE OF A TYPICAL AIRCRAFT MANUAL. THESE MATERIALS HAVE NOT BEEN APPROVED BY ANY AVIATION ADMINISTRATION FOR USE ON ANY AIRCRAFT AND SHOULD NEVER BE SO USED UNDER ANY CIRCUMSTANCES. FAILURE TO FOLLOW THIS WARNING COULD LEAD TO SERIOUS INJURY OR DEATH.

737-600/-700/-800/-900/ -900ER

Flight Crew Operations Manual

The Boeing Company

Document Number D6-27370-TBC
Revision Number: 54
Revision Date: March 30, 2024

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Volume 1

Volume 2

Preface — Chapter 0
Model Identification — Section 1

General

The aircraft listed in the table below are covered in the Flight Crew Operations Manual (FCOM). The numbers are used to distinguish data peculiar to one or more, but not all of the airplanes. Where data applies to all airplanes listed, no reference is made to individual airplane numbers. Configuration data reflects the airplane as delivered configuration and is updated for service bulletin incorporations in conformance with the policy stated in the introduction section of this chapter.

Registry number is supplied by the operator as provided by the national regulatory agency. Serial and tabulation numbers are supplied by Boeing.

Registry number(s) reflect the most current information supplied by the operator to the Boeing Company through the SR process and 60 days prior to the subject revision date. Registry numbers received after that date will be incorporated at the next scheduled revision. If a registry number is not provided the FCOM will default to serial number.

Registry Number	Serial Number	Tabulation Number
YX600	YX600	YX600
YX700	YX700	YX700
YX800	YX800	YX800
YX802	YX802	YX802
YX900	YX900	YX900
YX910	YX910	YX910

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General

This Flight Crew Operations Manual (FCOM) has been prepared by The Boeing Commercial Airplanes, Commercial Aviation Services organization. The purpose of this manual is to:

- provide the necessary operating limitations, procedures, performance, and systems information the flight crew needs to safely and efficiently operate the 737 airplane during all anticipated airline operations
- serve as a comprehensive reference for use during transition training for the 737 airplane
- serve as a review guide for use in recurrent training and proficiency checks
- provide necessary operational data from the FAA approved airplane flight manual (AFM) to ensure that legal requirements are satisfied
- establish standardized procedures and practices to enhance Boeing operational philosophy and policy.

This manual is prepared for the owner/operator named on the title page specifically for the airplanes listed in the "Model Identification" section. It contains operational procedures and information, which apply only to these airplanes. The manual covers the Boeing delivered configuration of these airplanes. Changes to the delivered configuration are incorporated when covered by contractual revision agreements between the owner/operator and The Boeing Company

This manual is not suitable for use for any airplanes not listed in the "Model Identification" section. Further, it may not be suitable for airplanes that have been transferred to other owners/operators.

Owners/operators are solely responsible for ensuring the operational documentation they are using is complete and matches the current configuration of the listed airplanes. This includes the accuracy and validity of all information furnished by the owner/operator or any other party. Owners/operators receiving active revision service are responsible to ensure that any modifications to the listed airplanes are properly reflected in the operational procedures and information contained in this manual.

This manual is structured in a two volume format with a quick reference handbook (QRH). Volume 1 includes operational limitations, normal procedures, supplementary procedures, dispatch performance data, and inflight performance data. Volume 2 contains systems information. The QRH contains all checklists necessary for normal and non-normal procedures as well as inflight performance data.

The manual is periodically revised to incorporate pertinent procedural and systems information. Items of a more critical nature will be incorporated in operational bulletins and distributed in a timely manner. In all cases, such revisions and changes must remain compatible with the approved AFM with which the operator must comply. In the event of conflict with the AFM, the AFM shall supersede.

This manual is written under the assumption that the user has had previous multi–engine jet aircraft experience and is familiar with basic jet airplane systems and basic pilot techniques common to airplanes of this type. Therefore, the FCOM does not contain basic flight information that is considered prerequisite training.

Please send all correspondence regarding content or use of this manual including bulletin status, to the 737 Manager, Flight Technical Data through the Service Requests (SR) application on the MyBoeingFleet home page.

Organization

The FCOM is organized in the following manner.

Volume 1

- Preface – contains general information regarding the manual's purpose, structure, and content. It also contains lists of abbreviations, a record of revisions, bulletins, and a list of effective pages.
- Limitations and Normal Procedures chapters cover operational limitations and normal procedures. All operating procedures are based on a thorough analysis of crew activity required to operate the airplane, and reflect the latest knowledge and experience available.
- Supplementary Procedures chapter covers those procedures accomplished as required rather than routinely on each flight.
- Performance Dispatch (PD) chapter contains performance information necessary for self dispatch.
- Performance Inflight (PI) chapter contains information necessary for inflight use.

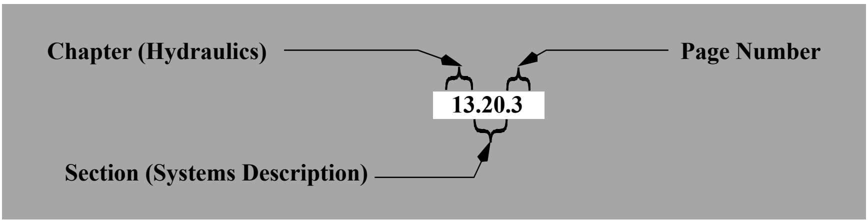
Volume 2 – Chapters 1 through 15 contain general airplane and systems information. These chapters are generally subdivided into sections covering controls and indicators and systems descriptions.

Quick Reference Handbook (QRH) – The QRH covers normal checklists, non–normal checklists, operational information, performance information necessary for inflight use (PI) on an expedited basis, and maneuvers.

Page Numbering

The FCOM uses a decimal page numbering system. The page number is divided into three fields; chapter, section, and page. An example of a page number for the hydraulics chapter follows: chapter 13, section 20, page 3.

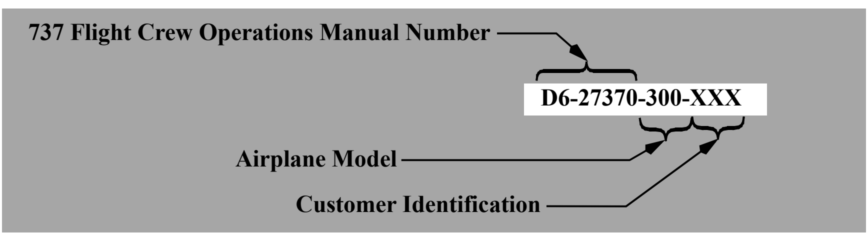
Example Page Number



Page Identification

Each page is identified by a customer document number and a page date. The customer document number is composed of the general 737 FCOM number, D6–27370–, and is followed by the customer identification. The page date is the date of publication of the manual or the most recent revision date.

Example Page Identification



Warnings, Cautions, and Notes

The following levels of written advisories are used throughout the manual.

WARNING: An operating procedure, technique, etc., that may result in personal injury or loss of life if not carefully followed.

CAUTION: An operating procedure, technique, etc., that may result in damage to equipment if not carefully followed.

Note: An operating procedure, technique, etc., considered essential to emphasize. Information contained in notes may also be safety related.

Flight Crew Operations Manual Configuration

Customer airplane configuration determines the data provided in this manual. The Boeing Company keeps a list of each airplane configuration as it is built and modified through the service bulletin process. The FCOM does not reflect customer originated modifications without special contract provisions.

Customer Configured Airplane Effectivity

Differences in airplane configuration for customer specific documents may be shown by the use of airplane effectivity throughout Volumes 1, 2 and QRH. The following rules are used to express airplane effectivity within customer documents:

- airplane effectivity can be displayed in one of four formats; by tabulation number, serial number, registry number or airplane number (customer defined). The default FCOM/QRH document effectivity display is by serial number
- airplane effectivities are listed in alpha-numeric order. A range of airplanes is defined by a dash, e.g. YZ008 - YZ014. A comma in the effectivity range indicates a break in the range, e.g. YZ008 - YZ014, YZ019, YZ021 - YZ025
- airplane effectivities apply only to the paragraph, illustration, operational note, procedural step, etc. and to subordinate items (if any) just below (except for titles) the specific effectivity range annotation;

Example (with subordinate items):

YZ008 - YZ014
Tail skid ....Check

Verify that the tail skid is not damaged.

Horizontal stabilizer and elevator ....Check

In this example, the effectivity YZ008 - YZ014 applies to the first procedural step (Tail skid.....) and further indented/subordinate step (Verify....). The effectivity does not apply to the next equivalently indented step (Horizontal stabilizer.....).

Example (without subordinate items):

YZ008 - YZ014
CABIN TEMPERATURE selector.. As needed
CABIN AIR CONDITIONING... As needed

In this example, the effectivity YZ008 - YZ014 applies to the first procedural step (CABIN TEMPERATURE selector.....) only. The effectivity does not apply to the next procedural step (CABIN AIR CONDITIONING.....).

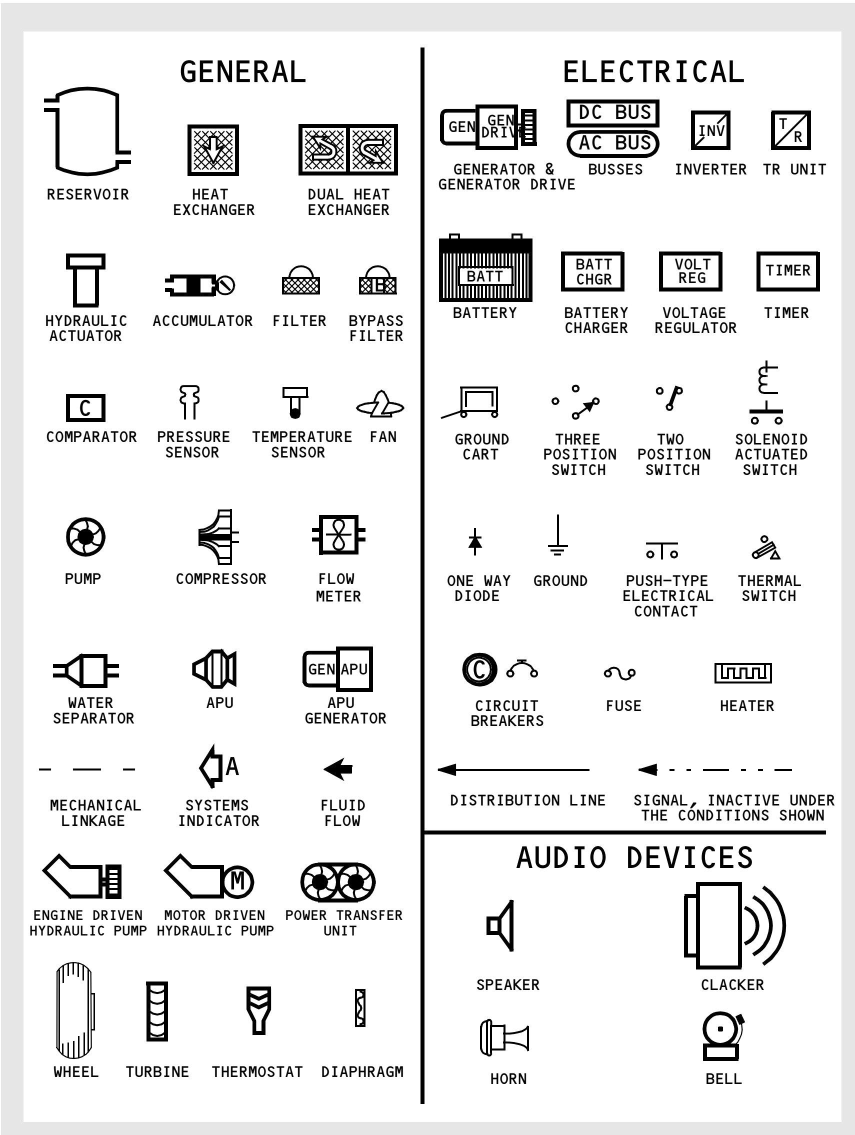
When airplane effectivities are centered immediately below a checklist title, the entire checklist applies to the listed airplanes. In the following example, the PACK checklist is applicable to YZ008 - YZ014 only:

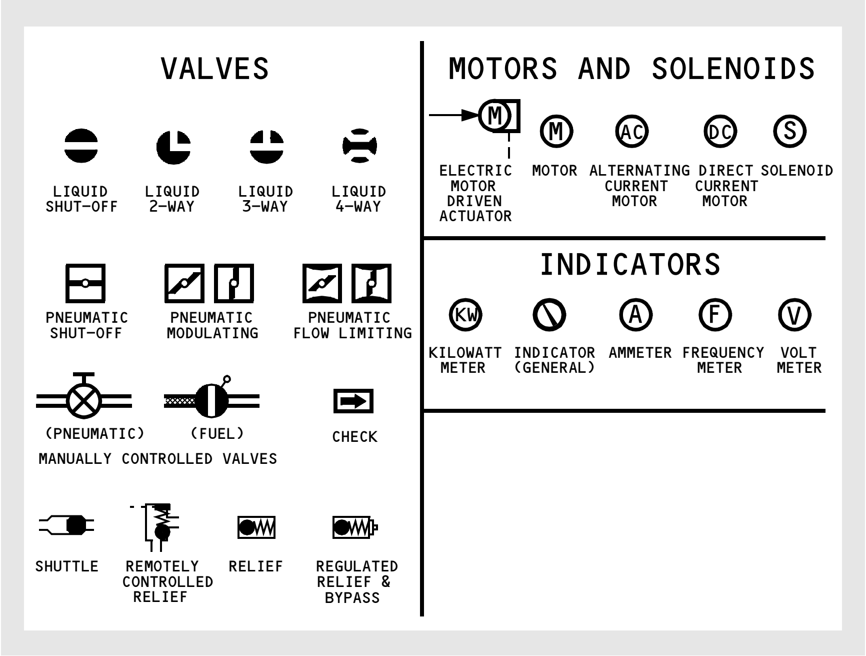
PACK

YZ008 - YZ014

Schematic Symbols

Symbols shown are those which may not be identified on schematic illustrations.




VALVES
LIQUID SHUT-OFF
LIQUID 2-WAY
LIQUID 3-WAY
LIQUID 4-WAY
PNEUMATIC SHUT-OFF
PNEUMATIC MODULATING
PNEUMATIC FLOW LIMITING
(PNEUMATIC)
(FUEL)
MANUALLY CONTROLLED VALVES
CHECK
SHUTTLE
REMOTELY CONTROLLED RELIEF
RELIEF
REGULATED RELIEF & BYPASS
MOTORS AND SOLENOIDS
M
ELECTRIC MOTOR DRIVEN ACTUATOR
M
MOTOR
AC
ALTERNATING CURRENT MOTOR
DC
DIRECT CURRENT MOTOR
S
SOLENOID
INDICATORS
KW
KILOWATT METER
INDICATOR (GENERAL)
A
AMMETER
F
FREQUENCY METER
V
VOLT METER

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Preface — Abbreviations

General

The following abbreviations may be found throughout the manual. Some abbreviations may also appear in lowercase letters. Abbreviations having very limited use are explained in the chapter where they are used. The abbreviations are general in nature and may or may not apply to a customer's airplane configuration.

A	
A/P	Autopilot
A/T	Autothrottle
AC	Alternating Current
ACARS	Aircraft Communications Addressing and Reporting System
ACP	Audio Control Panel
ACQ	Acquire
ACT	Active
ADF	Automatic Direction Finder
ADIRU	Air Data Inertial Reference Unit
ADM	Air Data Module
ADS-B	Automatic Dependent Surveillance-Broadcast
AED	Automatic External Defibrillator
AFDS	Autopilot Flight Director System
AFE	Above Field Elevation
AFM	Airplane Flight Manual (FAA approved)
AGL	Above Ground Level
AI	Anti-Ice
AIL	Aileron
ALT	Altitude
ALTN	Alternate
AM	Amplitude Modulation
ANP	Actual Navigation Performance
ANT	Antenna
AOA	Angle of Attack
AOR	Area of Responsibility
APP	Approach
APU	Auxiliary Power Unit
ARINC	Aeronautical Radio, Incorporated
ARPT	Airport
ARTE	Above Runway Threshold Elevation
ATA	Actual Time of Arrival
ATC	Air Traffic Control
ATT	Attitude
AUTO	Automatic
AUX	Auxiliary
AVAIL	Available
B	

B/C or BCRS	Back Course
BARO	Barometric
BAT/BATT	Battery
BRT	Bright
BTL DISCH	Bottle Discharge (fire extinguishers)
BTP	Bromotriflurpropene (fire extinguishers)
C	
C	Captain Celsius Center
CANC/ RCL	Cancel/Recall
CB	Circuit Breaker
CDFA	Continuous Descent Final Approach
CDU	Control Display Unit
CG	Center of Gravity
CHKL	Checklist
CLB	Climb
COMM	Communication
CON	Continuous
CONFIG	Configuration
CRZ	Cruise
CTL	Control
D	
DA	Decision Altitude
DDA	Derived Decision Altitude
DC	Direct Current
DDG	Dispatch Deviations Guide
DEP ARR	Departure Arrival
DES	Descent
DEU	Display Electronics Unit
DISC	Disconnect
DME	Distance Measuring Equipment
DSPL	Display
E	
E/D	End of Descent
E/E	Electrical and Electronic
EASA	European Aviation Safety Agency
EBAW	Enhanced Bank Angle Warning
ECS	Environmental Control System
EEC	Electronic Engine Control
EFIS	Electronic Flight Instrument System
EGPWS	Enhanced Ground Proximity Warning System
EGT	Exhaust Gas Temperature
ELEC	Electrical
ELEV	Elevator
ENG	Engine
EOSID	Engine Out Standard Instrument Departure
EXEC	Execute
EXT	Extend

F	
F	Fahrenheit
F/D or FLT DIR	Flight Director
F/O	First Officer
FA	Flight Attendant
FAF	Final Approach Fix
FAP	Final Approach Point
FAS	Final Approach Segment
FCC	Flight Control Computer
FCTL	Flight Control
FCTM	Flight Crew Training Manual
FFM	Force Fight Monitor
FL	Flight Level
FMA	Flight Mode Annunciation
FMC	Flight Management Computer
FMS	Flight Management System
FPA	Flight Path Angle
FPV	Flight Path Vector
FSEU	Flap Slat Electronic Unit
G	
G/P	Glide Path
G/S	Glide Slope
GA	Go-Around
GBAS	Ground-Based Augmentation System
GEN	Generator
GLS	GBAS Landing System

GP	Glide Path
GPS	Global Positioning System
GPWS	Ground Proximity Warning System
H	
HDG	Heading
HDG REF	Heading Reference
HDG SEL	Heading Select
HPA	Hectopascals
HUD	Head-Up Display
HYD	Hydraulic
I	
IAN	Integrated Approach Navigation
IAP	Instrument Approach Procedure
IAS	Indicated Airspeed
IAW	In Accordance With
IDENT	Identification
ILS	Instrument Landing System
IMMR	Integrated Multi-Mode Receiver
IN	Inches
INBD	Inboard
IND LTS	Indicator Lights
INOP	Inoperative
INTC CRS	Intercept Course
ISFD	Integrated Standby Flight Display
ISLN	Isolation
K	

K	Knots
KGS	Kilograms
L	
L	Left
LAT	Latitude
LBS	Pounds
LDA	Localizer-type Directional Aid
LDG ALT	Landing Altitude
LE	Leading Edge
LIM	Limit
LNAV	Lateral Navigation
LOM	Locator Outer Marker
LONG	Longitude
LVL CHG	Level Change
M	
MAG	Magnetic
MAN	Manual
MCP	Mode Control Panel
MDA	Minimum Descent Altitude
MEL	Minimum Equipment List
MFD	Multifunction Display
MIN	Minimum
MKR	Marker
MMO	Maximum Mach Operating Speed
MOD	Modify
MTRS	Meters
MVA	Minimum Vectoring Altitude
MX	Maintenance
N	
N1	Low Pressure Rotor Speed
N2	High Pressure Rotor Speed
NAV RAD	Navigation Radio
ND	Navigation Display
NDB	Non-Directional Beacon
NGS	Nitrogen Generation System
NM	Nautical Miles
NORM	Normal
NPS	Navigation Performance Scales
O	
OHU	Overhead Unit
OPT	Onboard Performance Tool
OVHD	Overhead
OVRD	Override
P	
PASS	Passenger
PCU	Power Control Unit
PERF INIT	Performance Initialization
PF	Pilot Flying
PFC	Primary Flight Computers
PIC	Pilot In Command
PM	Pilot Monitoring
PNL	Panel
POS	Position

POS INIT	Position Initialization
PRI	Primary
PRW	Perspective Runway
PTU	Power Transfer Unit
PWS	Predictive Windshear System
R	
R	Right
RA	Radio Altitude Resolution Advisory
RAAS	Runway Awareness and Advisory System
RECIRC	Recirculation
REF	Reference
RET	Retract
RF	Refill
RH	Right Hand
RNP	Required Navigation Performance
RVSM	Reduced Vertical Separation Minimum
S	
S/C	Step Climb
SEL	Select
SMYD	Stall Management Yaw Damper
SPD	Speed
SPLR	Spoiler
STA	Station
STAB	Stabilizer
STAT	Status
STD	Standard

STS	Speed Trim System
T	
T/D	Top of Descent
T or TK or TRK	Track
T or TRU	True
TA	Traffic Advisory
TAI	Thermal Anti-Ice
TAT	Total Air Temperature
TCAS	Traffic Alert and Collision Avoidance System
TDZE	Touch Down Zone Elevation
TE	Trailing Edge
TFC	Traffic
THR HLD	Throttle Hold
TO	Takeoff
TO/GA	Takeoff/Go–Around
U	
UPR DSPL	Upper Display
UTC	Universal Time Coordinated
V	
V/S	Vertical Speed
V1	Takeoff Decision Speed
V2	Takeoff Safety Speed
VA	Design Maneuvering Speed
VHF	Very High Frequency

VMO	Maximum Operating Speed
VNAV	Vertical Navigation
VOR	VHF Omnidirectional Range
VR	Rotation Speed
VREF	Reference Speed
VSD	Vertical Situation Display
VTK	Vertical Track
W	
WPT	Waypoint
WXR	Weather Radar
X	
XTK	Cross Track

Preface — Chapter 0
Revision Record — Section 4

Revision Transmittal Letter

To: All holders of The Boeing Company 737 Flight Crew Operations Manual (FCOM), Boeing Document Number D6-27370-TBC.

Subject: Flight Crew Operations Manual Revision.

This revision reflects the most current information available to The Boeing Company 60 days before the subject revision date. The following revision highlights explain changes in this revision. General information below explains the use of revision bars to identify new or revised information.

Revision Record

No.	Revision Date	Date Filed	No.	Revision Date	Date Filed
38	March 31, 2016		39	September 15, 2016	
40	March 16, 2017		41	September 14, 2017	
42	March 15, 2018		43	September 20, 2018	
44	March 21, 2019		45	September 19, 2019	
46	March 19, 2020		47	September 17, 2020	
48	March 18, 2021		49	September 2, 2021	
50	March 3, 2022		51	September 30, 2022	
52	March 31, 2023		53	September 30, 2023	
54	March 30, 2024				

General

The Boeing Company issues FCOM revisions to provide new or revised procedures and information. Formal revisions also incorporate appropriate information from previously issued FCOM bulletins.

The revision date is the approximate date the manual is approved for printing. The revision is mailed a few weeks after this date. This manual is effective upon receipt and supersedes any manual (with the same document number) with a previous revision number.

Formal revisions include a Transmittal Letter, a new Revision Record, Revision Highlights, and a current List of Effective Pages. Use the information on the new Revision Record and List of Effective Pages to verify the FCOM content.

Pages containing revised technical material have revision bars associated with the changed text or illustration. Editorial revisions (for example, spelling corrections) may have revision bars with no associated highlight.

The Revision Record should be completed by the person incorporating the revision into the manual.

Filing Instructions

Consult the List of Effective Pages (0.5). Pages identified with an asterisk (*) are either replacement pages or new (original) issue pages. Remove corresponding old pages and replace or add new pages. Remove pages that are marked DELETED; there are no replacement pages for deleted pages.

Be careful when inserting changes not to throw away pages from the manual that are not replaced. Using the List of Effective Pages (0.5) can help determine the correct content of the manual.

Revision Highlights

This section (0.4) replaces the existing section 0.4 in your manual.

Throughout the manual, airplane effectivity may be updated to reflect coverage as listed on the Preface - Model Identification page, or to show service bulletin airplane effectivity. Highlights are not supplied.

This manual is published from a database; the text and illustrations are marked with configuration information. Occasionally, because the editors rearrange the database markers, or mark items with configuration information due to the addition of new database content, some customers may receive revision bars on content that appears to be unchanged. Pages may also be republished without revision bars due to slight changes in the flow of the document.

Performance Data:

The Table of Contents designator for the Alternate Deceleration Rate option selection has been updated from AB4 to ALT-AB to more correctly align with the option description and the associated performance data changes. This change will cause the publishing system to identify each performance package affected as new even when the section existed previously. Revision information for other changes will still be included.

Chapter 0 - Preface

Section 1 - Model Identification

General

0.1.1 - Revised to add/change an airplane entry.

Section 6 - Bulletin Record

General

0.6.3 - Revised to reflect current bulletin status.

0.6.7 - Revised to reflect current bulletin status.

0.6.8 - Revised to reflect current bulletin status.

Section 45 - Bulletins

File Highlight

B.45.1 - Bulletin revised to add LGTS (Thessaloniki) Runway 10, Approach, to the airport/runway combinations susceptible to false PWS alerts listing.

Section 123 - Bulletins

File Highlight

B.123.1 - Bulletin revised to update the Background Information, Operating Instructions, and Administrative Information sections.

Chapter L - Limitations

Section 10 - Limitations and Operational Information

Autopilot/Flight Director System

L.10.7 - Added crosswind limit of 25 knots for CAT IIIb operations.

L.10.8 - Added single engine flap restriction for CATIIIb operations.

Chapter NP - Normal Procedures

Section 21 - Amplified Procedures

Preliminary Preflight Procedure – Captain or First Officer

NP.21.4 - Added note about activation of the PASSENGER OXYGEN switch causing activation of the audible horn and DON OXYGEN sign in the supernumerary cabin.

Preflight Procedure – First Officer

NP.21.16 - Added instruction "Supernumerary sign - AUTO or ON" for BCF, Special Freighter aircraft.

NP.21.22 - Added step for the 737-800BCF to open the flight deck door to allow check of the Main Deck Alerting System.

Before Takeoff Procedure

NP.21.36 - Added step to notify supernumeraries to prepare for takeoff.

Landing Procedure - ILS or GLS

NP.21.64 - Added step to notify supernumeraries to prepare for landing.

Landing Procedure - Instrument Approach using VNAV

NP.21.71 - Added step to notify supernumeraries to prepare for landing.

Chapter SP - Supplementary Procedures

Section 1 - Airplane General, Emer. Equip., Doors, Windows

Main Deck Cargo Door Operation

SP.1.7 - Added Main Deck Cargo Door Operation SP for the 737-800BCF.

Section 2 - Air Systems

Unpressurized Takeoff and Landing

SP.2.7 - Added step to avoid high rates of descent for supernumerary comfort.

Section 5 - Communications

Cockpit Voice Recorder Test

SP.5.2 - Added section "Cockpit Voice Recorder Test" for aircraft with the Allied Signal control panel 980-6616-001.

Section 12 - Fuel

Ground Transfer of Fuel

SP.12.3 - Added caution statement for ground transfer of fuel with supernumeraries onboard.

Section 16 - Adverse Weather

Turbulence

SP.16.26 - Added information for freighters about notifying supernumeraries prior to entering areas of reported turbulence.

SP.16.27 - Deleted Structural Considerations section from the Severe Turbulence procedure.

SP.16.27 - Deleted Climb, Cruise and Descent Considerations section from the Severe Turbulence procedure.

SP.16.27 - Deleted Manual Flight in Severe Turbulence section from the Severe Turbulence procedure.

Performance Package 50
737-800W CFM56-7B26 C M KG FAA CATC/N

Section 50 - Pkg Model Identification

737-800W CFM56-7B26 C M KG FAA CATC/N was added as Section 50.

Section 50 - Takeoff

737-800W CFM56-7B26 C M KG FAA CATC/N was added as Section 50.

Section 51 - Enroute

Added section "51".

Section 52 - Landing

Added section "52".

Section 53 - Gear Down

Added section "53".

Section 54 - Text

Added section "54".

Performance Package 60
737-900 CFM56-7B26 C FT LB FAA CATG/O

Section 60 - Pkg Model Identification

737-900 CFM56-7B26 C FT LB FAA CATG/O moved from Section 50 to 60.

Section 60 - Takeoff

737-900 CFM56-7B26 C FT LB FAA CATG/O moved from Section 50 to 60.

Section 61 - Enroute

Section "51" moved to "61".

Section 62 - Landing

Section "52" moved to "62".

Section 63 - Gear Down

Section "53" moved to "63".

Section 64 - Text

Section "54" moved to "64".

Performance Package 70
737-900ERW CFM56-7B26 C KG M FAA CATH/P

Section 70 - Pkg Model Identification

737-900ERW CFM56-7B26 C KG M FAA CATH/P moved from Section 60 to 70.

Section 70 - Takeoff

737-900ERW CFM56-7B26 C KG M FAA CATH/P moved from Section 60 to 70.

Section 71 - Enroute

Section "61" moved to "71".

Section 72 - Landing

Section "62" moved to "72".

Section 73 - Gear Down

Section "63" moved to "73".

Section 74 - Text

Section "64" moved to "74".

Performance Package 80
737-900ERW CFM56-7B27 C FT LB FAA CATH/P

Section 80 - Pkg Model Identification

737-900ERW CFM56-7B27 C FT LB FAA CATH/P moved from Section 70 to 80.

Section 80 - Takeoff

737-900ERW CFM56-7B27 C FT LB FAA CATH/P moved from Section 70 to 80.

Section 81 - Enroute

Section "71" moved to "81".

Section 82 - Landing

Section "72" moved to "82".

Section 83 - Gear Down

Section "73" moved to "83".

Section 84 - Text

Section "74" moved to "84".

Performance Package 20
737-700 CFM56-7B24 LB FAA CATF/M

Section 20 - General

VREF

PI.20.6 - Updated header to show VREF reference altitude.

Flight With Unreliable Airspeed / Turbulent Air Penetration

PI.20.82 - Added Flaps 1 and Flaps 5 Unreliable Airspeed Go-Around tables for additional go-around flaps options.

PI.20.82 - Added Flaps 1 and Flaps 5 Unreliable Airspeed Go-Around tables for additional go-around flaps options.

PI.20.83 - Updated Go-Around F15 table for airport altitude 14000 ft for cross model consistency.

Section 22 - Advisory Information

Non-Normal Configuration Landing Distance

PI.22.4 - Updated LOSS OF SYSTEM A AND SYSTEM B, MANUAL REVERSION, and LOSS OF SYSTEM B non-normal landing configurations to use constant braking coefficients of friction and to be consistent with current standard Boeing calculation methods. Updated All Flaps Up Landing and Trailing Edge Flaps Up Landing non-normal landing configurations to use Flaps Up reverse thrust effectiveness factor for all runway conditions. Due to publishing system limitations, the revision bar was applied to all the non-normal landing tables. Other non-normal landing tables not mentioned in this highlight had no data change.

Section 26 - Text

General

PI.26.6 - Added clarification on VREF in Flight with Unreliable Airspeed Final Approach table.

Performance Package 30
737-700W CFM56-7B26 KG JAA CATF/M

Section 30 - General

VREF

PI.30.7 - Updated header to show VREF reference altitude.

Flight With Unreliable Airspeed/Turbulent Air Penetration

PI.30.83 - Added Flaps 1 and Flaps 5 Unreliable Airspeed Go-Around tables for additional go-around flaps options.

PI.30.83 - Added Flaps 1 and Flaps 5 Unreliable Airspeed Go-Around tables for additional go-around flaps options.

PI.30.84 - Updated Go-Around F15 table for airport altitude 14000 ft for cross model consistency.

Section 32 - Advisory Information

Non-Normal Configuration Landing Distance

PI.32.3 - Updated LOSS OF SYSTEM A AND SYSTEM B, MANUAL REVERSION, and LOSS OF SYSTEM B non-normal landing configurations to use constant braking coefficients of friction and to be consistent with current standard Boeing calculation methods. Updated All Flaps Up Landing and Trailing Edge Flaps Up Landing non-normal landing configurations to use Flaps Up reverse thrust effectiveness factor for all runway conditions. Due to publishing system limitations, the revision bar was applied to all the non-normal landing tables. Other non-normal landing tables not mentioned in this highlight had no data change.

Section 37 - Text

General

PI.37.6 - Added clarification on VREF in Flight with Unreliable Airspeed Final Approach table.

Performance Package 50
737-800W CFM56-7B26 C M KG FAA CATC/N

Section 50 - Pkg Model Identification

737-800W CFM56-7B26 C M KG FAA CATC/N was added as Section 50.

Section 50 - General

737-800W CFM56-7B26 C M KG FAA CATC/N was added as Section 50.

Section 51 - All Engine

Added section "51".

Section 52 - Advisory Information

Added section "52".

Section 53 - Engine Inoperative

Added section "53".

Section 54 - Alternate Mode EEC

Added section "54".

Section 55 - Gear Down

Added section "55".

Section 56 - Gear Down, Engine Inop

Added section "56".

Section 57 - Text

Added section "57".

Performance Package 60
737-900 CFM56-7B26 C FT LB FAA CATG/O

Section 60 - Pkg Model Identification

737-900 CFM56-7B26 C FT LB FAA CATG/O moved from Section 50 to 60.

Section 60 - General

737-900 CFM56-7B26 C FT LB FAA CATG/O moved from Section 50 to 60.

VREF

PI.60.4 - Updated header to show VREF reference altitude.

Flight With Unreliable Airspeed/ Turbulent Air Penetration

PI.60.49 - Updated weight array.

PI.60.67 - Updated weight array.

PI.60.76 - Added Flaps 1 and Flaps 5 Unreliable Airspeed Go Around tables for additional go-around flaps options.

PI.60.76 - Added Flaps 1 and Flaps 5 Unreliable Airspeed Go Around tables for additional go-around flaps options.

PI.60.77 - Updated Go-Around F15 table for airport altitude 14000 ft for cross model consistency and updated weight array.

Section 61 - All Engine

Section "51" moved to "61".

Section 62 - Advisory Information

Section "52" moved to "62".

Section 63 - Engine Inoperative

Section "53" moved to "63".

Section 64 - Alternate Mode EEC

Section "54" moved to "64".

Section 65 - Gear Down

Section "55" moved to "65".

Section 66 - Gear Down, Engine Inop

Section "56" moved to "66".

Section 67 - Text

Section "57" moved to "67".

General

PI.67.6 - Added clarification on VREF in Flight with Unreliable Airspeed Final Approach table.

Performance Package 70
737-900ERW CFM56-7B26 C KG M FAA CATH/P

Section 70 - Pkg Model Identification

737-900ERW CFM56-7B26 C KG M FAA CATH/P moved from Section 60 to 70.

Section 70 - General

737-900ERW CFM56-7B26 C KG M FAA CATH/P moved from Section 60 to 70.

Section 71 - All Engine

Section "61" moved to "71".

Section 72 - Advisory Information

Section "62" moved to "72".

Section 73 - Engine Inoperative

Section "63" moved to "73".

Section 74 - Alternate Mode EEC

Section "64" moved to "74".

Section 75 - Gear Down

Section "65" moved to "75".

Section 76 - Gear Down, Engine Inop

Section "66" moved to "76".

Section 77 - Text

Section "67" moved to "77".

Performance Package 80
737-900ERW CFM56-7B27 C FT LB FAA CATH/P

Section 80 - Pkg Model Identification

737-900ERW CFM56-7B27 C FT LB FAA CATH/P moved from Section 70 to 80.

Section 80 - General

737-900ERW CFM56-7B27 C FT LB FAA CATH/P moved from Section 70 to 80.

VREF

PI.80.4 - Updated header to show VREF reference altitude.

Flight With Unreliable Airspeed/ Turbulent Air Penetration

PI.80.73 - Added Flaps 1 and Flaps 5 Unreliable Airspeed Go-Around tables for additional go-around flaps options.

PI.80.73 - Added Flaps 1 and Flaps 5 Unreliable Airspeed Go-Around tables for additional go-around flaps options.

PI.80.74 - Updated Go-Around F15 table for airport altitude 14000 ft for cross model consistency.

Section 81 - All Engine

Section "71" moved to "81".

Section 82 - Advisory Information

Section "72" moved to "82".

Non-Normal Configuration Landing Distance

PI.82.4 - Updated LOSS OF SYSTEM A and LOSS OF SYSTEM B non-normal landing configurations to use appropriate reverser deployment times to achieve cross-model consistency. Due to publishing system limitations, the revision bar was applied to all the non-normal landing tables. Other non-normal landing tables not mentioned in this highlight had no data change.

Section 83 - Engine Inoperative

Section "73" moved to "83".

Section 84 - Alternate Mode EEC

Section "74" moved to "84".

Section 85 - Gear Down

Section "75" moved to "85".

Section 86 - Gear Down, Engine Inop

Section "76" moved to "86".

Section 87 - Text

Section "77" moved to "87".

General

PI.87.6 - Added clarification on VREF in Flight with Unreliable Airspeed Final Approach table.

Chapter 1 - Airplane General, Emergency Equipment, Doors, Windows

Section 10 - Dimensions

Principal Dimensions

1.10.1 - Updated wing to wing and horizontal stabilizer meters dimensions to match the AMM.

1.10.2 - Updated wing to wing and horizontal stabilizer meters dimensions to match the AMM.

1.10.3 - Changed horizontal stabilizer meters dimension to match the AMM.

1.10.4 - Added the principal dimensions of the 737-800BCF equipped with winglets.

Turning Radius

1.10.10 - Added a graphic which shows the turning radius of the 737-800 with winglets.

Section 20 - Instrument Panels

Attendant Control Panel

1.20.21 - Added a graphic which depicts the Forward Attendant Control Panel installed on airplanes with the Sky Interior.

1.20.21 - Deleted a graphic which depicts the Aft Attendant Control Panel installed on airplanes with the Sky Interior.

Supernumerary Cabin Handset

1.20.22 - Added title.

Section 30 - Controls and Indicators

Emergency Lighting and Passenger Signs

1.30.10 - Added a graphic depicting the Emergency Lighting and Passenger Sign switches.

1.30.11 - Added text which describes the No Smoking Switch.

Doors

1.30.21 - Added a graphic depicting the Exterior Door Annunciator Lights.

1.30.22 - Added paragraph describing the exterior door annunciations.

1.30.24 - Added BCF Entry/Galley Service Doors section.

1.30.25 - Added Boeing standard Converted Freighter Main Deck Cargo Door Section by configuration.

1.30.29 - Added Cargo Configuration section.

Oxygen

1.30.36 - Added graphic depicting the Observer's Eros Oronasal Oxygen Mask and Regulator.

Water System Controls

1.30.41 - Added text and graphics depicting the Water System Controls.

Section 40 - Systems Description

Lighting Systems

1.40.6 - Added content describing the Supernumerary Cabin Signs.

1.40.16 - Changed Maximum Duration hours to match the AMM.

1.40.17 - Changed Maximum Duration hours to match the AMM.

1.40.18 - Changed Maximum Duration hours to match the AMM.

Oxygen Systems

1.40.24 - Added paragraph describing the oxygen system.

1.40.27 - Added a graphic depicting the Oxygen System Schematic for BCF and Freighters.

1.40.28 - Added text which describes the flight crew oxygen system.

1.40.28 - Added text which describes the donning instruction for the flight crew oxygen masks.

1.40.36 - Added portable oxygen system section.

Fire Extinguishers

1.40.37 - Added paragraph describing the fire extinguisher.

Added Emergency Equipment Locations section.

Doors and Windows

1.40.49 - Added paragraph describing doors and windows.

1.40.49 - Changed the caution when operating entry and service doors in windy conditions.

1.40.53 - Added section describing the main deck cargo door.

Emergency Escape

1.40.59 - Added text which describes emergency evacuation for STC aircraft.

1.40.62 - Added Emergency Evacuation Routes graphic for BCF aircraft.

1.40.67 - Added a graphic depicting that no overwing escape straps are installed.

Galleys

1.40.82 - Added paragraph describing the galley.

Water System

1.40.84 - Added water system graphic.

1.40.84 - Added text which describes the heater in the potable water system.

Chapter 2 - Air Systems

Section 10 - Controls and Indicators

Bleed Air Controls and Indicators

2.10.3 - Added bleed air control and indicators graphic for airplanes with INOP Placards on Recirculation Fans.

Air Conditioning Controls and Indicators

2.10.10 - Added illustration for airplanes with INOP Placards on Recirculation Fans.

2.10.11 - Added description of Temperature Selector for 737-800BCF aircraft.

2.10.12 - Added description of AIR Temperature (TEMP) Source Selector for 737-800 Freighter aircraft.

2.10.13 - Added Recirculation Fan Switches description with note regarding removal of recirculation fans on the 737-800BCF Freighter aircraft.

Section 20 - Bleed Air System Description

Engine Bleed System Supply

2.20.6 - Added bleed air system schematic with INOP placards on recirculation fans.

Section 30 - Air Conditioning System Description

Air Conditioning Distribution

2.30.5 - Changed "bay" to "compartment".

2.30.5 - Changed "bay" to "compartment".

2.30.5 - Changed "bay" to "compartment".

2.30.6 - Changed "bay" to "compartment".

2.30.6 - Changed "bay" to "compartment".

2.30.6 - Revised wording of the EQUIPMENT COOLING OFF light to uppercase for consistency.

2.30.6 - Revised paragraph to clarify the circulation of air into the forward cargo compartment.

Section 31 - Air Conditioning System Description

Introduction

2.31.1 - Added Introduction paragraph describing Air Systems for cargo conversion aircraft.

Zone Temperature Control

2.31.5 - Added description for temperature selectors.

2.31.5 - Added description for electronic temperature controllers.

2.31.6 - Added description of failure of cabin temperature control for supernumerary cabin.

2.31.6 - Added description of unbalanced Pack temperature control mode.

Air Conditioning Distribution

2.31.7 - Added information to reflect fleet configuration.

2.31.8 - Added description of 737-800BCF Cargo Compartment.

2.31.8 - Added description of Mix Manifold Exhaust Shutoff Valve.

2.31.8 - Changed "forward cargo bay" to "forward cargo compartment". Added statement: "(Additional information about the forward cargo compartment air circulation can be found in the Forward Cargo Compartment section of this chapter)."

2.31.8 - Added information about recirculation fans in the 737-800BCF.

2.31.9 - Changed "bay" to "compartment".

2.31.9 - Changed "bay" to "compartment".

2.31.9 - Changed "bay" to "compartment".

2.31.9 - Revised wording of the EQUIPMENT COOLING OFF light to uppercase for consistency.

2.31.9 - Added paragraph describing Forward Cargo Compartment Smoke Penetration Prevention for 737-800BCF aircraft.

2.31.9 - Revised paragraph to include use of recirculation fans to provide air from the passenger cabin and E/E Cooling system to the Forward Cargo Compartment.

2.31.11 - Added graphic with new Bleed Air symbol pattern for 737-800BCF.

Section 40 - Pressurization System Description

Pressurization Outflow

2.40.4 - Added description of air circulation in 737-800BCF cargo areas.

2.40.4 - Changed "bay" to "compartment".

2.40.4 - Added information about opening of Overboard Exhaust Valve.

Auto Mode Operation

2.40.6 - Added description of initial cabin pressurization for BCF.

Chapter 3 - Anti-Ice, Rain

Section 10 - Controls and Indicators

Probe Heat Panel

3.10.4 - Added graphic for airplanes with AUTO-ON Probe Heat switches and no TAT test switch.

Section 20 - System Description

Flight Deck Window Heat

3.20.2 - Added paragraph describing window heat for windows 1 and 2 for aircraft without window 3 heat.

3.20.3 - Added paragraph describing window heat for windows 1 and 2 for aircraft without window 3 heat.

3.20.3 - Added paragraph describing window heat operation for windows 1 and 2 for aircraft without window 3 heat.

3.20.3 - Added paragraph describing window heat operation for windows 1 and 2 for aircraft without window 3 heat.

3.20.6 - Added graphic for airplanes with green ON light, no window 3 heat, windows 4 and 5 not installed, and four temperature controllers.

Chapter 4 - Automatic Flight

Section 10 - Controls and Indicators

Flight Mode Annunciations (FMAs)

4.10.26 - Revised the formatting of Callout for CWS Roll Engaged. No content change.

4.10.27 - Revised the formatting of Callout for CWS Pitch Engaged. No content change.

4.10.28 - Revised the formatting of Callout for CWS Pitch Engaged. No content change.

4.10.28 - Revised the formatting of Callout for CWS Roll Engaged. No content change.

Chapter 5 - Communications

Section 10 - Controls and Indicators

Interphone and Passenger Address Controls

5.10.12 - Added description of service phone capabilities for 737-800BCF aircraft.

5.10.13 - Added description of service interphone headset jack capabilities for 737-800BCF aircraft.

Cockpit Voice Recorder

5.10.14 - Added Allied Signal cockpit voice recorder P/N 980-6116-001 with Headphone jack.

5.10.14 - Added Erase Switch Callout for aircraft cockpit voice recorder.

5.10.14 - Added Callout for cockpit voice recorder TEST Switch operation.

5.10.15 - Added Callout describing cockpit voice recorder HEADPHONE Jack use.

5.10.15 - Added Callout describing cockpit voice recorder STATUS Light operation.

Call System

5.10.16 - Added description of Attendant CALL Light for 737-800BCF aircraft.

5.10.16 - Added description of Flight Deck Call Light for 737-800BCF aircraft.

5.10.17 - Added description of pink call light for 737-800BCF aircraft.

5.10.17 - Added description of blue call light for 737-800BCF aircraft.

5.10.18 - Added description of Attendant Call Switch two-tone chime for 737-800BCF aircraft.

Section 20 - System Description

Degraded Audio System Operation

5.20.3 - Deleted paragraph "Audio warnings for altitude alert, GPWS, and windshear are not heard....in the degraded mode".

5.20.3 - Added paragraph "Audio warnings for altitude alert, GPWS, and windshear are heard....in the degraded mode".

Service Interphone System

5.20.4 - Added Service Interphone description for 737-800BCF.

Call System

5.20.5 - Added description of Call System for 737-800BCF.

5.20.6 - Added description of Call System for 737-800BCF.

5.20.6 - Added table for 737-800BCF aircraft.

Chapter 6 - Electrical

Section 10 - Controls and Indicators

AC and DC Metering Panel

6.10.5 - Added dual battery ac and dc metering panel graphic for BCF aircrafts.

6.10.7 - Added IFE/PASS SEAT switch description for BCF aircrafts.

Chapter 7 - Engines, APU

Section 10 - Side by Side – Displays

Primary and Secondary Engine Indications

7.10.7 - Deleted 5 minutes color limitation on EGT indications

Section 11 - Over/Under – Displays

Primary Engine Indications

7.11.1 - Added engine display in kilograms with full time fuel flow displayed.

Compact Engine Displays

7.11.16 - Added compact engine display configuration in kilograms with cross-bleed display.

Chapter 8 - Fire Protection

Section 10 - Controls and Indicators

Lavatory Fire

8.10.9 - Added JAMCO lavatory smoke detector per fleet effectivity.

Section 20 - System Description

Lavatory Fire Protection and Smoke Detection

8.20.8 - Added "FWD/AFT" for system clarification. No technical changes.

8.20.8 - Added information about Lavatory Smoke Detection ALARM MODE reset.

Chapter 9 - Flight Controls

Section 10 - Controls and Indicators

Leading Edge Devices

9.10.14 - Revised the callout for the Leading Edge Devices TRANSIT Lights from "devices" to "flaps and slats".

9.10.14 - Revised the callout for the Leading Edge Devices Extended (EXT) Lights from "slat" to "flaps and slats".

9.10.14 - Revised the callout for the Leading Edge Devices Full Extended (FULL EXT) Lights from "devices" to "slats".

Section 20 - System Description

Yaw Control

9.20.13 - Revised system description for Yaw Damper section to remove the yaw damper indicator for aircraft without the option of position indicator.

Flaps and Slats

9.20.20 - Added content to clarify Flap Load Relief system.

9.20.24 - Added notation to clarify Flight Deck Effects resultant from asymmetry and skew of the LE devices or TE flaps.

9.20.24 - Added notation to clarify Flight Deck Effects resultant from asymmetry and skew of the LE devices or TE flaps.

9.20.24 - Revised the description for the Leading Edge Devices TRANSIT from "devices" to "flaps and slats".

9.20.24 - Revised the description for the Leading Edge Devices EXT from "slats and flaps" to "flaps and slats" for standardization.

9.20.25 - Added notation to clarify Flight Deck Effects resultant from uncommanded motion of the LE devices or TE flaps.

9.20.25 - Added notation to clarify Flight Deck Effects resultant from uncommanded motion of the LE devices or TE flaps.

Chapter 10 - Flight Instruments, Displays

Section 11 - PFD/ND – Displays

PFD – Attitude Indications

10.11.22 - Added illustration for aircraft equipped with integrated cue command bar and rising runway.

10.11.28 - Updated the Radio Altitude Call Out #1 to better describe the Display Box highlight when descending through 2500 feet AGL.

10.11.28 - Updated the Radio Altitude Call Out #1 to better describe the Display Box highlight when descending through 2500 feet AGL.

PFD – Altitude Indications

10.11.33 - Updated the Metric Digital Readout to include the cyan metric symbol-M.

10.11.34 - Added illustration for aircraft without QFE Altimeter option.

PFD – Vertical Speed Indications

10.11.40 - Added illustration for VSI without TCAS advisory.

PFD Failure Flags

10.11.43 - Added illustration of PFD failure flags when RA is below ADI.

PFD Annunciations and Alerts

10.11.51 - Updated the Metric Digital Readout to include the cyan metric symbol-M.

Navigation Displays – Failure Indications and Flags

10.11.79 - Added illustration of failure flags for track up display, dual ADF receiver and no IAN.

Section 31 - PFD/ND – Primary Flight Display

Attitude

10.31.2 - Added sentence describing the pitch limit indication for flaps not up.

Traffic Alert and Collision Avoidance (TCAS) Indications

10.31.6 - Added sentence where TCAS advisories are in the attitude indication area only.

Section 41 - PFD/ND – Navigation Displays

ND Symbology

10.41.6 - Added symbology for system source annunciation for aircraft without GLS.

Chapter 11 - Flight Management, Navigation

Section 10 - Controls and Indicators

Flight Management System

11.10.2 - Added LCD MCDU.

11.10.5 - Added LCD MCDU.

11.10.5 - Added MCDU.

Inertial System

11.10.22 - Added ADIRS 69-73713-20 with GLS INOP and ILS INOP stickers.

Section 20 - Navigation Systems Description

Radio Navigation Systems

11.20.9 - Added description without GLS option.

Section 40 - FMC Preflight

Preflight Pages

11.40.50 - Added non-aspirated TAT probe without thrust bump.

Section 42 - FMC Cruise

Navigation Data

11.42.63 - Added dual FMC with GPS and no GLS.

11.42.63 - Added standard configuration without GLS.

Section 43 - FMC Descent and Approach

Approach

11.43.33 - Added approach information without GLS.

Chapter 12 - Fuel

Section 10 - Controls and Indicators

Fueling / Defueling / Measurement

12.10.11 - Added fueling panel in kilograms without preselect.

Section 20 - System Description

Fuel Quantity Indication

12.20.3 - Revised Fuel Quantity Indication description to be consistent across 737 airplane models.

12.20.3 - Added the description for the Total Fuel Quantity displayed on the Upper Display Unit for Fuel Quantity Indication system.

Chapter 13 - Hydraulics

Section 20 - System Description

Introduction

13.20.1 - Added main deck cargo door to the list in Hydraulics system.

13.20.3 - Added hydraulic schematic with main deck cargo door.

A and B Hydraulic Systems

13.20.3 - Modified "landing gear transfer unit" to "landing gear transfer valve" to match AMM.

13.20.5 - Modified Title from "LANDING GEAR TRANSFER UNIT" to “LANDING GEAR TRANSFER VALVE" to match AMM.

13.20.5 - Modified paragraph content from "LANDING GEAR TRANSFER UNIT" to “LANDING GEAR TRANSFER VALVE" to match AMM.

Chapter 14 - Landing Gear

Section 20 - System Description

Landing Gear Operation

14.20.2 - Modified Title from "LANDING GEAR TRANSFER UNIT" to “LANDING GEAR TRANSFER VALVE" to match AMM.

14.20.2 - Modified paragraph content from "LANDING GEAR TRANSFER UNIT" to “LANDING GEAR TRANSFER VALVE" to match AMM.

Nose Wheel Steering

14.20.3 - Modified paragraph content from "LANDING GEAR TRANSFER UNIT" to “LANDING GEAR TRANSFER VALVE" to match AMM.

Air/Ground System

14.20.7 - Added third extinguishing bottle for Cargo Fire Protection.

14.20.8 - Modified table content from "LANDING GEAR TRANSFER UNIT" to “LANDING GEAR TRANSFER VALVE" to match AMM.

Chapter 15 - Warning Systems

Section 10 - Controls and Indicators

Proximity Switch Electronic Unit Light

15.10.2 - Revised to add reference to MAIN CARGO door annunciator.

Ground Proximity Warning System (GPWS)

15.10.10 - Added GPWS inhibit switch graphic to accommodate airplanes with flap, gear, and terrain inhibit switches.

Section 20 - System Description

Introduction

15.20.1 - Modified paragraph to remove "flight attendant" as this does not apply to 737-800 BCF aircraft.

Master Caution Lights

15.20.5 - Added ice detector light.

15.20.5 - Added SPSEU light to annunciation list.

15.20.5 - Added lavatory smoke light.

15.20.6 - Added annunicator content.

15.20.6 - Added annunicator content.

15.20.6 - Added annunicator content.

15.20.6 - Added annunicator content.

15.20.6 - Added annunicator content.

15.20.6 - Revised to provide MID EXIT doors system annunciation.

15.20.6 - Revised to add reference to MAIN CARGO door annunciator.

15.20.6 - Added airstair light.

15.20.6 - Added high altitude landing - INOP light.

Warning Systems

15.20.8 - Added information to accommodate airplanes equipped with main deck cargo door.

15.20.11 - Deleted "FMC outputs" to match with the System Design document.

Ground Proximity Alerts

15.20.16 - Replaced "unsafe radio altitude" with "unsafe altitude" for clarity.

Tail Skid

15.20.41 - Revised Tail Skid Detail graphic to display the visible green indicator on the cartridge.

Volume 1

* Title Page 1-2	March 30, 2024
0.TOC.1-2	March 27, 2014

Model Identification

* 0.1.1-2	March 30, 2024

Introduction

0.2.1	September 26, 2013
0.2.2	September 19, 2019
0.2.3	March 15, 2018
0.2.4	March 15, 2018
0.2.5	September 24, 2015
0.2.6	September 26, 2013
0.2.7	September 26, 2013
0.2.8	September 26, 2013

Abbreviations

0.3.1	September 2, 2021
0.3.2	September 2, 2021
0.3.3	September 2, 2021
0.3.4	September 2, 2021
0.3.5	September 2, 2021
0.3.6	September 2, 2021

Revision Record (tab)

* 0.4.1	March 30, 2024
* 0.4.2	March 30, 2024

Revision Highlights

* 0.4.3	March 30, 2024
* 0.4.4	March 30, 2024
* 0.4.5	March 30, 2024
* 0.4.6	March 30, 2024
* 0.4.7	March 30, 2024
* 0.4.8	March 30, 2024
* 0.4.9	March 30, 2024
* 0.4.10	March 30, 2024
* 0.4.11	March 30, 2024
* 0.4.12	March 30, 2024
* 0.4.13	March 30, 2024
* 0.4.14	March 30, 2024
* 0.4.15	March 30, 2024
* 0.4.16	March 30, 2024
* 0.4.17	March 30, 2024
* 0.4.18	March 30, 2024
* 0.4.19	March 30, 2024
* 0.4.20	March 30, 2024
* 0.4.21	March 30, 2024
* 0.4.22	March 30, 2024
* 0.4.23	March 30, 2024
* 0.4.24	March 30, 2024

V1V2 List of Effective Pages

* 0.5.1-42	March 30, 2024

Bulletin Record (tab)

* 0.6.1-8	March 30, 2024
B.3.1	September 24, 2015
B.3.2	September 24, 2015
B.5.1	September 24, 2015
B.5.2	September 24, 2015
B.6.1	September 24, 2015
B.6.2	September 24, 2015
B.7.1	September 24, 2015
B.7.2	September 24, 2015
B.8.1	September 24, 2015
B.8.2	September 24, 2015
B.9.1	September 24, 2015
B.9.2	September 24, 2015
B.11.1	September 24, 2015
B.11.2	September 24, 2015
B.12.1	September 24, 2015
B.12.2	September 24, 2015
B.13.1	September 24, 2015
B.13.2	September 24, 2015
B.14.1	September 24, 2015
B.14.2	September 24, 2015
B.17.1	September 24, 2015
B.17.2	September 24, 2015
B.18.1	September 24, 2015
B.18.2	September 24, 2015
B.19.1	September 24, 2015
B.19.2	September 24, 2015
B.20.1	September 24, 2015

* = Revised, Added, or Deleted

B.20.2	September 24, 2015	B.47.1	September 24, 2015
B.21.1	September 24, 2015	B.47.2	September 24, 2015
B.21.2	September 24, 2015	B.48.1	September 24, 2015
B.22.1	September 24, 2015	B.48.2	September 24, 2015
B.22.2	September 24, 2015	B.48.3	September 24, 2015
B.23.1	September 24, 2015	B.48.4	September 24, 2015
B.23.2	September 24, 2015	B.50.1	September 2, 2021
B.24.1	September 24, 2015	B.50.2	September 2, 2021
B.24.2	September 24, 2015	B.52.1	September 24, 2015
B.27.1	September 24, 2015	B.52.2	September 24, 2015
B.27.2	September 24, 2015	B.53.1	September 30, 2023
B.29.1	September 24, 2015	B.53.2	September 30, 2023
B.29.2	September 24, 2015	B.53.3	September 30, 2023
B.30.1	September 24, 2015	B.53.4	September 24, 2015
B.30.2	September 24, 2015	B.54.1	September 24, 2015
B.33.1	September 24, 2015	B.54.2	September 24, 2015
B.33.2	September 24, 2015	B.59.1	September 24, 2015
B.33.3	September 24, 2015	B.59.2	September 24, 2015
B.33.4	September 24, 2015	B.61.1	September 24, 2015
B.34.1	September 24, 2015	B.61.2	September 24, 2015
B.34.2	September 24, 2015	B.62.1	September 24, 2015
B.35.1	September 24, 2015	B.62.2	September 24, 2015
B.35.2	September 24, 2015	B.63.1	September 24, 2015
B.37.1	September 24, 2015	B.63.2	September 24, 2015
B.37.2	September 24, 2015	B.64.1	September 24, 2015
B.37.3	September 24, 2015	B.64.2	September 24, 2015
B.37.4	September 24, 2015	B.65.1	September 24, 2015
B.38.1	September 24, 2015	B.65.2	September 24, 2015
B.38.2	September 24, 2015	B.65.3	September 24, 2015
B.39.1	September 24, 2015	B.65.4	September 24, 2015
B.39.2	September 24, 2015	B.66.1	September 24, 2015
B.41.1	September 24, 2015	B.66.2	September 24, 2015
B.41.2	September 24, 2015	B.66.3	September 24, 2015
B.41.3	September 24, 2015	B.66.4	September 24, 2015
B.41.4	September 24, 2015	B.67.1	September 24, 2015
B.42.1	September 24, 2015	B.67.2	September 24, 2015
B.42.2	September 24, 2015	B.68.1	September 24, 2015
B.42.3	September 24, 2015	B.68.2	September 24, 2015
B.42.4	September 24, 2015	B.70.1	September 24, 2015
B.44.1	September 24, 2015	B.70.2	September 24, 2015
B.44.2	September 24, 2015	B.71.1	September 24, 2015
* B.45.1	March 30, 2024	B.71.2	September 24, 2015
* B.45.2	March 30, 2024	B.71.3	September 24, 2015
* B.45.3	March 30, 2024	B.71.4	September 24, 2015
B.45.4	March 21, 2019	B.73.1	September 24, 2015
B.46.1	September 24, 2015	B.73.2	September 24, 2015
B.46.2	September 24, 2015	B.74.1	September 24, 2015

* = Revised, Added, or Deleted

B.74.2	September 24, 2015	B.99.1	September 15, 2016
B.75.1	September 24, 2015	B.99.2	September 15, 2016
B.75.2	September 24, 2015	B.100.1	March 16, 2017
B.75.3	September 24, 2015	B.100.2	March 16, 2017
B.75.4	September 24, 2015	B.101.1	March 16, 2017
B.76.1	September 24, 2015	B.101.2	March 16, 2017
B.76.2	September 24, 2015	B.101.3	March 16, 2017
B.77.1	September 24, 2015	B.101.4	March 16, 2017
B.77.2	September 24, 2015	B.102.1	March 16, 2017
B.79.1	September 24, 2015	B.102.2	March 16, 2017
B.79.2	September 24, 2015	B.103.1	September 14, 2017
B.80.1	September 24, 2015	B.103.2	September 14, 2017
B.80.2	September 24, 2015	B.105.1	September 20, 2018
B.80.3	September 24, 2015	B.105.2	September 20, 2018
B.80.4	September 24, 2015	B.106.1	September 14, 2017
B.81.1	September 24, 2015	B.106.2	September 14, 2017
B.81.2	September 24, 2015	B.107.1	September 14, 2017
B.85.1	September 24, 2015	B.107.2	September 14, 2017
B.85.2	September 24, 2015	B.107.3	September 14, 2017
B.86.1	September 30, 2023	B.107.4	September 14, 2017
B.86.2	September 30, 2023	B.108.1	September 20, 2018
B.86.3	September 30, 2023	B.108.2	September 20, 2018
B.86.4	September 24, 2015	B.108.3	September 20, 2018
B.88.1	September 30, 2023	B.108.4	September 20, 2018
B.88.2	September 30, 2023	B.109.1	September 20, 2018
B.88.3	September 30, 2023	B.109.2	September 20, 2018
B.88.4	September 24, 2015	B.110.1	March 21, 2019
B.89.1	September 30, 2023	B.110.2	March 21, 2019
B.89.2	September 30, 2023	B.111.1	September 19, 2019
B.89.3	September 30, 2023	B.111.2	September 19, 2019
B.89.4	September 24, 2015	B.111.3	September 19, 2019
B.90.1	September 24, 2015	B.111.4	September 19, 2019
B.90.2	September 24, 2015	B.114.1	September 2, 2021
B.92.1	September 24, 2015	B.114.2	September 2, 2021
B.92.2	September 24, 2015	B.114.3	September 2, 2021
B.92.3	September 24, 2015	B.114.4	September 2, 2021
B.92.4	September 24, 2015	B.115.1	September 2, 2021
B.93.1	September 24, 2015	B.115.2	September 2, 2021
B.93.2	September 24, 2015	B.116.1	September 2, 2021
B.97.1	March 16, 2017	B.116.2	September 2, 2021
B.97.2	March 16, 2017	B.117.1	September 30, 2023
B.97.3	March 16, 2017	B.117.2	September 30, 2023
B.97.4	March 16, 2017	B.117.3	September 30, 2023
B.97.5	March 16, 2017	B.117.4	September 30, 2023
B.97.6	March 16, 2017	B.117.5	September 30, 2023
B.98.1	September 15, 2016	B.117.6	September 30, 2023
B.98.2	September 15, 2016	B.117.7	September 30, 2023

* = Revised, Added, or Deleted

	B.117.8	September 30, 2023
	B.119.1	March 31, 2023
	B.119.2	March 31, 2023
	B.120.1	March 31, 2023
	B.120.2	March 31, 2023
	B.121.1	September 30, 2023
	B.121.2	September 30, 2023
*	B.122.1	March 30, 2024
*	B.122.2	March 30, 2024
*	B.123.1	March 30, 2024
*	B.123.2	March 30, 2024

Limitations (tab)

*	L.TOC.1-2	March 30, 2024
	L.10.1	March 15, 2018
	L.10.2	March 31, 2023
	L.10.3	March 31, 2023
	L.10.4	March 31, 2023
	L.10.5	March 31, 2023
	L.10.6	March 31, 2023
*	L.10.7	March 30, 2024
*	L.10.8	March 30, 2024
*	L.10.9	March 30, 2024
*	L.10.10	March 30, 2024
*	L.10.11	March 30, 2024
*	L.10.12	March 30, 2024
*	L.10.13	March 30, 2024
	L.10.14	March 16, 2017

Normal Procedures (tab)

	NP.TOC.1-4	September 30, 2022
	NP.11.1	September 26, 2013
	NP.11.2	March 18, 2011
	NP.11.3	September 2, 2021
	NP.11.4	March 3, 2022
	NP.11.5	September 24, 2007
	NP.11.6	September 14, 2017
	NP.11.7	September 14, 2017
	NP.11.8	March 31, 2006
	NP.21.1	September 30, 2022
	NP.21.2	March 31, 2023
	NP.21.3	March 31, 2023
*	NP.21.4	March 30, 2024
*	NP.21.5	March 30, 2024
*	NP.21.6	March 30, 2024
*	NP.21.7	March 30, 2024
*	NP.21.8	March 30, 2024
*	NP.21.9	March 30, 2024
*	NP.21.10	March 30, 2024
	NP.21.11	March 31, 2023
	NP.21.12	March 31, 2023
	NP.21.13	March 31, 2023
	NP.21.14	March 31, 2023
	NP.21.15	March 31, 2023
*	NP.21.16	March 30, 2024
*	NP.21.17	March 30, 2024
*	NP.21.18	March 30, 2024
*	NP.21.19	March 30, 2024
*	NP.21.20	March 30, 2024
*	NP.21.21	March 30, 2024
*	NP.21.22	March 30, 2024
*	NP.21.23	March 30, 2024
*	NP.21.24	March 30, 2024
*	NP.21.25	March 30, 2024
*	NP.21.26	March 30, 2024
*	NP.21.27	March 30, 2024
*	NP.21.28	March 30, 2024
*	NP.21.29	March 30, 2024
	NP.21.30	March 31, 2023
	NP.21.31	March 31, 2023
	NP.21.32	March 31, 2023
	NP.21.33	March 31, 2023
	NP.21.34	March 31, 2023
	NP.21.35	March 31, 2023
*	NP.21.36	March 30, 2024
	NP.21.37	March 31, 2023
	NP.21.38	March 31, 2023
	NP.21.39	March 31, 2023
	NP.21.40	March 31, 2023
	NP.21.41	March 31, 2023
	NP.21.42	March 31, 2023
	NP.21.43	March 31, 2023
	NP.21.44	March 31, 2023
	NP.21.45	March 31, 2023
	NP.21.46	March 31, 2023
	NP.21.47	March 31, 2023
	NP.21.48	March 31, 2023
	NP.21.49	March 31, 2023
	NP.21.50	March 31, 2023
	NP.21.51	March 31, 2023
	NP.21.52	March 31, 2023
	NP.21.53	March 31, 2023
	NP.21.54	March 31, 2023
	NP.21.55	March 31, 2023

* = Revised, Added, or Deleted

	NP.21.56	March 31, 2023
	NP.21.57	March 31, 2023
	NP.21.58	March 31, 2023
	NP.21.59	March 31, 2023
	NP.21.60	March 31, 2023
	NP.21.61	March 31, 2023
	NP.21.62	March 31, 2023
	NP.21.63	March 31, 2023
*	NP.21.64	March 30, 2024
*	NP.21.65	March 30, 2024
	NP.21.66	March 31, 2023
	NP.21.67	March 31, 2023
	NP.21.68	March 31, 2023
	NP.21.69	March 31, 2023
	NP.21.70	March 31, 2023
*	NP.21.71	March 30, 2024
*	NP.21.72	March 30, 2024
*	NP.21.73	March 30, 2024
	NP.21.74	September 30, 2022
	NP.21.75	September 30, 2022
	NP.21.76	September 30, 2022
	NP.21.77	September 30, 2022
	NP.21.78	September 30, 2022
	NP.21.79	September 30, 2022
	NP.21.80	September 30, 2022
	NP.21.81	September 30, 2022
	NP.21.82	September 30, 2022
	NP.21.83	September 30, 2022
	NP.21.84	September 30, 2022

Supplementary Procedures (tab)

*	SP.TOC.1-8	March 30, 2024
	SP.05.1	September 18, 2008
	SP.05.2	August 30, 2000
	SP.1.1	May 15, 2008
	SP.1.2	March 3, 2022
	SP.1.3	March 31, 2003
	SP.1.4	March 29, 2004
	SP.1.5	May 15, 2008
	SP.1.6	September 24, 2015
*	SP.1.7	March 30, 2024
*	SP.1.8	March 30, 2024
*	SP.1.9	March 30, 2024
*	SP.1.10	March 30, 2024
*	SP.1.11	March 30, 2024
*	SP.1.12	March 30, 2024
	SP.2.1	September 24, 2015
	SP.2.2	September 24, 2015
	SP.2.3	September 24, 2015
	SP.2.4	March 21, 2019
	SP.2.5	March 21, 2019
	SP.2.6	March 21, 2019
*	SP.2.7	March 30, 2024
	SP.2.8	March 21, 2019
	SP.3.1	September 20, 2018
	SP.3.2	September 17, 2020
	SP.3.3	September 17, 2020
	SP.3.4	September 17, 2020
	SP.3.5	March 18, 2021
	SP.3.6	March 18, 2021
	SP.4.1	September 24, 2015
	SP.4.2	March 31, 2023
	SP.4.3	March 31, 2023
	SP.4.4	March 31, 2023
	SP.4.5	March 31, 2023
	SP.4.6	March 31, 2023
	SP.4.7	March 31, 2023
	SP.4.8	March 31, 2023
	SP.4.9	March 31, 2023
	SP.4.10	March 31, 2023
	SP.4.11	March 31, 2023
	SP.4.12	March 31, 2023
	SP.4.13	March 31, 2023
	SP.4.14	March 31, 2023
	SP.5.1	March 29, 2004
*	SP.5.2	March 30, 2024
	SP.6.1	September 24, 2015
	SP.6.2	March 15, 2018
	SP.6.3	March 15, 2018
	SP.6.4	September 20, 2018
	SP.6.5	September 20, 2018
	SP.6.6	September 20, 2018
	SP.7.1	March 25, 2010
	SP.7.2	September 24, 2015
	SP.7.3	September 24, 2015
	SP.7.4	September 24, 2015
	SP.7.5	September 15, 2016
	SP.7.6	September 15, 2016
	SP.8.1	September 24, 2015
	SP.8.2	September 24, 2015
	SP.10.1	September 24, 2015
	SP.10.2	September 14, 2017
	SP.10.3	March 15, 2018
	SP.10.4	September 24, 2015

* = Revised, Added, or Deleted

Performance Dispatch (tab)

737-600 CFM56-7B22 KG FAA CATD

* = Revised, Added, or Deleted

PD.11.4	September 15, 2016
PD.11.5	September 15, 2016
PD.11.6	September 15, 2016
PD.11.7	September 15, 2016
PD.11.8	September 15, 2016
PD.12.1	September 15, 2016
PD.12.2	September 15, 2016
PD.12.3	September 15, 2016
PD.12.4	September 15, 2016
PD.12.5	September 15, 2016
PD.12.6	September 15, 2016
PD.12.7	September 15, 2016
PD.12.8	September 15, 2016
PD.13.1	September 15, 2016
PD.13.2	September 15, 2016
PD.14.1	September 15, 2016
PD.14.2	September 15, 2016
PD.14.3	September 15, 2016
PD.14.4	September 15, 2016
PD.14.5	September 15, 2016
PD.14.6	September 15, 2016

737-700 CFM56-7B24 LB FAA CATF/M

PD.TOC.20.1-2	September 15, 2016
PD.ModID.20.1-2	September 17, 2020
PD.20.1	September 15, 2016
PD.20.2	September 15, 2016
PD.20.3	September 15, 2016
PD.20.4	September 15, 2016
PD.20.5	September 15, 2016
PD.20.6	September 15, 2016
PD.20.7	September 15, 2016
PD.20.8	September 15, 2016
PD.20.9	September 15, 2016
PD.20.10	March 21, 2019
PD.21.1	September 15, 2016
PD.21.2	September 15, 2016
PD.21.3	September 15, 2016
PD.21.4	September 15, 2016
PD.21.5	September 15, 2016
PD.21.6	September 15, 2016
PD.21.7	September 15, 2016
PD.21.8	September 15, 2016
PD.22.1	September 15, 2016
PD.22.2	September 15, 2016
PD.22.3	September 15, 2016
PD.22.4	September 15, 2016
PD.22.5	September 15, 2016
PD.22.6	September 15, 2016
PD.22.7	September 15, 2016
PD.22.8	September 15, 2016
PD.23.1	September 15, 2016
PD.23.2	September 15, 2016
PD.24.1	September 15, 2016
PD.24.2	September 15, 2016
PD.24.3	September 15, 2016
PD.24.4	September 15, 2016
PD.24.5	September 15, 2016
PD.24.6	September 15, 2016

737-700W CFM56-7B26 KG JAA CATF/M

*	PD.TOC.30.1-2	March 30, 2024
	PD.ModID.30.1-2	September 2, 2021
	PD.30.1	September 2, 2021
	PD.30.2	September 2, 2021
	PD.30.3	September 2, 2021
	PD.30.4	September 2, 2021
	PD.30.5	September 2, 2021
	PD.30.6	September 2, 2021
	PD.30.7	September 2, 2021
	PD.30.8	September 2, 2021
	PD.30.9	September 2, 2021
	PD.30.10	September 2, 2021
	PD.30.11	September 2, 2021
	PD.30.12	September 2, 2021
	PD.30.13	September 2, 2021
	PD.30.14	September 2, 2021
	PD.30.15	September 2, 2021
	PD.30.16	September 2, 2021
	PD.30.17	September 2, 2021
	PD.30.18	September 2, 2021
	PD.30.19	September 2, 2021
	PD.30.20	September 2, 2021
	PD.30.21	September 2, 2021
	PD.30.22	September 2, 2021
	PD.31.1	September 2, 2021
	PD.31.2	September 2, 2021
	PD.31.3	September 2, 2021
	PD.31.4	September 2, 2021
	PD.31.5	September 2, 2021
	PD.31.6	September 2, 2021
	PD.31.7	September 2, 2021
	PD.31.8	September 2, 2021
	PD.32.1	September 2, 2021

* = Revised, Added, or Deleted

PD.32.2	September 2, 2021
PD.32.3	September 2, 2021
PD.32.4	September 2, 2021
PD.32.5	September 2, 2021
PD.32.6	September 2, 2021
PD.32.7	September 2, 2021
PD.32.8	September 2, 2021
PD.33.1	September 2, 2021
PD.33.2	September 2, 2021
PD.34.1	September 2, 2021
PD.34.2	September 2, 2021
PD.34.3	September 2, 2021
PD.34.4	September 2, 2021
PD.34.5	September 2, 2021
PD.34.6	September 2, 2021
PD.34.7	September 2, 2021
PD.34.8	September 2, 2021
737-800 CFM56-7B26 C KG M FAA CATC/N	
PD.TOC.40.1-2	September 2, 2021
PD.ModID.40.1-2	September 2, 2021
PD.40.1	September 2, 2021
PD.40.2	September 2, 2021
PD.40.3	September 2, 2021
PD.40.4	September 2, 2021
PD.40.5	September 2, 2021
PD.40.6	September 2, 2021
PD.40.7	September 2, 2021
PD.40.8	September 2, 2021
PD.40.9	September 2, 2021
PD.40.10	September 2, 2021
PD.41.1	September 2, 2021
PD.41.2	September 2, 2021
PD.41.3	September 2, 2021
PD.41.4	September 2, 2021
PD.41.5	September 2, 2021
PD.41.6	September 2, 2021
PD.41.7	September 2, 2021
PD.41.8	September 2, 2021
PD.41.9	September 2, 2021
PD.41.10	September 2, 2021
PD.42.1	September 2, 2021
PD.42.2	September 2, 2021
PD.42.3	September 2, 2021
PD.42.4	September 2, 2021
PD.42.5	September 2, 2021
PD.42.6	September 2, 2021
PD.42.7	September 2, 2021
PD.42.8	September 2, 2021
PD.43.1	September 2, 2021
PD.43.2	September 2, 2021
PD.43.3	September 2, 2021
PD.43.4	September 2, 2021
PD.43.5	September 2, 2021
PD.43.6	September 2, 2021
PD.43.7	September 2, 2021
PD.43.8	September 2, 2021
PD.43.9	September 2, 2021
PD.43.10	September 2, 2021
PD.44.1	September 2, 2021
PD.44.2	September 2, 2021
PD.44.3	September 2, 2021
PD.44.4	September 2, 2021
PD.44.5	September 2, 2021
PD.44.6	September 2, 2021
PD.44.7	September 2, 2021
PD.44.8	September 2, 2021
* PD.TOC.50.1-2	Deleted
* PD.ModID.50.1-2	Deleted
* PD.50.1-10	Deleted
* PD.50.11	Deleted
* PD.50.12	Deleted
* PD.51.1-8	Deleted
* PD.52.1-7	Deleted
* PD.52.8	Deleted
* PD.53.1-2	Deleted
* PD.54.1-6	Deleted
* PD.TOC.60.1-2	Deleted
* PD.ModID.60.1-2	Deleted
* PD.60.1-10	Deleted
* PD.61.1-8	Deleted
* PD.62.1-6	Deleted
* PD.62.7-8	Deleted
* PD.63.1-10	Deleted
* PD.64.1-6	Deleted
* PD.TOC.70.1-2	Deleted
* PD.ModID.70.1-2	Deleted
* PD.70.1-10	Deleted
* PD.70.11-12	Deleted
* PD.71.1-8	Deleted
* PD.72.1-7	Deleted
* PD.72.8-10	Deleted
* PD.73.1-10	Deleted
* PD.74.1-6	Deleted

* = Revised, Added, or Deleted

* = Revised, Added, or Deleted

* PD.70.1	March 30, 2024
* PD.70.2	March 30, 2024
* PD.70.3	March 30, 2024
* PD.70.4	March 30, 2024
* PD.70.5	March 30, 2024
* PD.70.6	March 30, 2024
* PD.70.7	March 30, 2024
* PD.70.8	March 30, 2024
* PD.70.9	March 30, 2024
* PD.70.10	March 30, 2024
* PD.71.1	March 30, 2024
* PD.71.2	March 30, 2024
* PD.71.3	March 30, 2024
* PD.71.4	March 30, 2024
* PD.71.5	March 30, 2024
* PD.71.6	March 30, 2024
* PD.71.7	March 30, 2024
* PD.71.8	March 30, 2024
* PD.72.1	March 30, 2024
* PD.72.2	March 30, 2024
* PD.72.3	March 30, 2024
* PD.72.4	March 30, 2024
* PD.72.5	March 30, 2024
* PD.72.6	March 30, 2024
* PD.72.7	March 30, 2024
* PD.72.8	March 30, 2024
* PD.73.1	March 30, 2024
* PD.73.2	March 30, 2024
* PD.73.3	March 30, 2024
* PD.73.4	March 30, 2024
* PD.73.5	March 30, 2024
* PD.73.6	March 30, 2024
* PD.73.7	March 30, 2024
* PD.73.8	March 30, 2024
* PD.73.9	March 30, 2024
* PD.73.10	March 30, 2024
* PD.74.1	March 30, 2024
* PD.74.2	March 30, 2024
* PD.74.3	March 30, 2024
* PD.74.4	March 30, 2024
* PD.74.5	March 30, 2024
* PD.74.6	March 30, 2024

737-900ERW CFM56-7B27 C FT LB FAA CATH/P

* PD.TOC.80.1-2	March 30, 2024
* PD.ModID.80.1-2	March 30, 2024
* PD.80.1	March 30, 2024
* PD.80.2	March 30, 2024
* PD.80.3	March 30, 2024
* PD.80.4	March 30, 2024
* PD.80.5	March 30, 2024
* PD.80.6	March 30, 2024
* PD.80.7	March 30, 2024
* PD.80.8	March 30, 2024
* PD.80.9	March 30, 2024
* PD.80.10	March 30, 2024
* PD.80.11	March 30, 2024
* PD.80.12	March 30, 2024
* PD.81.1	March 30, 2024
* PD.81.2	March 30, 2024
* PD.81.3	March 30, 2024
* PD.81.4	March 30, 2024
* PD.81.5	March 30, 2024
* PD.81.6	March 30, 2024
* PD.81.7	March 30, 2024
* PD.81.8	March 30, 2024
* PD.82.1	March 30, 2024
* PD.82.2	March 30, 2024
* PD.82.3	March 30, 2024
* PD.82.4	March 30, 2024
* PD.82.5	March 30, 2024
* PD.82.6	March 30, 2024
* PD.82.7	March 30, 2024
* PD.82.8	March 30, 2024
* PD.82.9	March 30, 2024
* PD.82.10	March 30, 2024
* PD.83.1	March 30, 2024
* PD.83.2	March 30, 2024
* PD.83.3	March 30, 2024
* PD.83.4	March 30, 2024
* PD.83.5	March 30, 2024
* PD.83.6	March 30, 2024
* PD.83.7	March 30, 2024
* PD.83.8	March 30, 2024
* PD.83.9	March 30, 2024
* PD.83.10	March 30, 2024
* PD.84.1	March 30, 2024
* PD.84.2	March 30, 2024
* PD.84.3	March 30, 2024
* PD.84.4	March 30, 2024
* PD.84.5	March 30, 2024
* PD.84.6	March 30, 2024

* = Revised, Added, or Deleted

* = Revised, Added, or Deleted

	PI.12.7	September 15, 2016
	PI.12.8	September 15, 2016
	PI.12.9	September 15, 2016
	PI.12.10	September 15, 2016
	PI.12.11	September 15, 2016
	PI.12.12	September 15, 2016
	PI.12.13	September 15, 2016
	PI.12.14	September 15, 2016
	PI.12.15	September 15, 2016
	PI.12.16	September 15, 2016
	PI.12.17	September 15, 2016
	PI.12.18	September 15, 2016
	PI.12.19	September 15, 2016
	PI.12.20	September 15, 2016
	PI.12.21	September 15, 2016
	PI.12.22	September 15, 2016
	PI.12.23	September 15, 2016
	PI.12.24	September 15, 2016
	PI.12.25	September 15, 2016
	PI.12.26	September 15, 2016
	PI.12.27	September 15, 2016
	PI.12.28	September 15, 2016
	PI.12.29	September 15, 2016
	PI.12.30	September 15, 2016
	PI.13.1	September 15, 2016
	PI.13.2	September 15, 2016
	PI.13.3	September 15, 2016
	PI.13.4	September 15, 2016
	PI.13.5	September 15, 2016
	PI.13.6	September 15, 2016
	PI.13.7	September 15, 2016
	PI.13.8	September 15, 2016
	PI.13.9	September 15, 2016
	PI.13.10	September 15, 2016
	PI.13.11	September 15, 2016
	PI.13.12	September 15, 2016
	PI.14.1	September 15, 2016
	PI.14.2	September 15, 2016
	PI.14.3	September 15, 2016
	PI.14.4	September 15, 2016
	PI.15.1	September 15, 2016
	PI.15.2	September 15, 2016
	PI.15.3	September 15, 2016
	PI.15.4	September 15, 2016
	PI.16.1	September 19, 2019
	PI.16.2	March 19, 2020
	PI.16.3	September 2, 2021
	PI.16.4	September 19, 2019
	PI.16.5	September 19, 2019
	PI.16.6	September 19, 2019
	PI.16.7	September 19, 2019
	PI.16.8	September 19, 2019
	PI.16.9	September 19, 2019
	PI.16.10	September 19, 2019
	PI.16.11	September 19, 2019
	PI.16.12	September 19, 2019
	737-700 CFM56-7B24 LB FAA CATF/M	
	PI.TOC.20.1-6	September 2, 2021
	PI.ModID.20.1-2	September 17, 2020
	PI.20.1	September 15, 2016
	PI.20.2	September 15, 2016
	PI.20.3	September 15, 2016
	PI.20.4	September 17, 2020
	PI.20.5	September 17, 2020
*	PI.20.6	March 30, 2024
	PI.20.7	September 19, 2019
	PI.20.8	September 19, 2019
	PI.20.9	September 19, 2019
	PI.20.10	September 19, 2019
	PI.20.11	September 19, 2019
	PI.20.12	September 19, 2019
	PI.20.13	September 19, 2019
	PI.20.14	September 19, 2019
	PI.20.15	September 19, 2019
	PI.20.16	September 19, 2019
	PI.20.17	September 19, 2019
	PI.20.18	September 19, 2019
	PI.20.19	September 19, 2019
	PI.20.20	September 19, 2019
	PI.20.21	September 19, 2019
	PI.20.22	September 17, 2020
	PI.20.23	September 17, 2020
	PI.20.24	September 19, 2019
	PI.20.25	September 19, 2019
	PI.20.26	September 19, 2019
	PI.20.27	September 19, 2019
	PI.20.28	September 19, 2019
	PI.20.29	September 19, 2019
	PI.20.30	September 19, 2019
	PI.20.31	September 19, 2019
	PI.20.32	September 19, 2019
	PI.20.33	September 19, 2019
	PI.20.34	September 19, 2019

* = Revised, Added, or Deleted

PI.20.35	September 19, 2019	* PI.20.82	March 30, 2024
PI.20.36	September 19, 2019	* PI.20.83	March 30, 2024
PI.20.37	September 19, 2019	* PI.20.84	March 30, 2024
PI.20.38	September 17, 2020	PI.21.1	September 15, 2016
PI.20.39	September 17, 2020	PI.21.2	September 15, 2016
PI.20.40	September 19, 2019	PI.21.3	September 15, 2016
PI.20.41	September 19, 2019	PI.21.4	September 15, 2016
PI.20.42	September 19, 2019	PI.21.5	September 15, 2016
PI.20.43	September 19, 2019	PI.21.6	September 15, 2016
PI.20.44	September 19, 2019	PI.21.7	September 15, 2016
PI.20.45	September 19, 2019	PI.21.8	September 15, 2016
PI.20.46	September 19, 2019	PI.21.9	September 15, 2016
PI.20.47	September 19, 2019	PI.21.10	September 15, 2016
PI.20.48	September 19, 2019	PI.22.1	September 17, 2020
PI.20.49	September 19, 2019	PI.22.2	September 17, 2020
PI.20.50	September 19, 2019	PI.22.3	September 17, 2020
PI.20.51	September 19, 2019	* PI.22.4	March 30, 2024
PI.20.52	September 19, 2019	* PI.22.5	March 30, 2024
PI.20.53	September 17, 2020	* PI.22.6	March 30, 2024
PI.20.54	September 17, 2020	* PI.22.7	March 30, 2024
PI.20.55	September 2, 2021	* PI.22.8	March 30, 2024
PI.20.56	September 2, 2021	* PI.22.9	March 30, 2024
PI.20.57	September 2, 2021	* PI.22.10	March 30, 2024
PI.20.58	September 2, 2021	* PI.22.11	March 30, 2024
PI.20.59	September 2, 2021	* PI.22.12	March 30, 2024
PI.20.60	September 2, 2021	* PI.22.13	March 30, 2024
PI.20.61	September 2, 2021	* PI.22.14	March 30, 2024
PI.20.62	September 2, 2021	* PI.22.15	March 30, 2024
PI.20.63	September 2, 2021	* PI.22.16	March 30, 2024
PI.20.64	September 2, 2021	* PI.22.17	March 30, 2024
PI.20.65	September 2, 2021	* PI.22.18	March 30, 2024
PI.20.66	September 2, 2021	* PI.22.19	March 30, 2024
PI.20.67	September 2, 2021	* PI.22.20	March 30, 2024
PI.20.68	September 2, 2021	* PI.22.21	March 30, 2024
PI.20.69	September 2, 2021	* PI.22.22	March 30, 2024
PI.20.70	September 2, 2021	* PI.22.23	March 30, 2024
PI.20.71	September 2, 2021	* PI.22.24	March 30, 2024
PI.20.72	September 2, 2021	* PI.22.25	March 30, 2024
PI.20.73	September 2, 2021	* PI.22.26	March 30, 2024
PI.20.74	September 2, 2021	* PI.22.27	March 30, 2024
PI.20.75	September 2, 2021	* PI.22.28	March 30, 2024
PI.20.76	September 2, 2021	PI.22.29	September 15, 2016
PI.20.77	September 2, 2021	PI.22.30	September 19, 2019
PI.20.78	September 2, 2021	PI.23.1	September 15, 2016
PI.20.79	September 2, 2021	PI.23.2	September 15, 2016
PI.20.80	September 2, 2021	PI.23.3	September 15, 2016
PI.20.81	September 2, 2021	PI.23.4	September 15, 2016

* = Revised, Added, or Deleted

	PI.23.5	September 15, 2016
	PI.23.6	September 15, 2016
	PI.23.7	September 15, 2016
	PI.23.8	September 15, 2016
	PI.23.9	September 15, 2016
	PI.23.10	September 15, 2016
	PI.23.11	September 15, 2016
	PI.23.12	September 15, 2016
	PI.24.1	September 15, 2016
	PI.24.2	September 15, 2016
	PI.24.3	September 15, 2016
	PI.24.4	September 15, 2016
	PI.24.5	September 15, 2016
	PI.24.6	September 15, 2016
	PI.25.1	September 15, 2016
	PI.25.2	September 15, 2016
	PI.25.3	September 15, 2016
	PI.25.4	September 15, 2016
	PI.26.1	September 19, 2019
	PI.26.2	March 19, 2020
	PI.26.3	September 2, 2021
	PI.26.4	September 19, 2019
	PI.26.5	September 19, 2019
*	PI.26.6	March 30, 2024
	PI.26.7	September 19, 2019
	PI.26.8	September 19, 2019
	PI.26.9	September 19, 2019
	PI.26.10	September 19, 2019
	PI.26.11	September 19, 2019
	PI.26.12	September 19, 2019

737-700W CFM56-7B26 KG JAA CATF/M

	PI.TOC.30.1-6	September 2, 2021
	PI.ModID.30.1-2	September 2, 2021
	PI.30.1	September 2, 2021
	PI.30.2	September 2, 2021
	PI.30.3	September 2, 2021
	PI.30.4	September 2, 2021
	PI.30.5	September 2, 2021
	PI.30.6	September 2, 2021
*	PI.30.7	March 30, 2024
	PI.30.8	September 2, 2021
	PI.30.9	September 2, 2021
	PI.30.10	September 2, 2021
	PI.30.11	September 2, 2021
	PI.30.12	September 2, 2021
	PI.30.13	September 2, 2021
	PI.30.14	September 2, 2021
	PI.30.15	September 2, 2021
	PI.30.16	September 2, 2021
	PI.30.17	September 2, 2021
	PI.30.18	September 2, 2021
	PI.30.19	September 2, 2021
	PI.30.20	September 2, 2021
	PI.30.21	September 2, 2021
	PI.30.22	September 2, 2021
	PI.30.23	September 2, 2021
	PI.30.24	September 2, 2021
	PI.30.25	September 2, 2021
	PI.30.26	September 2, 2021
	PI.30.27	September 2, 2021
	PI.30.28	September 2, 2021
	PI.30.29	September 2, 2021
	PI.30.30	September 2, 2021
	PI.30.31	September 2, 2021
	PI.30.32	September 2, 2021
	PI.30.33	September 2, 2021
	PI.30.34	September 2, 2021
	PI.30.35	September 2, 2021
	PI.30.36	September 2, 2021
	PI.30.37	September 2, 2021
	PI.30.38	September 2, 2021
	PI.30.39	September 2, 2021
	PI.30.40	September 2, 2021
	PI.30.41	September 2, 2021
	PI.30.42	September 2, 2021
	PI.30.43	September 2, 2021
	PI.30.44	September 2, 2021
	PI.30.45	September 2, 2021
	PI.30.46	September 2, 2021
	PI.30.47	September 2, 2021
	PI.30.48	September 2, 2021
	PI.30.49	September 2, 2021
	PI.30.50	September 2, 2021
	PI.30.51	September 2, 2021
	PI.30.52	September 2, 2021
	PI.30.53	September 2, 2021
	PI.30.54	September 2, 2021
	PI.30.55	September 2, 2021
	PI.30.56	September 2, 2021
	PI.30.57	September 2, 2021
	PI.30.58	September 2, 2021
	PI.30.59	September 2, 2021
	PI.30.60	September 2, 2021

* = Revised, Added, or Deleted

	PI.30.61	September 2, 2021	*	PI.32.14	March 30, 2024
	PI.30.62	September 2, 2021	*	PI.32.15	March 30, 2024
	PI.30.63	September 2, 2021	*	PI.32.16	March 30, 2024
	PI.30.64	September 2, 2021	*	PI.32.17	March 30, 2024
	PI.30.65	September 2, 2021	*	PI.32.18	March 30, 2024
	PI.30.66	September 2, 2021	*	PI.32.19	March 30, 2024
	PI.30.67	September 2, 2021	*	PI.32.20	March 30, 2024
	PI.30.68	September 2, 2021	*	PI.32.21	March 30, 2024
	PI.30.69	September 2, 2021	*	PI.32.22	March 30, 2024
	PI.30.70	September 2, 2021	*	PI.32.23	March 30, 2024
	PI.30.71	September 2, 2021	*	PI.32.24	March 30, 2024
	PI.30.72	September 2, 2021	*	PI.32.25	March 30, 2024
	PI.30.73	September 2, 2021	*	PI.32.26	March 30, 2024
	PI.30.74	September 2, 2021	*	PI.32.27	March 30, 2024
	PI.30.75	September 2, 2021		PI.32.28	September 2, 2021
	PI.30.76	September 2, 2021		PI.32.29	September 2, 2021
	PI.30.77	September 2, 2021		PI.32.30	September 2, 2021
	PI.30.78	September 2, 2021		PI.33.1	September 2, 2021
	PI.30.79	September 2, 2021		PI.33.2	September 2, 2021
	PI.30.80	September 2, 2021		PI.33.3	September 2, 2021
	PI.30.81	September 2, 2021		PI.33.4	September 2, 2021
	PI.30.82	September 2, 2021		PI.33.5	September 2, 2021
*	PI.30.83	March 30, 2024		PI.33.6	September 2, 2021
*	PI.30.84	March 30, 2024		PI.33.7	September 2, 2021
	PI.31.1	September 2, 2021		PI.33.8	September 2, 2021
	PI.31.2	September 2, 2021		PI.33.9	September 2, 2021
	PI.31.3	September 2, 2021		PI.33.10	September 2, 2021
	PI.31.4	September 2, 2021		PI.33.11	September 2, 2021
	PI.31.5	September 2, 2021		PI.33.12	September 2, 2021
	PI.31.6	September 2, 2021		PI.34.1	September 2, 2021
	PI.31.7	September 2, 2021		PI.34.2	September 2, 2021
	PI.31.8	September 2, 2021		PI.35.1	September 2, 2021
	PI.31.9	September 2, 2021		PI.35.2	September 2, 2021
	PI.31.10	September 2, 2021		PI.35.3	September 2, 2021
	PI.32.1	September 2, 2021		PI.35.4	September 2, 2021
	PI.32.2	September 2, 2021		PI.35.5	September 2, 2021
*	PI.32.3	March 30, 2024		PI.35.6	September 2, 2021
*	PI.32.4	March 30, 2024		PI.36.1	September 2, 2021
*	PI.32.5	March 30, 2024		PI.36.2	September 2, 2021
*	PI.32.6	March 30, 2024		PI.36.3	September 2, 2021
*	PI.32.7	March 30, 2024		PI.36.4	September 2, 2021
*	PI.32.8	March 30, 2024		PI.37.1	September 2, 2021
*	PI.32.9	March 30, 2024		PI.37.2	September 2, 2021
*	PI.32.10	March 30, 2024		PI.37.3	September 2, 2021
*	PI.32.11	March 30, 2024		PI.37.4	September 2, 2021
*	PI.32.12	March 30, 2024		PI.37.5	September 2, 2021
*	PI.32.13	March 30, 2024	*	PI.37.6	March 30, 2024

* = Revised, Added, or Deleted

* = Revised, Added, or Deleted

PI.41.9	September 2, 2021	PI.45.2	September 2, 2021
PI.41.10	September 2, 2021	PI.45.3	September 2, 2021
PI.42.1	September 2, 2021	PI.45.4	September 2, 2021
PI.42.2	September 2, 2021	PI.46.1	September 2, 2021
PI.42.3	September 2, 2021	PI.46.2	September 2, 2021
PI.42.4	September 2, 2021	PI.46.3	September 2, 2021
PI.42.5	September 2, 2021	PI.46.4	September 2, 2021
PI.42.6	September 2, 2021	PI.47.1	September 2, 2021
PI.42.7	September 2, 2021	PI.47.2	September 2, 2021
PI.42.8	September 2, 2021	PI.47.3	September 2, 2021
PI.42.9	September 2, 2021	PI.47.4	September 2, 2021
PI.42.10	September 2, 2021	PI.47.5	September 2, 2021
PI.42.11	September 2, 2021	PI.47.6	September 2, 2021
PI.42.12	September 2, 2021	PI.47.7	September 2, 2021
PI.42.13	September 2, 2021	PI.47.8	September 2, 2021
PI.42.14	September 2, 2021	PI.47.9	September 2, 2021
PI.42.15	September 2, 2021	PI.47.10	September 2, 2021
PI.42.16	September 2, 2021	PI.47.11	September 2, 2021
PI.42.17	September 2, 2021	PI.47.12	September 2, 2021
PI.42.18	September 2, 2021	PI.47.13	September 2, 2021
PI.42.19	September 2, 2021	PI.47.14	September 2, 2021
PI.42.20	September 2, 2021	* PI.TOC.50.1-6	Deleted
PI.42.21	September 2, 2021	* PI.ModID.50.1-2	Deleted
PI.42.22	September 2, 2021	* PI.50.1-3	Deleted
PI.42.23	September 2, 2021	* PI.50.4	Deleted
PI.42.24	September 2, 2021	* PI.50.5-16	Deleted
PI.42.25	September 2, 2021	* PI.50.17-19	Deleted
PI.42.26	September 2, 2021	* PI.50.20-30	Deleted
PI.42.27	September 2, 2021	* PI.50.31-33	Deleted
PI.42.28	September 2, 2021	* PI.50.34-44	Deleted
PI.42.29	September 2, 2021	* PI.50.45-46	Deleted
PI.42.30	September 2, 2021	* PI.50.47-76	Deleted
PI.43.1	September 2, 2021	* PI.51.1-10	Deleted
PI.43.2	September 2, 2021	* PI.52.1-3	Deleted
PI.43.3	September 2, 2021	* PI.52.4-28	Deleted
PI.43.4	September 2, 2021	* PI.52.29-30	Deleted
PI.43.5	September 2, 2021	* PI.53.1-12	Deleted
PI.43.6	September 2, 2021	* PI.54.1-2	Deleted
PI.43.7	September 2, 2021	* PI.55.1-6	Deleted
PI.43.8	September 2, 2021	* PI.56.1-6	Deleted
PI.43.9	September 2, 2021	* PI.57.1-14	Deleted
PI.43.10	September 2, 2021	* PI.TOC.60.1-6	Deleted
PI.43.11	September 2, 2021	* PI.ModID.60.1-2	Deleted
PI.43.12	September 2, 2021	* PI.60.1-3	Deleted
PI.44.1	September 2, 2021	* PI.60.4	Deleted
PI.44.2	September 2, 2021	* PI.60.5-14	Deleted
PI.45.1	September 2, 2021	* PI.60.15-17	Deleted

* = Revised, Added, or Deleted

* PI.60.18-26	Deleted
* PI.60.27-29	Deleted
* PI.60.30-38	Deleted
* PI.60.39-40	Deleted
* PI.60.41-68	Deleted
* PI.61.1-10	Deleted
* PI.62.1-3	Deleted
* PI.62.4-28	Deleted
* PI.62.29-30	Deleted
* PI.63.1-12	Deleted
* PI.64.1-2	Deleted
* PI.65.1-6	Deleted
* PI.66.1-4	Deleted
* PI.67.1-14	Deleted
* PI.TOC.70.1-6	Deleted
* PI.ModID.70.1-2	Deleted
* PI.70.1-3	Deleted
* PI.70.4	Deleted
* PI.70.5-16	Deleted
* PI.70.17-19	Deleted
* PI.70.20-30	Deleted
* PI.70.31-33	Deleted
* PI.70.34-44	Deleted
* PI.70.45-46	Deleted
* PI.70.47-74	Deleted
* PI.71.1-10	Deleted
* PI.72.1-3	Deleted
* PI.72.4-28	Deleted
* PI.72.29-30	Deleted
* PI.73.1-12	Deleted
* PI.74.1-2	Deleted
* PI.75.1-6	Deleted
* PI.76.1-4	Deleted
* PI.77.1-14	Deleted
737-800W CFM56-7B26 C M KG FAA CATC/N	
* PI.TOC.50.1-6	March 30, 2024
* PI.ModID.50.1-2	March 30, 2024
* PI.50.1	March 30, 2024
* PI.50.2	March 30, 2024
* PI.50.3	March 30, 2024
* PI.50.4	March 30, 2024
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* PI.50.7	March 30, 2024
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* PI.50.41	March 30, 2024
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* PI.50.46	March 30, 2024
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* PI.50.49	March 30, 2024
* PI.50.50	March 30, 2024
* PI.50.51	March 30, 2024
* PI.50.52	March 30, 2024
* PI.50.53	March 30, 2024
* PI.50.54	March 30, 2024
* PI.50.55	March 30, 2024
* PI.50.56	March 30, 2024

* = Revised, Added, or Deleted

* PI.50.57	March 30, 2024	* PI.52.18	March 30, 2024
* PI.50.58	March 30, 2024	* PI.52.19	March 30, 2024
* PI.50.59	March 30, 2024	* PI.52.20	March 30, 2024
* PI.50.60	March 30, 2024	* PI.52.21	March 30, 2024
* PI.50.61	March 30, 2024	* PI.52.22	March 30, 2024
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* PI.50.63	March 30, 2024	* PI.52.24	March 30, 2024
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* PI.50.65	March 30, 2024	* PI.52.26	March 30, 2024
* PI.50.66	March 30, 2024	* PI.52.27	March 30, 2024
* PI.50.67	March 30, 2024	* PI.52.28	March 30, 2024
* PI.50.68	March 30, 2024	* PI.52.29	March 30, 2024
* PI.50.69	March 30, 2024	* PI.52.30	March 30, 2024
* PI.50.70	March 30, 2024	* PI.53.1	March 30, 2024
* PI.50.71	March 30, 2024	* PI.53.2	March 30, 2024
* PI.50.72	March 30, 2024	* PI.53.3	March 30, 2024
* PI.50.73	March 30, 2024	* PI.53.4	March 30, 2024
* PI.50.74	March 30, 2024	* PI.53.5	March 30, 2024
* PI.50.75	March 30, 2024	* PI.53.6	March 30, 2024
* PI.50.76	March 30, 2024	* PI.53.7	March 30, 2024
* PI.51.1	March 30, 2024	* PI.53.8	March 30, 2024
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* PI.51.3	March 30, 2024	* PI.53.10	March 30, 2024
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* PI.51.6	March 30, 2024	* PI.54.1	March 30, 2024
* PI.51.7	March 30, 2024	* PI.54.2	March 30, 2024
* PI.51.8	March 30, 2024	* PI.55.1	March 30, 2024
* PI.51.9	March 30, 2024	* PI.55.2	March 30, 2024
* PI.51.10	March 30, 2024	* PI.55.3	March 30, 2024
* PI.52.1	March 30, 2024	* PI.55.4	March 30, 2024
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* PI.52.3	March 30, 2024	* PI.55.6	March 30, 2024
* PI.52.4	March 30, 2024	* PI.56.1	March 30, 2024
* PI.52.5	March 30, 2024	* PI.56.2	March 30, 2024
* PI.52.6	March 30, 2024	* PI.56.3	March 30, 2024
* PI.52.7	March 30, 2024	* PI.56.4	March 30, 2024
* PI.52.8	March 30, 2024	* PI.57.1	March 30, 2024
* PI.52.9	March 30, 2024	* PI.57.2	March 30, 2024
* PI.52.10	March 30, 2024	* PI.57.3	March 30, 2024
* PI.52.11	March 30, 2024	* PI.57.4	March 30, 2024
* PI.52.12	March 30, 2024	* PI.57.5	March 30, 2024
* PI.52.13	March 30, 2024	* PI.57.6	March 30, 2024
* PI.52.14	March 30, 2024	* PI.57.7	March 30, 2024
* PI.52.15	March 30, 2024	* PI.57.8	March 30, 2024
* PI.52.16	March 30, 2024	* PI.57.9	March 30, 2024
* PI.52.17	March 30, 2024	* PI.57.10	March 30, 2024

* = Revised, Added, or Deleted

* PI.57.11	March 30, 2024	* PI.60.40	March 30, 2024
* PI.57.12	March 30, 2024	* PI.60.41	March 30, 2024
* PI.57.13	March 30, 2024	* PI.60.42	March 30, 2024
* PI.57.14	March 30, 2024	* PI.60.43	March 30, 2024
		* PI.60.44	March 30, 2024
737-900 CFM56-7B26 C FT LB FAA CATG/O		* PI.60.45	March 30, 2024
* PI.TOC.60.1-6	March 30, 2024	* PI.60.46	March 30, 2024
* PI.ModID.60.1-2	March 30, 2024	* PI.60.47	March 30, 2024
* PI.60.1	March 30, 2024	* PI.60.48	March 30, 2024
* PI.60.2	March 30, 2024	* PI.60.49	March 30, 2024
* PI.60.3	March 30, 2024	* PI.60.50	March 30, 2024
* PI.60.4	March 30, 2024	* PI.60.51	March 30, 2024
* PI.60.5	March 30, 2024	* PI.60.52	March 30, 2024
* PI.60.6	March 30, 2024	* PI.60.53	March 30, 2024
* PI.60.7	March 30, 2024	* PI.60.54	March 30, 2024
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* PI.60.38	March 30, 2024	* PI.61.7	March 30, 2024
* PI.60.39	March 30, 2024	* PI.61.8	March 30, 2024

* = Revised, Added, or Deleted

737-900ERW CFM56-7B26 C KG M FAA CATH/P

* = Revised, Added, or Deleted

* PI.70.19	March 30, 2024	* PI.70.66	March 30, 2024
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* = Revised, Added, or Deleted

* PI.73.5	March 30, 2024
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* PI.77.14	March 30, 2024

737-900ERW CFM56-7B27 C FT LB FAA CATH/P

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* PI.80.56	March 30, 2024

* = Revised, Added, or Deleted

* PI.80.57	March 30, 2024	* PI.82.20	March 30, 2024
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* = Revised, Added, or Deleted

* PI.87.13	March 30, 2024
* PI.87.14	March 30, 2024

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Volume 2

1 Airplane General, Emergency Equipment, Doors, Windows (tab)

* 1.TOC.1-4	March 30, 2024
* 1.10.1	March 30, 2024
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1.20.4	September 30, 2022
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1.20.6	September 30, 2022
1.20.7	September 30, 2022
1.20.8	September 30, 2022
1.20.9	September 30, 2022
1.20.10	September 30, 2022
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1.20.12	September 30, 2022
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1.20.14	March 3, 2022
1.20.15	September 27, 2004
1.20.16	March 31, 2016
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1.20.18	March 31, 2016
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* 1.30.23	March 30, 2024
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1.40.2	March 31, 2023
1.40.3	March 31, 2023
1.40.4	March 31, 2023

* = Revised, Added, or Deleted

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*	1.40.44	March 30, 2024	*	2.TOC.1-4	March 30, 2024
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*	1.40.41-70	Deleted			

* = Revised, Added, or Deleted

3 Anti-Ice, Rain (tab)

4 Automatic Flight (tab)

* = Revised, Added, or Deleted

4.10.11	March 31, 2023
4.10.12	March 31, 2023
4.10.13	March 31, 2023
4.10.14	March 31, 2023
4.10.15	March 31, 2023
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4.10.18	March 31, 2023
4.10.19	March 31, 2023
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* 4.10.21	March 30, 2024
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4.20.25	September 30, 2023
4.20.26	March 31, 2023
4.20.27	March 31, 2023
4.20.28	March 31, 2023
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4.20.30	March 31, 2023
4.20.31	March 31, 2023
4.20.32	March 31, 2023
4.20.33	March 31, 2023
4.20.34	September 30, 2022
4.20.35	September 30, 2022
4.20.36	September 30, 2022
4.20.37	September 30, 2022
4.20.38	September 20, 2018
4.20.39	September 20, 2018
4.20.40	September 20, 2018
4.20.41	September 30, 2023
4.20.42	September 20, 2018
4.20.43	September 20, 2018
4.20.44	September 20, 2018

5 Communications (tab)

* 5.TOC.1-2	March 30, 2024
5.10.1	September 2, 2021
5.10.2	March 31, 2023
5.10.3	March 31, 2023
5.10.4	March 31, 2023
5.10.5	March 31, 2023
5.10.6	March 31, 2023
5.10.7	March 31, 2023
5.10.8	March 31, 2023
5.10.9	March 31, 2023
5.10.10	March 31, 2023
5.10.11	March 31, 2023
* 5.10.12	March 30, 2024
* 5.10.13	March 30, 2024
* 5.10.14	March 30, 2024
* 5.10.15	March 30, 2024
* 5.10.16	March 30, 2024
* 5.10.17	March 30, 2024
* 5.10.18	March 30, 2024
5.20.1	September 17, 2020
5.20.2	September 17, 2020
* 5.20.3	March 30, 2024
* 5.20.4	March 30, 2024
* 5.20.5	March 30, 2024
* 5.20.6	March 30, 2024
* 5.20.7	March 30, 2024
* 5.20.8	March 30, 2024

6 Electrical (tab)

* 6.TOC.1-2	March 30, 2024

* = Revised, Added, or Deleted

6.10.1	March 27, 2009
6.10.2	September 18, 2008
6.10.3	March 3, 2022
* 6.10.4	March 30, 2024
* 6.10.5	March 30, 2024
* 6.10.6	March 30, 2024
* 6.10.7	March 30, 2024
* 6.10.8	March 30, 2024
* 6.10.9	March 30, 2024
* 6.10.10	March 30, 2024
* 6.10.11	March 30, 2024
* 6.10.12	March 30, 2024
6.20.1	June 6, 2001
6.20.2	March 31, 2023
6.20.3	March 31, 2023
6.20.4	March 31, 2023
6.20.5	September 30, 2023
6.20.6	September 30, 2023
* 6.20.7	March 30, 2024
* 6.20.8	March 30, 2024
6.20.9	March 31, 2023
6.20.10	March 31, 2023
6.20.11	March 31, 2023
6.20.12	March 31, 2023
6.20.13	March 31, 2023
6.20.14	March 31, 2023
6.20.15	March 31, 2023
6.20.16	March 31, 2023
6.20.17	March 31, 2023
6.20.18	March 31, 2023
6.20.19	March 31, 2023
6.20.20	September 30, 2023
6.20.21	March 31, 2023
6.20.22	March 31, 2023
6.20.23	March 31, 2023
6.20.24	March 31, 2023
6.20.25	September 30, 2022
6.20.26	September 30, 2022

7 Engines, APU (tab)

* 7.TOC.1-4	March 30, 2024
7.10.1	September 18, 2008
7.10.2	September 15, 2016
7.10.3	September 15, 2016
7.10.4	September 15, 2016
7.10.5	September 15, 2016
7.10.6	March 16, 2017
* 7.10.7	March 30, 2024
* 7.10.8	March 30, 2024
7.10.9	September 15, 2016
7.10.10	September 15, 2016
7.10.11	September 15, 2016
7.10.12	September 15, 2016
7.10.13	September 15, 2016
7.10.14	September 15, 2016
* 7.11.1	March 30, 2024
* 7.11.2	March 30, 2024
* 7.11.3	March 30, 2024
* 7.11.4	March 30, 2024
* 7.11.5	March 30, 2024
* 7.11.6	March 30, 2024
* 7.11.7	March 30, 2024
* 7.11.8	March 30, 2024
* 7.11.9	March 30, 2024
* 7.11.10	March 30, 2024
* 7.11.11	March 30, 2024
* 7.11.12	March 30, 2024
* 7.11.13	March 30, 2024
* 7.11.14	March 30, 2024
* 7.11.15	March 30, 2024
* 7.11.16	March 30, 2024
* 7.11.17	March 30, 2024
* 7.11.18	March 30, 2024
* 7.11.19	March 30, 2024
* 7.11.20	March 30, 2024
* 7.15.1	March 30, 2024
* 7.15.2	March 30, 2024
7.15.3	September 30, 2023
7.15.4	September 30, 2023
7.15.5	September 30, 2023
7.15.6	September 30, 2023
7.15.7	September 30, 2023
7.15.8	September 30, 2023
7.15.9	September 30, 2023
7.15.10	September 30, 2023
7.20.1	March 19, 2020
7.20.2	March 31, 2023
7.20.3	March 31, 2023
7.20.4	March 31, 2023
7.20.5	March 31, 2023
7.20.6	March 31, 2023
7.20.7	September 15, 2016
7.20.8	September 15, 2016
7.20.9	September 15, 2016

* = Revised, Added, or Deleted

* = Revised, Added, or Deleted

	10.10.7	March 31, 2023
	10.10.8	March 31, 2023
	10.10.9	March 31, 2023
	10.10.10	March 31, 2023
	10.10.11	March 31, 2023
	10.10.12	March 31, 2023
	10.10.13	March 31, 2023
	10.10.14	March 31, 2023
	10.10.15	March 31, 2023
	10.10.16	March 31, 2023
	10.10.17	March 31, 2023
	10.10.18	March 31, 2023
	10.10.19	March 31, 2023
*	10.10.20	March 30, 2024
*	10.10.21	March 30, 2024
*	10.10.22	March 30, 2024
*	10.10.23	March 30, 2024
	10.10.24	March 31, 2023
	10.10.25	March 31, 2023
	10.10.26	March 31, 2023
	10.10.27	March 31, 2023
	10.10.28	March 31, 2023
	10.10.29	March 31, 2023
	10.10.30	March 31, 2023
	10.10.31	March 31, 2023
	10.10.32	March 31, 2023
	10.10.33	March 31, 2023
	10.10.34	March 31, 2023
*	10.10.35	March 30, 2024
*	10.10.36	March 30, 2024
	10.10.37	March 31, 2023
	10.10.38	March 31, 2023
	10.10.39	March 31, 2023
	10.10.40	March 31, 2023
	10.10.41	March 31, 2023
	10.10.42	March 31, 2023
	10.10.43	March 31, 2023
	10.10.44	March 31, 2023
	10.10.45	March 31, 2023
	10.10.46	March 31, 2023
	10.10.47	March 31, 2023
	10.10.48	March 31, 2023
	10.10.49	March 31, 2023
	10.10.50	March 31, 2023
	10.10.51	March 31, 2023
	10.10.52	March 31, 2023
	10.10.53	March 31, 2023
	10.10.54	March 31, 2023
	10.10.55	March 31, 2023
	10.10.56	March 31, 2023
	10.10.57	March 31, 2023
	10.10.58	March 31, 2023
	10.10.59	March 31, 2023
	10.10.60	March 31, 2023
	10.10.61	March 31, 2023
	10.10.62	March 31, 2023
	10.10.63	March 31, 2023
	10.10.64	March 31, 2023
	10.11.1	March 29, 2004
	10.11.2	September 20, 2018
	10.11.3	September 20, 2018
	10.11.4	September 20, 2018
	10.11.5	September 20, 2018
	10.11.6	September 20, 2018
	10.11.7	September 20, 2018
	10.11.8	September 20, 2018
	10.11.9	September 20, 2018
	10.11.10	March 18, 2021
	10.11.11	September 20, 2018
	10.11.12	March 18, 2021
*	10.11.13	March 30, 2024
*	10.11.14	March 30, 2024
*	10.11.15	March 30, 2024
	10.11.16	September 20, 2018
	10.11.17	March 19, 2020
	10.11.18	March 19, 2020
	10.11.19	September 20, 2018
	10.11.20	September 30, 2022
	10.11.21	September 30, 2022
*	10.11.22	March 30, 2024
*	10.11.23	March 30, 2024
*	10.11.24	March 30, 2024
*	10.11.25	March 30, 2024
*	10.11.26	March 30, 2024
*	10.11.27	March 30, 2024
*	10.11.28	March 30, 2024
*	10.11.29	March 30, 2024
*	10.11.30	March 30, 2024
*	10.11.31	March 30, 2024
*	10.11.32	March 30, 2024
*	10.11.33	March 30, 2024
*	10.11.34	March 30, 2024
*	10.11.35	March 30, 2024
*	10.11.36	March 30, 2024

* = Revised, Added, or Deleted

* 10.11.37	March 30, 2024	* 10.11.84	March 30, 2024
* 10.11.38	March 30, 2024	* 10.11.85	March 30, 2024
* 10.11.39	March 30, 2024	* 10.11.86	March 30, 2024
* 10.11.40	March 30, 2024	10.12.1	September 29, 2005
* 10.11.41	March 30, 2024	10.12.2	September 29, 2005
* 10.11.42	March 30, 2024	10.12.3	September 29, 2005
* 10.11.43	March 30, 2024	10.12.4	September 29, 2005
* 10.11.44	March 30, 2024	10.12.5	September 30, 2011
* 10.11.45	March 30, 2024	10.12.6	September 30, 2011
* 10.11.46	March 30, 2024	10.12.7	September 30, 2011
* 10.11.47	March 30, 2024	10.12.8	September 30, 2022
* 10.11.48	March 30, 2024	10.12.9	September 30, 2022
* 10.11.49	March 30, 2024	10.12.10	September 30, 2011
* 10.11.50	March 30, 2024	10.12.11	September 30, 2011
* 10.11.51	March 30, 2024	* 10.12.12	March 30, 2024
* 10.11.52	March 30, 2024	* 10.12.13	March 30, 2024
* 10.11.53	March 30, 2024	10.12.14	September 30, 2011
* 10.11.54	March 30, 2024	10.12.15	September 30, 2011
* 10.11.55	March 30, 2024	10.12.16	September 30, 2011
* 10.11.56	March 30, 2024	10.15.1	September 30, 2011
* 10.11.57	March 30, 2024	10.15.2	March 29, 2004
* 10.11.58	March 30, 2024	10.15.3	September 17, 2020
* 10.11.59	March 30, 2024	10.15.4	September 17, 2020
* 10.11.60	March 30, 2024	10.15.5	September 26, 2013
* 10.11.61	March 30, 2024	10.15.6	March 31, 2003
10.11.62	September 30, 2022	10.15.7	March 27, 2009
10.11.63	September 30, 2022	10.15.8	March 31, 2003
10.11.64	September 30, 2022	10.15.9	March 31, 2003
10.11.65	September 30, 2022	10.15.10	March 31, 2003
10.11.66	September 30, 2022	10.15.11	March 31, 2003
10.11.67	September 30, 2022	10.15.12	March 31, 2003
10.11.68	September 30, 2022	10.15.13	March 31, 2003
10.11.69	September 30, 2022	10.15.14	September 26, 2013
10.11.70	September 30, 2022	10.15.15	September 26, 2013
10.11.71	September 30, 2022	10.15.16	September 14, 2017
10.11.72	September 30, 2022	10.15.17	March 31, 2003
10.11.73	September 30, 2022	10.15.18	March 31, 2003
10.11.74	September 30, 2022	10.15.19	March 31, 2003
* 10.11.75	March 30, 2024	10.15.20	March 31, 2003
* 10.11.76	March 30, 2024	10.15.21	March 31, 2003
* 10.11.77	March 30, 2024	* 10.15.22	March 30, 2024
* 10.11.78	March 30, 2024	* 10.15.23	March 30, 2024
* 10.11.79	March 30, 2024	10.15.24	March 31, 2003
* 10.11.80	March 30, 2024	10.16.1	September 14, 2017
* 10.11.81	March 30, 2024	10.16.2	September 14, 2017
* 10.11.82	March 30, 2024	10.16.3	September 17, 2020
* 10.11.83	March 30, 2024	10.16.4	September 17, 2020

* = Revised, Added, or Deleted

10.16.5	September 14, 2017	10.21.2	September 20, 2018
10.16.6	September 14, 2017	10.21.3	September 20, 2018
10.16.7	September 14, 2017	10.21.4	September 30, 2022
10.16.8	September 14, 2017	10.21.5	September 30, 2022
10.16.9	September 14, 2017	10.21.6	August 30, 2000
10.16.10	September 14, 2017	10.21.7	August 30, 2000
10.16.11	September 14, 2017	10.21.8	August 30, 2000
10.16.12	September 20, 2018	10.21.9	August 30, 2000
10.16.13	September 20, 2018	10.21.10	August 30, 2000
10.16.14	September 20, 2018	10.21.11	March 16, 2017
10.16.15	September 20, 2018	10.21.12	September 25, 2009
10.16.16	September 20, 2018	10.21.13	September 25, 2009
10.16.17	September 20, 2018	10.21.14	September 30, 2022
10.16.18	September 14, 2017	10.21.15	September 26, 2013
10.16.19	September 14, 2017	10.21.16	September 30, 2011
10.16.20	September 20, 2018	10.21.17	March 19, 2020
10.16.21	September 20, 2018	10.21.18	September 26, 2013
10.16.22	September 20, 2018	10.22.1	September 29, 2005
10.16.23	September 20, 2018	10.22.2	September 26, 2013
10.16.24	September 20, 2018	10.22.3	September 30, 2022
* 10.16.25	March 30, 2024	10.22.4	September 26, 2013
* 10.16.26	March 30, 2024	10.22.5	September 30, 2022
10.17.1	March 27, 2014	10.22.6	September 14, 2017
10.17.2	September 30, 2022	10.22.7	September 26, 2013
10.17.3	September 30, 2022	10.22.8	September 29, 2005
10.17.4	September 24, 2015	10.30.1	September 30, 2011
10.17.5	September 25, 2009	10.30.2	March 31, 2023
10.17.6	September 19, 2019	10.30.3	March 31, 2023
10.20.1	September 30, 2011	10.30.4	March 31, 2023
10.20.2	September 25, 2009	10.31.1	September 24, 2015
10.20.3	September 25, 2009	* 10.31.2	March 30, 2024
10.20.4	August 30, 2000	* 10.31.3	March 30, 2024
10.20.5	September 27, 2012	* 10.31.4	March 30, 2024
10.20.6	September 27, 2012	* 10.31.5	March 30, 2024
10.20.7	September 27, 2012	* 10.31.6	March 30, 2024
10.20.8	September 27, 2012	10.40.1	September 30, 2011
10.20.9	September 27, 2012	10.40.2	September 27, 2004
10.20.10	September 27, 2012	10.40.3	March 28, 2005
10.20.11	September 27, 2012	10.40.4	March 28, 2013
10.20.12	September 27, 2012	10.40.5	September 26, 2013
10.20.13	September 27, 2012	10.40.6	September 26, 2013
10.20.14	September 30, 2022	10.40.7	September 26, 2013
10.20.15	September 26, 2013	10.40.8	September 26, 2013
10.20.16	September 27, 2012	10.40.9	September 26, 2013
10.20.17	March 19, 2020	10.40.10	September 26, 2013
10.20.18	September 26, 2013	10.40.11	September 26, 2013
10.21.1	September 30, 2011	10.40.12	September 26, 2013

* = Revised, Added, or Deleted

10.40.13	September 26, 2013	10.42.14	September 26, 2013
10.40.14	September 24, 2015	10.42.15	September 26, 2013
10.40.15	September 20, 2018	10.42.16	September 17, 2020
10.40.16	September 20, 2018	10.42.17	September 14, 2017
10.40.17	September 20, 2018	10.42.18	September 14, 2017
10.40.18	September 24, 2015	10.42.19	September 14, 2017
10.40.19	September 24, 2015	10.42.20	September 14, 2017
10.40.20	September 20, 2018	10.42.21	September 14, 2017
10.40.21	September 20, 2018	10.42.22	September 14, 2017
10.40.22	September 20, 2018	10.42.23	September 14, 2017
10.41.1	September 30, 2011	10.42.24	September 14, 2017
10.41.2	March 22, 2012	10.42.25	September 14, 2017
10.41.3	March 27, 2014	10.42.26	September 14, 2017
10.41.4	September 20, 2018	10.65.1	March 27, 2014
10.41.5	March 27, 2014	10.65.2	March 27, 2014
* 10.41.6	March 30, 2024	10.65.3	March 27, 2014
* 10.41.7	March 30, 2024	10.65.4	March 27, 2014
10.41.8	September 20, 2018	10.65.5	March 27, 2014
10.41.9	September 25, 2014	10.65.6	March 27, 2014
10.41.10	March 27, 2014	10.65.7	March 27, 2014
10.41.11	March 27, 2014	10.65.8	March 27, 2014
10.41.12	March 27, 2014	10.65.9	March 27, 2014
10.41.13	March 27, 2014	10.65.10	March 27, 2014
10.41.14	March 27, 2014	10.65.11	September 14, 2017
10.41.15	September 20, 2018	10.65.12	September 14, 2017
10.41.16	September 25, 2014	10.65.13	September 14, 2017
10.41.17	March 27, 2014	10.65.14	September 14, 2017
10.41.18	March 27, 2014	10.65.15	September 14, 2017
10.41.19	March 27, 2014	10.65.16	September 14, 2017
10.41.20	March 27, 2014	10.65.17	September 14, 2017
10.41.21	September 26, 2013	10.65.18	September 14, 2017
10.41.22	March 27, 2014	10.65.19	September 14, 2017
10.41.23	September 26, 2013	10.65.20	September 14, 2017
10.41.24	March 26, 2015	10.65.21	September 14, 2017
10.42.1	September 14, 2017	10.65.22	September 14, 2017
10.42.2	September 14, 2017	10.65.23	September 14, 2017
10.42.3	September 26, 2013	10.65.24	September 14, 2017
10.42.4	September 14, 2017	10.65.25	September 14, 2017
10.42.5	September 17, 2020	10.65.26	September 14, 2017
10.42.6	September 14, 2017	10.65.27	September 14, 2017
10.42.7	September 14, 2017	10.65.28	September 14, 2017
10.42.8	March 27, 2014	10.65.29	September 14, 2017
10.42.9	March 27, 2014	10.65.30	September 14, 2017
10.42.10	March 27, 2014	10.65.31	September 14, 2017
10.42.11	March 27, 2014	10.65.32	September 14, 2017
10.42.12	September 14, 2017	10.65.33	September 14, 2017
10.42.13	September 26, 2013	10.65.34	September 14, 2017

* = Revised, Added, or Deleted

	10.65.35	September 14, 2017
	10.65.36	September 14, 2017
	10.65.37	September 14, 2017
	10.65.38	September 14, 2017
	10.65.39	September 14, 2017
	10.65.40	September 14, 2017
	10.65.41	September 14, 2017
	10.65.42	September 14, 2017

11 Flight Management, Navigation (tab)

*	11.TOC.1-8	March 30, 2024
	11.10.1	September 17, 2020
*	11.10.2	March 30, 2024
*	11.10.3	March 30, 2024
*	11.10.4	March 30, 2024
*	11.10.5	March 30, 2024
*	11.10.6	March 30, 2024
*	11.10.7	March 30, 2024
*	11.10.8	March 30, 2024
*	11.10.9	March 30, 2024
*	11.10.10	March 30, 2024
*	11.10.11	March 30, 2024
*	11.10.12	March 30, 2024
*	11.10.13	March 30, 2024
*	11.10.14	March 30, 2024
*	11.10.15	March 30, 2024
*	11.10.16	March 30, 2024
*	11.10.17	March 30, 2024
*	11.10.18	March 30, 2024
*	11.10.19	March 30, 2024
*	11.10.20	March 30, 2024
*	11.10.21	March 30, 2024
*	11.10.22	March 30, 2024
*	11.10.23	March 30, 2024
*	11.10.24	March 30, 2024
*	11.10.25	March 30, 2024
*	11.10.26	March 30, 2024
*	11.10.27	March 30, 2024
*	11.10.28	March 30, 2024
*	11.10.29	March 30, 2024
*	11.10.30	March 30, 2024
*	11.10.31	March 30, 2024
*	11.10.32	March 30, 2024
*	11.10.33	March 30, 2024
*	11.10.34	March 30, 2024
*	11.10.35	March 30, 2024
*	11.10.36	March 30, 2024
*	11.10.37	March 30, 2024
*	11.10.38	March 30, 2024
	11.20.1	September 24, 2015
	11.20.2	September 24, 2015
	11.20.3	September 24, 2015
	11.20.4	March 18, 2021
	11.20.5	September 24, 2015
	11.20.6	September 24, 2015
	11.20.7	September 24, 2015
	11.20.8	September 24, 2015
*	11.20.9	March 30, 2024
*	11.20.10	March 30, 2024
*	11.20.11	March 30, 2024
*	11.20.12	March 30, 2024
*	11.20.13	March 30, 2024
*	11.20.14	March 30, 2024
*	11.20.15	March 30, 2024
	11.20.16	September 20, 2018
	11.30.1	August 30, 2000
	11.30.2	March 28, 2005
	11.30.3	October 15, 2001
	11.30.4	October 15, 2001
	11.31.1	September 27, 2012
	11.31.2	September 27, 2012
	11.31.3	September 27, 2012
	11.31.4	September 26, 2013
	11.31.5	March 18, 2021
	11.31.6	September 26, 2013
	11.31.7	September 26, 2013
	11.31.8	March 29, 2004
	11.31.9	September 29, 2005
	11.31.10	September 28, 2006
	11.31.11	September 2, 2021
	11.31.12	September 30, 2022
	11.31.13	September 30, 2022
	11.31.14	September 30, 2022
	11.31.15	September 30, 2022
	11.31.16	September 30, 2022
	11.31.17	September 30, 2022
	11.31.18	September 30, 2022
	11.31.19	September 30, 2022
	11.31.20	September 30, 2022
	11.31.21	September 30, 2022
	11.31.22	September 30, 2022
	11.31.23	September 30, 2022
	11.31.24	September 30, 2022
	11.31.25	September 30, 2022

* = Revised, Added, or Deleted

11.31.26	September 30, 2022	11.34.5	March 31, 2023
11.31.27	September 30, 2022	11.34.6	March 31, 2023
11.31.28	September 30, 2022	11.34.7	March 31, 2023
11.31.29	September 30, 2022	11.34.8	March 31, 2023
11.31.30	September 30, 2022	11.34.9	March 31, 2023
11.31.31	September 30, 2022	11.34.10	March 31, 2023
11.31.32	September 30, 2022	11.34.11	March 31, 2023
11.31.33	September 30, 2022	11.34.12	March 31, 2023
11.31.34	September 30, 2022	11.34.13	March 31, 2023
11.31.35	September 30, 2022	11.34.14	March 31, 2023
11.31.36	September 30, 2022	11.34.15	March 31, 2023
11.31.37	September 30, 2022	11.34.16	March 31, 2023
11.31.38	September 30, 2022	11.34.17	March 31, 2023
11.31.39	September 30, 2022	11.34.18	March 31, 2023
11.31.40	September 30, 2022	11.34.19	March 31, 2023
11.31.41	September 30, 2022	11.34.20	March 31, 2023
11.31.42	September 30, 2022	11.34.21	March 31, 2023
11.31.43	September 30, 2022	11.34.22	March 31, 2023
11.31.44	September 30, 2022	11.34.23	March 31, 2023
11.31.45	September 30, 2022	11.34.24	March 31, 2023
11.31.46	September 30, 2022	11.34.25	March 31, 2023
11.31.47	September 30, 2022	11.34.26	March 31, 2023
11.31.48	September 30, 2022	11.34.27	March 31, 2023
11.32.1	August 30, 2000	11.34.28	March 31, 2023
11.32.2	October 15, 2001	11.34.29	March 31, 2023
11.32.3	September 26, 2013	11.34.30	March 31, 2023
11.32.4	September 26, 2013	11.34.31	March 31, 2023
11.32.5	September 26, 2013	11.34.32	March 31, 2023
11.32.6	September 15, 2016	11.34.33	March 31, 2023
11.32.7	September 15, 2016	11.34.34	March 31, 2023
11.32.8	September 15, 2016	11.34.35	March 31, 2023
11.33.1	March 27, 2009	11.34.36	March 31, 2023
11.33.2	September 26, 2013	11.34.37	March 31, 2023
11.33.3	March 29, 2004	11.34.38	March 31, 2023
11.33.4	March 29, 2004	11.34.39	March 31, 2023
11.33.5	March 29, 2004	11.34.40	March 31, 2023
11.33.6	September 26, 2013	11.34.41	September 30, 2023
11.33.7	September 26, 2013	11.34.42	March 31, 2023
11.33.8	September 26, 2013	11.34.43	March 31, 2023
11.33.9	September 26, 2013	11.34.44	March 31, 2023
11.33.10	September 26, 2013	11.34.45	March 31, 2023
11.33.11	September 24, 2015	11.34.46	March 31, 2023
11.33.12	September 24, 2015	11.34.47	March 31, 2023
11.34.1	March 31, 2023	11.34.48	March 31, 2023
11.34.2	March 31, 2023	* 11.34.49	March 30, 2024
11.34.3	March 31, 2023	* 11.34.50	March 30, 2024
11.34.4	March 31, 2023	* 11.34.51	March 30, 2024

* = Revised, Added, or Deleted

* 11.34.52	March 30, 2024	11.40.23	September 30, 2022
* 11.34.53	March 30, 2024	11.40.24	March 3, 2022
* 11.34.54	March 30, 2024	11.40.25	March 3, 2022
* 11.34.55	March 30, 2024	11.40.26	March 31, 2023
11.34.56	March 31, 2023	11.40.27	March 31, 2023
11.34.57	March 31, 2023	11.40.28	March 3, 2022
11.34.58	March 31, 2023	11.40.29	March 3, 2022
11.34.59	March 31, 2023	11.40.30	March 31, 2023
11.34.60	March 31, 2023	* 11.40.31	March 30, 2024
11.34.61	March 31, 2023	* 11.40.32	March 30, 2024
11.34.62	March 31, 2023	* 11.40.33	March 30, 2024
11.34.63	March 31, 2023	11.40.34	March 31, 2023
11.34.64	March 31, 2023	11.40.35	March 31, 2023
11.34.65	March 31, 2023	11.40.36	March 31, 2023
* 11.34.66	March 30, 2024	11.40.37	March 31, 2023
* 11.34.67	March 30, 2024	11.40.38	March 31, 2023
11.34.68	March 31, 2023	11.40.39	March 31, 2023
11.34.69	March 31, 2023	11.40.40	March 31, 2023
11.34.70	March 31, 2023	11.40.41	March 31, 2023
11.34.71	March 31, 2023	11.40.42	March 31, 2023
11.34.72	March 31, 2023	11.40.43	September 30, 2023
11.34.73	March 31, 2023	11.40.44	September 30, 2023
11.34.74	March 31, 2023	11.40.45	March 31, 2023
11.34.75	March 31, 2023	11.40.46	March 31, 2023
11.34.76	March 31, 2023	11.40.47	March 31, 2023
11.40.1	March 29, 2004	11.40.48	March 31, 2023
* 11.40.2	March 30, 2024	11.40.49	March 31, 2023
* 11.40.3	March 30, 2024	* 11.40.50	March 30, 2024
11.40.4	March 29, 2004	* 11.40.51	March 30, 2024
11.40.5	March 29, 2004	* 11.40.52	March 30, 2024
11.40.6	March 29, 2004	* 11.40.53	March 30, 2024
11.40.7	March 19, 2020	* 11.40.54	March 30, 2024
11.40.8	March 3, 2022	* 11.40.55	March 30, 2024
11.40.9	March 3, 2022	* 11.40.56	March 30, 2024
11.40.10	March 3, 2022	* 11.40.57	March 30, 2024
11.40.11	March 31, 2023	* 11.40.58	March 30, 2024
11.40.12	March 31, 2023	* 11.40.59	March 30, 2024
* 11.40.13	March 30, 2024	* 11.40.60	March 30, 2024
* 11.40.14	March 30, 2024	* 11.40.61	March 30, 2024
* 11.40.15	March 30, 2024	* 11.40.62	March 30, 2024
11.40.16	March 3, 2022	* 11.40.63	March 30, 2024
11.40.17	March 3, 2022	* 11.40.64	March 30, 2024
11.40.18	March 3, 2022	* 11.40.65	March 30, 2024
11.40.19	March 3, 2022	* 11.40.66	March 30, 2024
11.40.20	March 3, 2022	* 11.40.67	March 30, 2024
11.40.21	September 30, 2022	* 11.40.68	March 30, 2024
11.40.22	September 30, 2022	* 11.40.69	March 30, 2024

* = Revised, Added, or Deleted

* 11.40.70	March 30, 2024	11.41.35	March 15, 2018
* 11.40.71	March 30, 2024	11.41.36	September 14, 2017
* 11.40.72	March 30, 2024	11.41.37	September 14, 2017
* 11.40.73	March 30, 2024	11.41.38	September 14, 2017
* 11.40.74	March 30, 2024	11.41.39	September 14, 2017
* 11.40.75	March 30, 2024	11.41.40	September 14, 2017
* 11.40.76	March 30, 2024	11.42.1	March 29, 2004
* 11.40.77	March 30, 2024	11.42.2	March 31, 2023
* 11.40.78	March 30, 2024	11.42.3	March 31, 2023
* 11.40.79	March 30, 2024	11.42.4	March 31, 2023
* 11.40.80	March 30, 2024	11.42.5	March 31, 2023
* 11.40.81	March 30, 2024	11.42.6	March 31, 2023
* 11.40.82	March 30, 2024	11.42.7	March 31, 2023
11.41.1	September 26, 2013	11.42.8	March 31, 2023
11.41.2	September 14, 2017	11.42.9	March 31, 2023
11.41.3	September 14, 2017	11.42.10	March 31, 2023
11.41.4	September 26, 2013	11.42.11	March 31, 2023
11.41.5	September 26, 2013	11.42.12	March 31, 2023
11.41.6	March 19, 2020	11.42.13	March 31, 2023
11.41.7	September 26, 2013	11.42.14	March 31, 2023
11.41.8	September 26, 2013	11.42.15	March 31, 2023
11.41.9	September 30, 2022	11.42.16	March 31, 2023
11.41.10	September 30, 2022	11.42.17	March 31, 2023
11.41.11	September 30, 2022	11.42.18	March 31, 2023
11.41.12	September 30, 2022	11.42.19	March 31, 2023
11.41.13	September 30, 2022	11.42.20	March 31, 2023
11.41.14	September 14, 2017	11.42.21	March 31, 2023
11.41.15	September 14, 2017	11.42.22	March 31, 2023
11.41.16	September 14, 2017	11.42.23	March 31, 2023
11.41.17	September 14, 2017	11.42.24	March 31, 2023
11.41.18	September 14, 2017	11.42.25	March 31, 2023
11.41.19	September 14, 2017	11.42.26	March 31, 2023
11.41.20	September 14, 2017	11.42.27	March 31, 2023
11.41.21	September 14, 2017	11.42.28	March 31, 2023
11.41.22	September 14, 2017	11.42.29	March 31, 2023
11.41.23	September 14, 2017	* 11.42.30	March 30, 2024
11.41.24	September 14, 2017	* 11.42.31	March 30, 2024
11.41.25	September 14, 2017	11.42.32	March 31, 2023
11.41.26	September 14, 2017	11.42.33	March 31, 2023
11.41.27	September 14, 2017	11.42.34	March 31, 2023
11.41.28	September 14, 2017	11.42.35	March 31, 2023
11.41.29	September 14, 2017	11.42.36	March 31, 2023
11.41.30	September 14, 2017	11.42.37	March 31, 2023
11.41.31	September 14, 2017	11.42.38	March 31, 2023
11.41.32	September 14, 2017	11.42.39	March 31, 2023
11.41.33	September 14, 2017	11.42.40	March 31, 2023
11.41.34	September 14, 2017	11.42.41	March 31, 2023

* = Revised, Added, or Deleted

11.42.42	March 31, 2023	11.43.19	March 16, 2017
* 11.42.43	March 30, 2024	11.43.20	March 31, 2016
* 11.42.44	March 30, 2024	11.43.21	March 31, 2016
* 11.42.45	March 30, 2024	11.43.22	March 31, 2016
* 11.42.46	March 30, 2024	11.43.23	March 31, 2016
* 11.42.47	March 30, 2024	11.43.24	September 15, 2016
* 11.42.48	March 30, 2024	11.43.25	September 15, 2016
* 11.42.49	March 30, 2024	11.43.26	September 15, 2016
* 11.42.50	March 30, 2024	11.43.27	September 15, 2016
* 11.42.51	March 30, 2024	11.43.28	September 14, 2017
* 11.42.52	March 30, 2024	11.43.29	September 15, 2016
* 11.42.53	March 30, 2024	11.43.30	September 15, 2016
* 11.42.54	March 30, 2024	11.43.31	September 15, 2016
* 11.42.55	March 30, 2024	11.43.32	September 15, 2016
* 11.42.56	March 30, 2024	* 11.43.33	March 30, 2024
* 11.42.57	March 30, 2024	* 11.43.34	March 30, 2024
* 11.42.58	March 30, 2024	* 11.43.35	March 30, 2024
* 11.42.59	March 30, 2024	11.43.36	September 14, 2017
* 11.42.60	March 30, 2024	11.43.37	September 17, 2020
* 11.42.61	March 30, 2024	11.43.38	March 19, 2020
* 11.42.62	March 30, 2024	11.43.39	September 17, 2020
* 11.42.63	March 30, 2024	11.43.40	September 17, 2020
* 11.42.64	March 30, 2024	11.43.41	March 19, 2020
* 11.42.65	March 30, 2024	* 11.43.42	March 30, 2024
11.42.66	March 15, 2018	* 11.43.43	March 30, 2024
11.42.67	March 15, 2018	11.43.44	March 19, 2020
11.42.68	March 15, 2018	11.43.45	March 19, 2020
11.42.69	March 15, 2018	11.43.46	March 19, 2020
11.42.70	March 15, 2018	11.43.47	March 19, 2020
11.43.1	September 14, 2017	11.43.48	March 19, 2020
11.43.2	September 15, 2016	11.43.49	March 19, 2020
11.43.3	September 24, 2015	11.43.50	March 19, 2020
11.43.4	September 30, 2011	11.43.51	March 19, 2020
11.43.5	September 26, 2013	11.43.52	March 19, 2020
11.43.6	September 26, 2013	11.43.53	March 19, 2020
11.43.7	September 30, 2011	11.43.54	March 19, 2020
11.43.8	September 30, 2011	11.43.55	March 19, 2020
11.43.9	March 31, 2016	11.43.56	March 19, 2020
11.43.10	March 31, 2016	11.43.57	March 19, 2020
11.43.11	March 31, 2016	11.43.58	March 19, 2020
11.43.12	March 31, 2016	11.43.59	March 19, 2020
* 11.43.13	March 30, 2024	11.43.60	March 19, 2020
* 11.43.14	March 30, 2024	11.60.1	September 30, 2023
11.43.15	March 31, 2016	11.60.2	September 30, 2023
11.43.16	March 16, 2017	11.60.3	September 30, 2023
11.43.17	March 16, 2017	11.60.4	September 30, 2023
11.43.18	March 16, 2017	11.60.5	September 30, 2023

* = Revised, Added, or Deleted

11.60.6	September 30, 2023
11.60.7	September 30, 2023
11.60.8	September 30, 2023
11.60.9	September 30, 2023
11.60.10	September 30, 2023
11.60.11	September 30, 2023
11.60.12	September 30, 2023
11.60.13	September 30, 2023
11.60.14	September 30, 2023
11.60.15	September 30, 2023
11.60.16	September 30, 2023
11.60.17	September 30, 2023
11.60.18	September 30, 2023
11.60.19	September 30, 2023
11.60.20	September 30, 2023
11.60.21	September 30, 2023
11.60.22	September 30, 2023
11.60.23	September 30, 2023
11.60.24	September 30, 2023
11.60.25	September 30, 2023
11.60.26	September 30, 2023
11.60.27	September 30, 2023
11.60.28	September 30, 2023
11.60.29	September 30, 2023
11.60.30	September 30, 2023
11.60.31	September 30, 2023
11.60.32	September 30, 2023
11.60.33	September 30, 2023
11.60.34	September 30, 2023
11.60.35	September 30, 2023
11.60.36	September 30, 2023
11.60.37	September 30, 2023
11.60.38	September 30, 2023
11.60.39	September 30, 2023
11.60.40	September 30, 2023

12 Fuel (tab)

12.TOC.1-2	September 26, 2013
12.10.1	September 18, 2008
12.10.2	September 26, 2013
12.10.3	September 26, 2013
12.10.4	September 14, 2017
12.10.5	March 18, 2011
12.10.6	September 18, 2008
12.10.7	September 26, 2013
12.10.8	September 18, 2008
12.10.9	September 28, 2006
12.10.10	September 28, 2006
* 12.10.11	March 30, 2024
* 12.10.12	March 30, 2024
* 12.10.13	March 30, 2024
* 12.10.14	March 30, 2024
12.20.1	March 27, 2014
12.20.2	March 22, 2012
* 12.20.3	March 30, 2024
* 12.20.4	March 30, 2024
12.20.5	September 25, 2009
12.20.6	September 25, 2009

13 Hydraulics (tab)

* 13.TOC.1-2	March 30, 2024
13.10.1	September 18, 2008
13.10.2	August 30, 2000
13.10.3	March 27, 2009
13.10.4	January 25, 2008
13.10.5	January 25, 2008
13.10.6	January 25, 2008
13.10.7	January 25, 2008
13.10.8	January 25, 2008
* 13.20.1	March 30, 2024
* 13.20.2	March 30, 2024
* 13.20.3	March 30, 2024
* 13.20.4	March 30, 2024
* 13.20.5	March 30, 2024
* 13.20.6	March 30, 2024
* 13.20.7	March 30, 2024
* 13.20.8	March 30, 2024
* 13.20.9	March 30, 2024
* 13.20.10	March 30, 2024

14 Landing Gear (tab)

14.TOC.1-2	September 15, 2016
14.10.1	September 30, 2023
14.10.2	March 31, 2023
14.10.3	March 31, 2023
14.10.4	March 31, 2023
14.10.5	March 31, 2023
14.10.6	March 31, 2023
14.10.7	September 30, 2023
14.10.8	March 31, 2023
* 14.10.9	March 30, 2024
* 14.10.10	March 30, 2024
14.20.1	September 24, 2015
* 14.20.2	March 30, 2024

* = Revised, Added, or Deleted

*	14.20.3	March 30, 2024
	14.20.4	September 30, 2022
	14.20.5	January 25, 2008
	14.20.6	September 26, 2013
*	14.20.7	March 30, 2024
*	14.20.8	March 30, 2024
	14.20.9	September 26, 2013
	14.20.10	September 26, 2013

15 Warning Systems (tab)

*	15.TOC.1-2	March 30, 2024
*	15.10.1	March 30, 2024
*	15.10.2	March 30, 2024
	15.10.3	March 31, 2023
	15.10.4	March 31, 2023
	15.10.5	March 31, 2023
	15.10.6	March 31, 2023
	15.10.7	March 31, 2023
	15.10.8	March 31, 2023
	15.10.9	March 31, 2023
*	15.10.10	March 30, 2024
	15.10.11	March 31, 2023
	15.10.12	March 31, 2023
	15.10.13	March 31, 2023
	15.10.14	March 31, 2023
	15.10.15	March 31, 2023
	15.10.16	March 31, 2023
	15.10.17	March 31, 2023
	15.10.18	March 31, 2023
	15.10.19	March 31, 2023
	15.10.20	March 31, 2023
	15.10.21	March 31, 2023
	15.10.22	March 31, 2023
	15.10.23	March 31, 2023
	15.10.24	March 31, 2023
*	15.20.1	March 30, 2024
*	15.20.2	March 30, 2024
	15.20.3	March 31, 2023
	15.20.4	March 31, 2023
*	15.20.5	March 30, 2024
*	15.20.6	March 30, 2024
*	15.20.7	March 30, 2024
*	15.20.8	March 30, 2024
*	15.20.9	March 30, 2024
*	15.20.10	March 30, 2024
*	15.20.11	March 30, 2024
*	15.20.12	March 30, 2024
*	15.20.13	March 30, 2024
*	15.20.14	March 30, 2024
*	15.20.15	March 30, 2024
*	15.20.16	March 30, 2024
*	15.20.17	March 30, 2024
*	15.20.18	March 30, 2024
*	15.20.19	March 30, 2024
*	15.20.20	March 30, 2024
*	15.20.21	March 30, 2024
*	15.20.22	March 30, 2024
*	15.20.23	March 30, 2024
*	15.20.24	March 30, 2024
*	15.20.25	March 30, 2024
*	15.20.26	March 30, 2024
*	15.20.27	March 30, 2024
*	15.20.28	March 30, 2024
*	15.20.29	March 30, 2024
*	15.20.30	March 30, 2024
*	15.20.31	March 30, 2024
*	15.20.32	March 30, 2024
*	15.20.33	March 30, 2024
*	15.20.34	March 30, 2024
*	15.20.35	March 30, 2024
*	15.20.36	March 30, 2024
*	15.20.37	March 30, 2024
*	15.20.38	March 30, 2024
*	15.20.39	March 30, 2024
*	15.20.40	March 30, 2024
*	15.20.41	March 30, 2024
*	15.20.42	March 30, 2024

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* = Revised, Added, or Deleted

Preface — Chapter 0
Bulletin Record — Section 6

General

The Boeing Company issues Flight Crew Operations Manual Bulletins to provide important information to flight crews prior to the next formal revision of the Flight Crew Operations Manual. The transmitted information may be of interest to only specific Operators or may apply to all Operators of this model airplane. Each bulletin will vary.

Bulletins are dated and numbered sequentially for each operator. Each new bulletin is recorded in this record when received and filed as instructed. A bulletin may not apply to all airplane models. When appropriate, the next formal FCOM revision will include an updated bulletin record page to reflect current bulletin status.

Temporary information is normally incorporated into the manual at the next formal revision. When the condition remains temporary after a bulletin incorporation, the temporary paragraphs are identified by a heading referencing the originating bulletin. When the temporary condition no longer exists, the bulletin is cancelled and the original manual content is restored.

Bulletin status is defined as follows:

- In Effect (IE) – the bulletin contains pertinent information not otherwise covered in the Flight Crew Operations Manual. The bulletin remains active and should be retained in the manual
- Incorporated (INC) – the bulletin operating information has been incorporated into the Flight Crew Operations Manual. However, the bulletin remains active and should be retained in the manual
- Cancelled (CANC) – the bulletin is no longer active and should be removed from the Flight Crew Operations Manual. All bulletins previously cancelled are no longer listed in the Bulletin Record.

The person filing a new or revised bulletin should amend the Bulletin Record as instructed in the Administrative Information section of the bulletin. When a bulletin includes replacement pages for the Flight Crew Operations Manual or QRH, the included pages should be filed as instructed in the Flight Crew Operations Manual Information section of the bulletin.

Number	Subject	Date	Status
TBC-3 R1	Standby Power Test	November 8, 1999	IE
TBC-5 R1	Window Overheat	November 15, 2000	IE
TBC-6	Possible Autopilot Low Frequency Pitch Oscillation During Flap Extension While in a Turn	January 29, 1999	IE
TBC-7	Engine Overheat/Fire and APU Fire Detection	January 29, 1999	IE
TBC-8 R1	Uncommanded Engine Acceleration Due to an Engine Fuel Control Fault	December 17, 1999	IE
TBC-9 R1	APU DC Fuel Pump Operational Anomaly	June 30, 2004	IE
TBC-11 R1	Collins ILS/GPS Multi-Mode Receiver (MMR) Failure	March 26, 1999	IE
TBC-12 R1	Inadvertent RTO Autobraking During Landing	September 6, 1999	IE
TBC-13 R1	Nuisance PWS Fail Annunciation	April 23, 1999	IE
TBC-14 R1	AFDS Performance Degradation with Radio Altimeter Failure	June 30, 2004	IE
TBC-17 R1	Control Wheel Microphone/Interphone Switch Anomaly	November 6, 2000	IE
TBC-18 R2	Nuisance Zone Temp Light Illuminations on 737-800 Airplanes	November 1, 2001	IE
TBC-19	737-600/-700/-800 Elevator Tab Operational Limitations	June 10, 1999	IE
TBC-20 R1	VHF Radio Use for ATC Ground Operations	June 30, 2004	IE
TBC-21 R1	GPWS Minimums Voice Callout Anomaly	June 30, 2004	IE
TBC-22 R1	TCAS Display Anomaly	June 30, 2004	IE
TBC-23 R1	Look-Ahead Terrain Alerting Display Anomalies	June 30, 2004	IE
TBC-24	GPWS 2500 Foot Voice Callout Anomaly	May 17, 2000	IE

Number	Subject	Date	Status
TBC-27 R1	PSEU Fault Indications	June 30, 2004	IE
TBC-29 R2	Emergency Airworthiness Directive 2002-08-52	July 19, 2002	IE
TBC-30 R1	Inflight Start EGT Display	June 30, 2004	IE
TBC-33 R1	Airworthiness Directive 2002-08-20, AMOC Letter 120S-02-907	November 1, 2002	IE
TBC-34	FMC MAP Display Blanking with FMC Update U10.3, U10.4 and U10.4A software	August 2, 2002	IE
TBC-35 R1	Integrated Standby Flight Display (ISFD) Alignment Anomaly	July 14, 2004	IE
TBC-37	AD-2002-19-51, Flight Control Modules	September 16, 2002	IE
TBC-38 R1	Flight Director and Autopilot Mode Entry Failures	November 1, 2004	IE
TBC-39 R1	Autopilot Altitude Acquire/Altitude Capture Anomaly	November 1, 2004	IE
TBC-41 R1	Target Speed Anomaly with Flaps Extended and VNAV Engaged	November 1, 2004	IE
TBC-42 R2	FMC Navigation Anomaly	November 1, 2004	IE
TBC-44 R1	Flight Director Anomaly	October 21, 2005	IE
TBC-45 R4	Predictive Windshear System Anomaly	December 7, 2023	IE
TBC-46 R1	FMC Arc Leg Sequencing Anomaly	November 1, 2004	IE
TBC-47	Lack of "GLIDESLOPE" Alert During Approach	May 24, 2004	IE
TBC-48 R1	Center Tank Fuel System Changes	April 3, 2007	IE
TBC-50 R2	Nuisance Stall Warning Stick Shaker Events	March 18, 2021	IE
TBC-52 R1	Master Caution System Anomaly	July 25, 2008	IE

Number	Subject	Date	Status
TBC-53 R2	Unwanted "GLIDESLOPE" Advisory During Approaches On Airplanes Equipped with the Integrated Approach Navigation (IAN) Option	April 26, 2023	IE
TBC-54 R1	FMC Update 549849-015 U10.6 Prediction Errors	April 11, 2006	IE
TBC-59	Flight Deck Display Unit Blanking Anomaly	April 1, 2006	IE
TBC-61	Head-Up Display (HUD) Software Anomaly	August 4, 2006	IE
TBC-62	FMC Update U10.6 Erroneous Holding Pattern	October 16, 2006	IE
TBC-63	NO LAND 3 Annunciation After Landing	November 13, 2006	IE
TBC-64 R1	FMC Failure	January 17, 2007	IE
TBC-65	Incorrect Implementation Of TO/GA To LNAV Feature With CDS Blockpoint 06 (BP06) and FMC Update U10.5 Or U10.5A Installed	February 12, 2007	IE
TBC-66	Instrument Procedure, Transition Altitude and FMC Loss of Flight Information (FMC Update U10.6)	March 16, 2007	IE
TBC-67	Spoiler Retraction Failure on Airplanes with the Short Field Performance Package	March 5, 2007	IE
TBC-68	Unintentional Initiation of the FMC Engine Out Mode (FMC Update U10.7)	April 16, 2007	IE
TBC-70	Arming VNAV on the Ground (FMC Update U10.7)	June 11, 2007	IE
TBC-71 R3	APU Electrical Bus Disconnect	November 16, 2007	IE
TBC-73	FMC Lockup with Selection of a Standard Instrument Departure (SID) on Missed Approach (FMC Update U10.0 and later)	January 28, 2008	IE

Number	Subject	Date	Status
TBC-74	Hand Microphone Use With Flight Deck PC Power Outlets	September 22, 2008	IE
TBC-75 R1	Cabin Altitude Warning Indications and Procedures Briefing	April 30, 2009	IE
TBC-76	Instrument Approach Procedures With An FMC Missed Approach Altitude Constraint Above 10,000 Feet MSL	April 13, 2009	IE
TBC-77	Nuisance Predictive Windshear (PWS) Fail Annunciations with the Honeywell RDR-4000 Weather Radar	April 27, 2009	IE
TBC-79	VNAV Not to Be Used for Approach Operations with FMC Update U10.8 Installed	June 26, 2009	IE
TBC-80	Reversion from FMC Update U10.8 to Update U10.7 or earlier	July 17, 2009	IE
TBC-81	Inflight Elevator Tab Vibration	March 26, 2010	IE
TBC-85	Impact of Arming VNAV on the Ground on the Windshear Escape Maneuver (FMC Update 10.8 and 10.8A)	January 10, 2011	IE
TBC-86 R1	U10.8A FMC Restarts from ATS (Air Traffic Services) or AOC (Aeronautical Operational Control) Datalink issues	June 5, 2013	IE
TBC-88 R2	Impact of Automatic Approaches in 737NG airplanes with Fail-Operational Autoland option into ILS Runway 34, Kagoshima Airport, Japan	November 16, 2012	IE
TBC-89 R1	Reduced Engine Response Times	January 9, 2015	IE
TBC-90 R1	Thrust Instability Events	January 14, 2013	IE
TBC-92 R1	Thrust Shortfall Condition Caused by Electronic Engine Control (EEC) Software Version 7BV4	January 9, 2015	IE
TBC-93	Airspeed Low Aural Alert Anomaly	April 1, 2014	IE

Number	Subject	Date	Status
TBC-97 R2	Window Heat Control Unit (WHCU) Initialization Indications	September 19, 2016	IE
TBC-98	NPS Scales Mask ILS/GLS Localizer and Glideslope Fail Flags	April 28, 2016	IE
TBC-99	Incorrect FMC Speed/Altitude Constraints following a runway change with a Standard Terminal Arrival (STAR) and the previous runway already executed in the FMC	July 1, 2016	IE
TBC-100	NAV Display Blanking/Blinking After Installation of Common Display System (CDS) BP15	October 17, 2016	IE
TBC-101 R1	Cabin Pressurization Panel Blanking/Dimming Issues	December 19, 2016	IE
TBC-102	Incorrect FMC Constraint Altitude on a Standard Terminal Arrival Route (STAR) with a Common Waypoint, after Selection of another Approach	December 16, 2016	IE
TBC-103	VNAV INVALID-PERF Scratchpad Message	April 17, 2017	IE
TBC-105 R1	Integrated Approach Navigation (IAN) Anomaly with Localizer Backcourse Approaches	June 26, 2018	IE
TBC-106	Overrun Warning (ORW) System Restriction if a Landing Runway is Not Selected or Available n the FMC	May 3, 2017	IE
TBC-107	ADIRU P/N HG2050BC02 Position Drift and Ground Speed Errors	July 17, 2017	IE
TBC-108	Descent Below Glide Slope During Approach on 737NG Airplanes With Rockwell Collins Flight Control Computer (FCC) software Version P8.0 or P9.0 Installed	April 20, 2018	IE

Number	Subject	Date	Status
TBC-109	737 NG Approach Data Block Anomaly with GLS Channel Selected	April 23, 2018	IE
TBC-110	Lateral Path Exceedance On Approach Procedures With A Course Reversal	November 19, 2018	IE
TBC-111 R1	All Six Display Units Blanking With CDS BP15 and FMC U12 or Newer Installed	September 19, 2019	IE
TBC-114	Dual loss of GPS for airplanes equipped with Honeywell Integrated Multi-Mode Receiver (IMMR) 69002600-0101 in combination with specific IMMR software installed	March 22, 2021	IE
TBC-115	Localizer Overshoot When Using LNAV to Intercept the Localizer for Fail Operational Airplanes with Rockwell Collins FCC 9.0 or 11.1 or Newer	April 28, 2021	IE
TBC-116	Localizer Overshoot When Using LNAV to Intercept the Localizer for Fail Passive Airplanes with Rockwell Collins FCC 11.1 or Newer	April 30, 2021	IE
TBC-117 R3	Radio Altimeter Anomalies Due to 5G C-Band Wireless Broadband Interference in the United States	June 30, 2023	IE
TBC-119	DATALINK FULL Datalink Status Message	November 9, 2022	IE
TBC-120	Dual FMC Resets During CPDLC On Airplanes Equipped With FMC U14 or U14.1, and FANS 1 or FANS 2	November 11, 2022	IE
TBC-121	Flap Lever Operation	April 15, 2023	IE
TBC-122	Dual FMC Resets After a Conditional Waypoint (VECTOR)	October 17, 2023	IE

Number	Subject	Date	Status
TBC-123 R1	Unexpected Roll Command during RNP approaches with a RNP of 0.3 or below	December 20, 2023	IE

Flight Crew Operations Manual Bulletin
for
The Boeing Company

The Boeing Company
Seattle, Washington 98124-2207

737

Number: TBC-3 R1

IssueDate: November 8, 1999

Subject: Standby Power Test

Reason: To inform flight crews of an anomaly during a standby power test.

The purpose of this reissue is to provide Service Bulletin information.

Information in this bulletin is recommended by The Boeing Company, but may not be FAA approved at the time of writing. In the event of conflict with the FAA approved Airplane Flight Manual (AFM), the AFM shall supersede. The Boeing Company regards the information or procedures described herein as having a direct or indirect bearing on the safe operation of this model airplane.

THE FOLLOWING PROCEDURE AND/OR INFORMATION IS EFFECTIVE UPON RECEIPT

Background Information

Flight test has revealed that when performing the standby power test, an anomaly in the stall management/yaw damper (-1SMYD) software may cause several faults to appear after the test is completed. These faults include:

- Captain's airspeed indicator VMO arc disappears
- SPD LIMIT flag (amber) displays on the mach airspeed indicator
- MACH TRIM light illuminates
- AUTO SLAT light illuminates
- ELEC light illuminates

These faults must be cleared by maintenance recycling the -1SMYD circuit breaker and/or clearing the fault in the Electrical Metering Panel prior to flight.

The condition will be fixed with the installation of -2SMYD or higher software. Component Service Bulletin 285A1010-27-01, released February 25, 1999, provides information on the upgrade to the -2SMYD software. Component Service Bulletin 285A1010-27-03, released February 25, 1999, provides information on the upgrade to the -4SMYD software. These Service Bulletins and this Operations Manual bulletin apply to airplanes with manufacturer's line numbers 1 through 51.

Administrative Information

Insert this bulletin behind the Bulletin Record page in Volume 1 of your Flight Crew Operations Manual (FCOM). Amend the FCOM Bulletin Record page to show bulletin TBC-3 R1 "In Effect" (IE).

This bulletin will be cancelled after Boeing is notified that all affected airplanes in your fleet have been modified by Service Bulletin 285A1010-27-01 or 285A1010-27-03. If you do not plan to modify all your airplanes and would like to have the contents of this bulletin incorporated in your Operations Manual, please advise Boeing accordingly.

Please send all correspondence regarding Flight Crew Operations Manual Bulletin status, to the 737 Manager, Flight Technical Data, through the Service Requests Application (SR App) on the MyBoeingFleet home page.

Flight Crew Operations Manual Bulletin
for
The Boeing Company

The Boeing Company
Seattle, Washington 98124-2207

737

Number: TBC-5 R1

IssueDate: November 15, 2000

Subject: Window Overheat

Reason: To inform flight crews of a window OVERHEAT light anomaly.

The purpose of this reissue is to provide Service Bulletin information.

Information in this bulletin is recommended by The Boeing Company, but may not be FAA approved at the time of writing. In the event of conflict with the FAA approved Airplane Flight Manual (AFM), the AFM shall supersede. The Boeing Company regards the information or procedures described herein as having a direct or indirect bearing on the safe operation of this model airplane.

THE FOLLOWING PROCEDURE AND/OR INFORMATION IS EFFECTIVE UPON RECEIPT

Background Information

Flight tests have revealed power transfers may trigger the window OVERHEAT lights to illuminate due to a relay/bus timing incompatibility.

Vendor Service Bulletin Koito 8300-30-040 provides information on the upgrade that fixes this anomaly.

Operating Instructions

If the window OVERHEAT lights illuminate during a power transfer, the window heat switches must be momentarily cycled OFF, and then back ON to clear the problem. If the lights fail to extinguish, accomplish the Window Overheat non-normal procedure

Administrative Information

Insert this bulletin behind the Bulletin Record page in Volume 1 of your Flight Crew Operations Manual (FCOM). Amend the FCOM Bulletin Record page to show bulletin TBC-5 R1 "In Effect" (IE).

This bulletin will be canceled after Boeing is notified that all affected airplanes in your fleet have been modified by Vendor Service Bulletin Koito 8300-30-040. If you do not plan to modify all your airplanes and would like to have the contents of this bulletin incorporated in your FCOM, please advise Boeing accordingly.

Please send all correspondence regarding Flight Crew Operations Manual Bulletin status, to the 737 Manager, Flight Technical Data, through the Service Requests Application (SR App) on the MyBoeingFleet home page.

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Flight Crew Operations Manual Bulletin
for
The Boeing Company

The Boeing Company
Seattle, Washington 98124-2207

737

Number: TBC-6

IssueDate: January 29, 1999

Subject: Possible Autopilot Low Frequency Pitch Oscillation During Flap Extension While in a Turn

Reason: To inform flight crews of the possibility that the autopilot may not hold altitude when extending flaps from Flaps UP to Flaps 1.

Information in this bulletin is recommended by The Boeing Company, but may not be FAA approved at the time of writing. In the event of conflict with the FAA approved Airplane Flight Manual (AFM), the AFM shall supersede. The Boeing Company regards the information or procedures described herein as having a direct or indirect bearing on the safe operation of this model airplane.

THE FOLLOWING PROCEDURE AND/OR INFORMATION IS EFFECTIVE UPON RECEIPT

Background Information

During a recent test flight on the 737-700 with the autopilot engaged in command (CMD) mode, a low frequency pitch oscillation was experienced while entering a turn with flaps UP and simultaneously selecting flaps 1. Airspeed at the time was greater than 230 knots. This oscillation occurs as a result of a combination of aircraft loading near the aft CG limit, off nominal rigging of the elevator tab shift mechanism and FCC timing of the tab shift with flap extension.

Operating Instructions

Although the probability of having all of the parameters required to trigger this anomaly is considered to be low, flight crews should be made aware of this possible condition and should monitor autopilot performance while turning and simultaneously selecting flaps from UP to 1. In some cases, disconnecting the autopilot and retrimming may be necessary. This anomaly has not been experienced at any other flap position.

Administrative Information

Insert this bulletin behind the Bulletin Record page in Volume 1 of your Flight Crew Operations Manual (FCOM). Amend the FCOM Bulletin Record page to show bulletin TBC-6 "In Effect" (IE).

This bulletin will be cancelled after Boeing is notified that all affected airplanes in your fleet have been modified by Service Bulletin 737– 27–1215. If you do not plan to modify all your airplanes and would like to have the contents of this bulletin incorporated in your Operations Manual, please advise Boeing accordingly.

Please send all correspondence regarding Flight Crew Operations Manual Bulletin status, to the 737 Manager, Flight Technical Data, through the Service Requests Application (SR App) on the MyBoeingFleet home page.

Flight Crew Operations Manual Bulletin
for
The Boeing Company

The Boeing Company
Seattle, Washington 98124-2207

737

Number: TBC-7

IssueDate: January 29, 1999

Subject: Engine Overheat/Fire and APU Fire Detection

Reason: To inform flight crews of a potential malfunction of the engine overheat/fire and APU fire detection system.

Information in this bulletin is recommended by The Boeing Company, but may not be FAA approved at the time of writing. In the event of conflict with the FAA approved Airplane Flight Manual (AFM), the AFM shall supersede. The Boeing Company regards the information or procedures described herein as having a direct or indirect bearing on the safe operation of this model airplane.

THE FOLLOWING PROCEDURE AND/OR INFORMATION IS EFFECTIVE UPON RECEIPT

Background Information

This bulletin was originally issued for your initial airplane deliveries and subsequently cancelled (CANC). It is being re-issued to cover follow-on deliveries.

A defect in the manufacturing process of the engine and APU fire detector loops may allow a slow leak of the internally contained helium gas. This slow leak may result in an increase in the predetermined temperature limit for a fire or overheat condition alert.

The wheel well fire detection and wing-body overheat detection systems are not affected.

Boeing issued an All-Operator telex, same subject, requesting the operators to inspect their 737-700 and series airplanes and spares inventory to identify the fire detector assemblies and fire detector elements serial numbers. Flight crews flying airplanes with suspect parts should use the operating instructions contained in this bulletin until repairs have been completed.

Operating Instructions

Engine Overheat

If an engine overheat condition occurs (ENG OVERHEAT light illuminates), it should be treated as an engine fire and the Engine Fire, Severe Damage or Separation non-normal procedure should be accomplished.

APU Operation

The APU system does not have overheat detection and the predetermined temperature limit for a APU fire may have increased. The APU should not be operated in flight unless an emergency condition requires its use. If the APU is started in flight, land at the nearest suitable field.

Note: Dispatch configurations requiring the use of the APU during flights are not authorized i.e. Dispatch with an Engine Driven Generator System inoperative.

Administrative Information

Insert this bulletin behind the Bulletin Record page in Volume 1 of your Flight Crew Operations Manual (FCOM). Amend the FCOM Bulletin Record page to show bulletin TBC-7 "In Effect" (IE).

This condition is temporary until the system is modified. The All-Operator telex provides instructions on how to receive replacement parts.

Please send all correspondence regarding Flight Crew Operations Manual Bulletin status, to the 737 Manager, Flight Technical Data, through the Service Requests Application (SR App) on the MyBoeingFleet home page.

Flight Crew Operations Manual Bulletin
for
The Boeing Company

The Boeing Company
Seattle, Washington 98124-2207

737

Number: TBC-8 R1

IssueDate: December 17, 1999

Subject: Uncommanded Engine Acceleration Due to an Engine Fuel Control Fault

Reason: To inform flight crews of a CFM 56-7 engine anomaly.

The purpose of this reissue is to provide Service Bulletin information.

Information in this bulletin is recommended by The Boeing Company, but may not be FAA approved at the time of writing. In the event of conflict with the FAA approved Airplane Flight Manual (AFM), the AFM shall supersede. The Boeing Company regards the information or procedures described herein as having a direct or indirect bearing on the safe operation of this model airplane.

THE FOLLOWING PROCEDURE AND/OR INFORMATION IS EFFECTIVE UPON RECEIPT

Background Information

There have been five (5) cases of uncommanded fuel flow accelerations on CFM56-7 engines. These are the result of an engine fuel control anomaly that can lead to excessive fuel flow, causing uncommanded thrust increase, engine RPM and/or EGT limit exceedances, or engine surge.

The first three (3) events occurred at near idle engine power during approach. For two (2) of the three (3) events, flight crew action was necessary to shut down the effected engine.

Two (2) subsequent events of uncommanded fuel flow accelerations occurred on an airplane which had EEC Software version 7BI installed. These events occurred on the ground, one while parking at the gate and one while taxiing. It should be noted this software was designed to minimize but not eliminate repeat occurrences of uncommanded fuel flow acceleration.

Alert Service Bulletin CFM56-7B S/B 73-A026, dated January 20, 1999, introduced EEC software version 7.B.J which provided a significant improvement in the Fault Accommodation Logic. There have been no additional uncommanded engine acceleration events since the release of software version 7.B.J. This Alert Service Bulletin and this Operations Manual Bulletin apply to airplanes with manufacturer's line numbers 1 through 193. Line number 194 and on received the software fix during production.

In addition, a review of the current 737 non-normal procedures has been conducted and the results include a new procedure for an engine limit, surge, stall condition. This change aligns the 737 non-normal procedure with other Boeing models' non-normal procedure.

Operating Instructions

If one or more of the following occurs, perform the Engine Limit/Surge/Stall procedure:

- engine RPM or EGT indications are abnormal, approaching or exceeding limits
- no response to thrust lever movement
- abnormal engine noises.

Note: Flight crews should remain vigilant for uncommanded engine acceleration during all phases of flight.

Administrative Information

Insert this bulletin behind the Bulletin Record page in Volume 1 of your Flight Crew Operations Manual (FCOM). Amend the FCOM Bulletin Record page to show bulletin TBC-8 R1 "In Effect" (IE).

This bulletin will be cancelled after Boeing is notified that all affected airplanes in your fleet have been modified by Alert Service Bulletin CFM56-7B S/B 73-A026. If you do not plan to modify all your airplanes and would like to have the contents of this bulletin incorporated in your Operations Manual, please advise Boeing accordingly.

Please send all correspondence regarding Flight Crew Operations Manual Bulletin status, to the 737 Manager, Flight Technical Data, through the Service Requests Application (SR App) on the MyBoeingFleet home page.

Flight Crew Operations Manual Bulletin
for
The Boeing Company

The Boeing Company
Seattle, Washington 98124-2207

737

Number: TBC-9 R1

IssueDate: June 30, 2004

Subject: APU DC Fuel Pump Operational Anomaly

Reason: To inform flight crews of an APU DC fuel pump operational anomaly.

The purpose of this reissue is to provide Service Bulletin information.

Information in this bulletin is recommended by The Boeing Company, but may not be FAA approved at the time of writing. In the event of conflict with the FAA approved Airplane Flight Manual (AFM), the AFM shall supersede. The Boeing Company regards the information or procedures described herein as having a direct or indirect bearing on the safe operation of this model airplane.

THE FOLLOWING PROCEDURE AND/OR INFORMATION IS EFFECTIVE UPON RECEIPT

Background Information

The APU DC Fuel Pump is intended to provide pressurized fuel to the APU when no AC fuel pump is operating.

Flight testing has revealed that the APU DC fuel pump will not operate automatically when the APU fuel control senses a low fuel pressure condition, unless the center tank fuel pump switches are in the ON position. This condition is caused by the routing of the low fuel pressure signal through the center tank pump switches. When these switches are in the OFF position, the low pressure signal is interrupted.

Operating Instructions

With the center tank fuel pump switches in the OFF position, the APU DC fuel pump does not function as described in the Operations Manual and should be treated as inoperative.

Note: With no AC power available and the DC fuel pump inoperative, APU starts are not recommended above 25,000 feet.

Administrative Information

Insert this bulletin behind the Bulletin Record page in Volume 1 of your Flight Crew Operations Manual (FCOM). Amend the FCOM Bulletin Record page to show bulletin TBC-9 R1 "In Effect" (IE).

This anomaly is corrected by Boeing Service Bulletin 737-28-1152. This FCOM Bulletin will be canceled after Boeing is notified that all affected airplanes in the operator’s fleet have been modified.

Please send all correspondence regarding Flight Crew Operations Manual Bulletin status, to the 737 Manager, Flight Technical Data, through the Service Requests Application (SR App) on the MyBoeingFleet home page.

Flight Crew Operations Manual Bulletin
for
The Boeing Company

The Boeing Company
Seattle, Washington 98124-2207

737

Number: TBC-11 R1

IssueDate: March 26, 1999

Subject: Collins ILS/GPS Multi-Mode Receiver (MMR) Failure

Reason: To inform flight crews of the lack of failure indications associated with certain internal Multi-Mode Receiver (MMR) failures.

The purpose of this reissue is to provide Service Bulletin information.

Information in this bulletin is recommended by The Boeing Company, but may not be FAA approved at the time of writing. In the event of conflict with the FAA approved Airplane Flight Manual (AFM), the AFM shall supersede. The Boeing Company regards the information or procedures described herein as having a direct or indirect bearing on the safe operation of this model airplane.

THE FOLLOWING PROCEDURE AND/OR INFORMATION IS EFFECTIVE UPON RECEIPT

Background Information

Flight testing has shown that certain internal MMR failures can occur which do not display fault indications or failure flags. In this event, the associated ILS and GPS will not function. ILS frequency, localizer deviation and glideslope deviation indicators will not be displayed. Normal GPS functions and updates will not be available and the altitude range arc will move erratically if displayed.

Collins GLU-920 Service Bulletins (8 and 10 through 15) provide information on the upgrade that fixes the anomaly.

Operating Instructions

If course and glideslope deviation indicators are not displayed, consider the event as an ILS receiver failure. Dual channel approach and autoland will not be available. Consider the effect on approach minimums and select an appropriate course of action. When flight conditions permit, view FMC Position Page 2 and determine if a GPS position is missing. If so, consider the associated GPS receiver as failed.

Administrative Information

Insert this bulletin behind the Bulletin Record page in Volume 1 of your Flight Crew Operations Manual (FCOM). Amend the FCOM Bulletin Record page to show bulletin TBC-11 R1 "In Effect" (IE).

This bulletin will be cancelled after Boeing is notified that all affected airplanes in your fleet have been modified by Collins GLU-920 Service Bulletins (8 and 10 through 15). If you do not plan to modify all your airplanes and would like to have the contents of this bulletin incorporated in your Operations Manual, please advise Boeing accordingly.

Please send all correspondence regarding Flight Crew Operations Manual Bulletin status, to the 737 Manager, Flight Technical Data, through the Service Requests Application (SR App) on the MyBoeingFleet home page.

Flight Crew Operations Manual Bulletin
for
The Boeing Company

The Boeing Company
Seattle, Washington 98124-2207

737

Number: TBC-12 R1

IssueDate: September 6, 1999

Subject: Inadvertent RTO Autobraking During Landing

Reason: To inform flight crews of the potential risk of RTO braking during landing on 737-600/700/800 airplanes.

The purpose of this reissue is to provide Service Letter information.

Information in this bulletin is recommended by The Boeing Company, but may not be FAA approved at the time of writing. In the event of conflict with the FAA approved Airplane Flight Manual (AFM), the AFM shall supersede. The Boeing Company regards the information or procedures described herein as having a direct or indirect bearing on the safe operation of this model airplane.

THE FOLLOWING PROCEDURE AND/OR INFORMATION IS EFFECTIVE UPON RECEIPT

Background Information

A 737-800 operator has reported three incidents of inadvertent selection of RTO braking during landing roll. In each case, flight crews were attempting to disarm the autobrakes by placing the Auto Brake Select Switch to the "OFF" position. The RTO events were caused by over-rotating the switch past the "OFF" position to the "RTO" position. Boeing Flight Test and Boeing Engineering have confirmed that RTO arming and application logic in the autobrake system may allow RTO braking to engage if the switch is placed in the "RTO" position at any speed after landing autobraking has initiated.

Boeing Service Letter 737-SL-32-078 provides information concerning an autobrake software modification to re-verify the arming conditions when RTO is selected during landing roll. This modification will prevent RTO braking even if the switch is inadvertently placed in the "RTO" position during landing.

Operating Instructions

Although the autobrake system can be disarmed by placing the Auto Brake Select Switch in the "OFF" position, Boeing recommends the use of manual braking to disarm the autobrake system. Flight crews may also disarm the autobrakes by moving the SPEED BRAKE lever to the down detent if speed brakes are not further required to assist stopping.

Administrative Information

Insert this bulletin behind the Bulletin Record page in Volume 1 of your Flight Crew Operations Manual (FCOM). Amend the FCOM Bulletin Record page to show bulletin TBC-12 R1 "In Effect" (IE).

This bulletin will be cancelled after Boeing is notified that all affected airplanes in your fleet have been modified by Service Letter 737-SL-32-078. If you do not plan to modify all your airplanes and would like to have the contents of this bulletin incorporated in your Operations Manual, please advise Boeing accordingly.

Please send all correspondence regarding Flight Crew Operations Manual Bulletin status, to the 737 Manager, Flight Technical Data, through the Service Requests Application (SR App) on the MyBoeingFleet home page.

Flight Crew Operations Manual Bulletin
for
The Boeing Company

The Boeing Company **Seattle, Washington 98124-2207**	737

Number: TBC-13 R1

IssueDate: April 23, 1999

Subject: Nuisance PWS Fail Annunciation

Reason: To inform flight crews of predictive windshear system operational conditions that can cause the subject annunciation to be displayed.

The purpose of this reissue is to provide Service Bulletin information.

Information in this bulletin is recommended by The Boeing Company, but may not be FAA approved at the time of writing. In the event of conflict with the FAA approved Airplane Flight Manual (AFM), the AFM shall supersede. The Boeing Company regards the information or procedures described herein as having a direct or indirect bearing on the safe operation of this model airplane.

THE FOLLOWING PROCEDURE AND/OR INFORMATION IS EFFECTIVE UPON RECEIPT

Background Information

Flight testing and customer reports have confirmed that a nuisance PWS FAIL annunciation will occur for approximately 30 seconds under the following conditions

- WXR has not been selected on at any time since electrical power up, and
- one or both engines are advanced for takeoff and the indicated airspeed is increasing.

This applies to the Allied Signal weather radar system with the Predictive Windshear function activated. (Allied Signal/Bendix weather radar system receiver-transmitter part number 066-50008-0405). The message will extinguish approximately 30 seconds after appearing.

Allied Signal/Bendix Service Bulletin RTA-4B-34-97 (M4508) corrects the anomaly. This service bulletin converts the weather radar RT unit part number from 066-50008-0405 to 066-50008-0406.

All airplanes prior to Line Number 347 are affected. Follow-on airplanes will have the -0406 receiver-transmitters installed prior to delivery.

Operating Instructions

To prevent the annunciation from occurring, select the weather radar system on prior to takeoff. The weather radar may then remain on or be turned off as desired for the remainder of the flight. Consider any subsequent PWS FAIL annunciation or WINDSHEAR alert as valid.

Administrative Information

Insert this bulletin behind the Bulletin Record page in Volume 1 of your Flight Crew Operations Manual (FCOM). Amend the FCOM Bulletin Record page to show bulletin TBC-13 R1 "In Effect" (IE).

This bulletin will be cancelled after Boeing is notified that all affected airplanes in your fleet have been modified by Allied Signal/Bendix Service Bulletin RTA-4B-34-97 (M4508).

If you do not plan to modify all your airplanes and would like to have the contents of this operations manual bulletin incorporated in your Operations Manual, please advise Boeing accordingly.

Please send all correspondence regarding Flight Crew Operations Manual Bulletin status, to the 737 Manager, Flight Technical Data, through the Service Requests Application (SR App) on the MyBoeingFleet home page.

Flight Crew Operations Manual Bulletin
for
The Boeing Company

The Boeing Company **Seattle, Washington 98124-2207**	737

Number: TBC-14 R1

IssueDate: June 30, 2004

Subject: AFDS Performance Degradation with Radio Altimeter Failure

Reason: To inform flight crews of potential AFDS performance degradation associated with certain Radio Altimeter failure modes.

The purpose of this reissue is to provide Service Letter information.

Information in this bulletin is recommended by The Boeing Company, but may not be FAA approved at the time of writing. In the event of conflict with the FAA approved Airplane Flight Manual (AFM), the AFM shall supersede. The Boeing Company regards the information or procedures described herein as having a direct or indirect bearing on the safe operation of this model airplane.

THE FOLLOWING PROCEDURE AND/OR INFORMATION IS EFFECTIVE UPON RECEIPT

Background Information

The LNAV function of the flight management computer (FMC) is limited to a bank angle limit of 30 degrees by the flight control computers (FCC) when the radio altitude is 400 feet or greater. Below 200 feet, LNAV is limited to 8 degrees of bank angle. Between 200 and 400 feet bank angle is limited to 15 degrees. The actual bank angle commanded by the FMC will be within these bounds.

Flight testing has confirmed that certain radio altimeter failure modes can cause degraded autopilot flight director system (AFDS) performance. These failure modes may not cause an amber RA failure flag to be displayed.

If a radio altimeter fails while transmitting a valid altitude of less than 200 feet or if the radio altimeter output never becomes valid after power up on the ground, the associated FCC, which uses that radio altimeter as its primary source of data, will use the last valid altitude received or use zero feet if no valid altitude is received after power-up. This will result in the LNAV command on that side always being limited to 8 degrees of bank angle, during either autopilot or flight director operation. Depending on the aggressiveness of the programmed turns of the active LNAV path, this failure could result in the airplane departing the LNAV path if the FMC desired commands exceed the AFDS bank limits. This failure will be indicated by the airplane symbol not following the defined (magenta) path as shown on the Navigation Display.

Operating Instructions

Boeing procedures emphasize the need for pilot monitoring of automated systems to ensure acceptable performance in flight. In this case, vigilant flight path monitoring will reveal the radio altimeter failure as a deviation from the FMC computed path when using LNAV guidance. This failure will also cause a flight director disagreement in LNAV mode. The flight director associated with the failed radio altimeter will be limited to 8 degrees of bank. The flight director associated with the operating radio altimeter will not be bank angle limited unless the airplane is below 400 feet AGL. If these effects occur, the flight crew must utilize other appropriate methods of flight path control at their disposal. These methods include but are not limited to: use of manual flight modes to keep the airplane on the FMC path or use of VOR guidance to track appropriate radials if the LNAV track overlays VOR airway structure. Additionally, the autopilot and flight director LNAV steering commands will be normal from the FCC associated with a functioning radio altimeter.

Administrative Information

Insert this bulletin behind the Bulletin Record page in Volume 1 of your Flight Crew Operations Manual (FCOM). Amend the FCOM Bulletin Record page to show bulletin TBC-14 R1 "In Effect" (IE).

This anomaly is corrected by Boeing Service Bulletin 737-SL-22-044. This FCOM Bulletin will be canceled after Boeing is notified that all affected airplanes in the operator’s fleet have been modified.

Please send all correspondence regarding Flight Crew Operations Manual Bulletin status, to the 737 Manager, Flight Technical Data, through the Service Requests Application (SR App) on the MyBoeingFleet home page.

Flight Crew Operations Manual Bulletin
for
The Boeing Company

The Boeing Company
Seattle, Washington 98124-2207

737

Number: TBC-17 R1

IssueDate: November 6, 2000

Subject: Control Wheel Microphone/Interphone Switch Anomaly

Reason: To inform flight crews that the position of the Control Wheel Microphone/ Interphone switch can prevent PA announcements from the flight deck.

The purpose of this reissue is to provide Service Bulletin information.

Information in this bulletin is recommended by The Boeing Company, but may not be FAA approved at the time of writing. In the event of conflict with the FAA approved Airplane Flight Manual (AFM), the AFM shall supersede. The Boeing Company regards the information or procedures described herein as having a direct or indirect bearing on the safe operation of this model airplane.

THE FOLLOWING PROCEDURE AND/OR INFORMATION IS EFFECTIVE UPON RECEIPT

Background Information

An operator recently reported an anomaly while attempting a PA announcement using the audio panel PTT switch with the Control Wheel Microphone/Interphone switch latched in the INT (flight interphone) position. If the Control Wheel Microphone/Interphone switch is latched in the INT position and the associated audio panel PTT switch or hand microphone is used with the PA Transmitter Select switch selected, transmissions cannot be made on the PA system. The aft aisle PA handset or PA hand microphone continue to function normally in this condition. The other pilot's PTT switch and hand microphone operate normally if the associated Control Wheel Microphone/Interphone switch is not also latched in the INT position.

Boeing Service Bulletin 737-23-1157 provides information on the upgrade that fixes this anomaly.

Administrative Information

Insert this bulletin behind the Bulletin Record page in Volume 1 of your Flight Crew Operations Manual (FCOM). Amend the FCOM Bulletin Record page to show bulletin TBC-17 R1 "In Effect" (IE).

This bulletin will be cancelled after Boeing is notified that all affected airplanes in your fleet have been modified by Service Bulletin 737-23-1157. If you do not plan to modify all your airplanes and would like to have the contents of this bulletin incorporated in your Operations Manual, please advise Boeing accordingly.

Please send all correspondence regarding Flight Crew Operations Manual Bulletin status, to the 737 Manager, Flight Technical Data, through the Service Requests Application (SR App) on the MyBoeingFleet home page.

Flight Crew Operations Manual Bulletin
for
The Boeing Company

The Boeing Company
Seattle, Washington 98124-2207

737

Number: TBC-18 R2

IssueDate: November 1, 2001

Subject: Nuisance Zone Temp Light Illuminations on 737-800 Airplanes

Reason: To inform flight crews of operational issues associated with nuisance ZONE TEMP light illumination during preflight procedures.

The purpose of this reissue is to provide amplification of Normal Preflight and Shutdown procedures.

Information in this bulletin is recommended by The Boeing Company, but may not be FAA approved at the time of writing. In the event of conflict with the FAA approved Airplane Flight Manual (AFM), the AFM shall supersede. The Boeing Company regards the information or procedures described herein as having a direct or indirect bearing on the safe operation of this model airplane.

THE FOLLOWING PROCEDURE AND/OR INFORMATION IS EFFECTIVE UPON RECEIPT

Background Information

Many 737-800 operators have reported intermittent illumination of one, two or all three air conditioning system ZONE TEMP lights on the forward overhead panel during master caution recall. Subsequent maintenance interrogation of the pack/zone temperature controllers typically shows no faults or occasionally, trim air valve(s) faults. Resetting the master caution system extinguishes the ZONE TEMP light(s). A telex was sent to the operators that provides a workaround to prevent, or at least reduce the number of nuisance ZONE TEMP lights. This alternate procedure was coordinated with Service Engineering, Environmental Control Systems (ECS) Engineering and ECS vendor, Allied Signal.

The root cause of the problem has been associated with turning the Battery switch OFF while the Trim Air switches remain ON and ground power is applied to the airplane. With the Battery switch OFF, the Trim Air valves are not powered, and the Zone Temp Controllers remain powered. The result can be a ZONE TEMP light on master caution recall.

Service Bulletin 737-21-1133, to be released December 14, 2000, provides information for the hardware upgrade that fixes the ZONE TEMP light nuisance.

Operating Instructions

After landing, turn the Trim Air switches OFF prior to turning the Battery switch OFF during the Secure Procedure. Prior to Engine Start turn the Trim Air switches ON after turning the Battery switch ON (follow the normal Flight Deck Preparation - First Officer Procedure).

This procedure is temporary until system modifications are complete.

Administrative Information

Insert this bulletin behind the Bulletin Record page in Volume 1 of your Flight Crew Operations Manual (FCOM). Amend the FCOM Bulletin Record page to show bulletin TBC-18 R2 "In Effect" (IE).

This bulletin will be cancelled after Boeing is notified that all affected airplanes in your fleet have been modified by Service Bulletin 737-21-1133. If you do not plan to modify all your airplanes and would like to have the contents of this bulletin incorporated in your Operations Manual, please advise Boeing accordingly.

Please send all correspondence regarding Flight Crew Operations Manual Bulletin status, to the 737 Manager, Flight Technical Data, through the Service Requests Application (SR App) on the MyBoeingFleet home page.

Flight Crew Operations Manual Bulletin
for
The Boeing Company

The Boeing Company
Seattle, Washington 98124-2207

Number: TBC-19

IssueDate: June 10, 1999

Subject: 737-600/-700/-800 Elevator Tab Operational Limitations

Reason: To inform flight crews of operational limitations associated with elevator tab inspection requirements.

Information in this bulletin is recommended by The Boeing Company, but may not be FAA approved at the time of writing. In the event of conflict with the FAA approved Airplane Flight Manual (AFM), the AFM shall supersede. The Boeing Company regards the information or procedures described herein as having a direct or indirect bearing on the safe operation of this model airplane.

THE FOLLOWING PROCEDURE AND/OR INFORMATION IS EFFECTIVE UPON RECEIPT

Background Information

As a result of structural damage to an elevator tab rod fitting discovered on an in-service 737-800 airplane, the FAA has issued an Airworthiness Directive (AD) requiring operators to perform inspections and modifications of this part. The AD will require an operational limitation on certain 737-600/-700/-800 airplanes until inspections and modifications detailed in service bulletin SB 737-55A1068 are complete. This service bulletin calls for inspection within 10 days and has instructions for an interim fix and ongoing inspections.

Boeing analysis has confirmed that the damage was aggravated by speedbrake induced airframe vibrations. The severity of this vibration can be reduced by restricting the maximum airspeed with speedbrakes extended. Since this airspeed restriction adversely affects the airplane's ability to descend rapidly, the maximum cruise altitude must also be reduced to meet FAA emergency descent oxygen requirements.

The AD and this bulletin apply to airplanes with manufacturer's line numbers 1 through 190. Airplanes with service bulletin SB 737-55-1063 installed are not affected. Service bulletin SB 737-55-1063 calls for replacement of the tab mast fitting with a new part.

Operating Instructions

Do not operate airplanes affected by this bulletin at speeds in excess of 310 knots IAS with speedbrakes extended. Do not operate these airplanes above FL 390.

This procedure is required within 24 hours of AD release and is temporary until service bulletins SB 737-55A1068 or SB 737-55-1063 are complete.

Administrative Information

Insert this bulletin behind the Bulletin Record page in Volume 1 of your Flight Crew Operations Manual (FCOM). Amend the FCOM Bulletin Record page to show bulletin TBC-19 "In Effect" (IE).

This bulletin will be canceled after Boeing is notified that all affected airplanes in your fleet have been modified by either Service Bulletin 737-55A1068 or 737-55-1063.

Please send all correspondence regarding Flight Crew Operations Manual Bulletin status, to the 737 Manager, Flight Technical Data, through the Service Requests Application (SR App) on the MyBoeingFleet home page.

Flight Crew Operations Manual Bulletin
for
The Boeing Company

The Boeing Company
Seattle, Washington 98124-2207

737

Number: TBC-20 R1

IssueDate: June 30, 2004

Subject: VHF Radio Use for ATC Ground Operations

Reason: To inform flight crews of the recommendation to use the VHF radio connected to the top of fuselage antenna for primary ATC communications on the ground.

The purpose of this reissue is to provide Service Bulletin information.

Information in this bulletin is recommended by The Boeing Company, but may not be FAA approved at the time of writing. In the event of conflict with the FAA approved Airplane Flight Manual (AFM), the AFM shall supersede. The Boeing Company regards the information or procedures described herein as having a direct or indirect bearing on the safe operation of this model airplane.

THE FOLLOWING PROCEDURE AND/OR INFORMATION IS EFFECTIVE UPON RECEIPT

Background Information

As a result of antenna location, several operators have reported blanking or inability to use the VHF radio connected to the bottom of fuselage antenna for Air Traffic Control (ATC) communications during ground operations at certain locations. The investigation of these reports indicated that blocking of the signal to the lower antenna caused the temporary loss of communications while on the ground. This blocking can be caused by the airplane not having line of sight to the tower due to the airplane fuselage, other airplanes or airport topography.

This issue will be addressed in a Federal Aviation Administration (FAA) Airworthiness Directive. Boeing has sent a telegraphic Service Letter to all operators and will create an Alert Service Bulletin to address retrofit of delivered airplanes. The Alert Service Bulletin is scheduled for release by second quarter 2000 and will direct the reconnection of the antennas to the following positions:

- VHF 1 to top center fuselage antenna
- VHF 2 to bottom aft fuselage antenna
- VHF 3, if installed, will remain in the bottom forward position.

In addition, Boeing is processing a change in production to reconnect the VHF antennas as described above.

Operating Instructions

Use the VHF radio connected to the top of fuselage antenna for primary ATC communications on the ground.

Administrative Information

Insert this bulletin behind the Bulletin Record page in Volume 1 of your Flight Crew Operations Manual (FCOM). Amend the FCOM Bulletin Record page to show bulletin TBC-20 R1 "In Effect" (IE).

This bulletin will be canceled after Boeing is notified that all affected airplanes in your fleet have been modified by Service Bulletin 737-23A1170. If you do not plan to modify all your airplanes and would like to have the contents of this bulletin incorporated in your FCOM, please advise Boeing accordingly.

Please send all correspondence regarding Flight Crew Operations Manual Bulletin status, to the 737 Manager, Flight Technical Data, through the Service Requests Application (SR App) on the MyBoeingFleet home page.

Flight Crew Operations Manual Bulletin
for
The Boeing Company

The Boeing Company
Seattle, Washington 98124-2207

737

Number: TBC-21 R1

IssueDate: June 30, 2004

Subject: GPWS Minimums Voice Callout Anomaly

Reason: To inform flight crews of an anomaly in the DH/MDA voice callout functionality.

The purpose of this reissue is to provide Service Bulletin information.

Information in this bulletin is recommended by The Boeing Company, but may not be FAA approved at the time of writing. In the event of conflict with the FAA approved Airplane Flight Manual (AFM), the AFM shall supersede. The Boeing Company regards the information or procedures described herein as having a direct or indirect bearing on the safe operation of this model airplane.

THE FOLLOWING PROCEDURE AND/OR INFORMATION IS EFFECTIVE UPON RECEIPT

Background Information

The DH/MDA Callouts do not always function correctly on airplanes equipped with Look Ahead Terrain Alerting (GPWS). If the Minimums Reference Selector (MINS) on the EFIS Control Panel is rotated from BARO to RADIO below 1000 feet AGL, the callout may occur immediately and not at the appropriate altitude. This does not occur when the switch is rotated above 1000 feet AGL.

The Landing Altitude/Minimums Indications on the PFD display function correctly. These include the BARO Minimums Pointer and the Minimums Reference/Altitude.

Operating Instructions

Do not rotate the Minimums Reference Selector (MINS) on the EFIS Control Panel from BARO to RADIO once the airplane has descended below 1000 feet AGL.

Administrative Information

Insert this bulletin behind the Bulletin Record page in Volume 1 of your Flight Crew Operations Manual (FCOM). Amend the FCOM Bulletin Record page to show bulletin TBC-21 R1 "In Effect" (IE).

This bulletin will be canceled after Boeing is notified that all affected airplanes in your fleet have been modified by Service Bulletin 737-34-1616. If you do not plan to modify all your airplanes and would like to have the contents of this bulletin incorporated in your FCOM, please advise Boeing accordingly.

Please send all correspondence regarding Flight Crew Operations Manual Bulletin status, to the 737 Manager, Flight Technical Data, through the Service Requests Application (SR App) on the MyBoeingFleet home page.

Flight Crew Operations Manual Bulletin for The Boeing Company

The Boeing Company
Seattle, Washington 98124-2207

737

Number: TBC-22 R1

IssueDate: June 30, 2004

Subject: TCAS Display Anomaly

Reason: To inform flight crews of a TCAS display anomaly.

The purpose of this reissue is to provide Service Bulletin information.

THE FOLLOWING PROCEDURE AND/OR INFORMATION IS EFFECTIVE UPON RECEIPT

Background Information

Flight testing and in-service experience has revealed anomalous TCAS display behavior for airplanes with TCAS MOPS 7 software installed. The problem is limited to the relative bearing display of TCAS "other traffic" beyond 40 NM from the airplane. TCAS "other traffic" is defined as non-threat traffic that is more than six miles laterally and 1200 feet vertically from the airplane. The following anomalies have been observed:

- The relative bearing of TCAS "other traffic" targets may be erroneous for targets beyond the 40 NM range.
- Relative bearing errors of TCAS "other traffic" targets may be as large as 180 degrees and the displayed bearing positions of these targets may change abruptly.
- Bearing errors for TCAS "other traffic" targets will increase as distance of traffic from the airplane increases, and are more pronounced at relative bearings of 360, 90, 180, and 270 degrees.

This problem does not affect relative bearing accuracy of TCAS targets that are less than 40 NM from the airplane. TCAS alerting and collision avoidance logic is not affected.

Operating Instructions

If a Traffic Advisory (TA) or Resolution Advisory (RA) occurs accomplish the published Traffic Avoidance procedure. Bearing information for TCAS traffic targets beyond 40 NM may not be accurate.

Administrative Information

Insert this bulletin behind the Bulletin Record page in Volume 1 of your Flight Crew Operations Manual (FCOM). Amend the FCOM Bulletin Record page to show bulletin TBC-22 R1 "In Effect" (IE).

This anomaly is corrected by Honeywell Service Bulletin 7517900-34-6005 or 7517900-34-6006 (TCAS computer update). This FCOM Bulletin will be canceled after Boeing is notified that all affected airplanes in the operator’s fleet have been modified.

Please send all correspondence regarding Flight Crew Operations Manual Bulletin status, to the 737 Manager, Flight Technical Data, through the Service Requests Application (SR App) on the MyBoeingFleet home page.

Flight Crew Operations Manual Bulletin
for
The Boeing Company

The Boeing Company
Seattle, Washington 98124-2207

737

Number: TBC-23 R1

IssueDate: June 30, 2004

Subject: Look-Ahead Terrain Alerting Display Anomalies

Reason: To inform flight crews of display anomalies associated with GPWS look-ahead terrain alerting.

The purpose of this reissue is to provide Service Bulletin information.

Information in this bulletin is recommended by The Boeing Company, but may not be FAA approved at the time of writing. In the event of conflict with the FAA approved Airplane Flight Manual (AFM), the AFM shall supersede. The Boeing Company regards the information or procedures described herein as having a direct or indirect bearing on the safe operation of this model airplane.

THE FOLLOWING PROCEDURE AND/OR INFORMATION IS EFFECTIVE UPON RECEIPT

Background Information

During a GPWS look-ahead terrain CAUTION or WARNING, terrain display data may be positioned inaccurately on the navigation display.

At ranges of 40 NM or greater, solid amber or solid red terrain data displays at an erroneous distance ahead of the airplane symbol. The error increases as the range selection is increased and can be up to 20 NM at the 160 NM range setting. Dotted red, dotted amber, and dotted green terrain data display correctly. Only solid amber (look-ahead terrain CAUTION active) and solid red terrain (look-ahead terrain WARNING active) data displays are affected.

In addition, display of solid amber and solid red terrain data may be delayed by 2 or 3 display sweeps after the initial terrain alert. Once displayed, solid terrain data may be removed on a subsequent display sweep.

Operating Instructions

The terrain data display is intended to serve as a situational awareness tool only. It does not provide the accuracy or fidelity on which to solely base terrain avoidance maneuvering decisions.

In the event of a look-ahead terrain CAUTION or WARNING, accomplish the appropriate Terrain Avoidance maneuver in the Non-Normal Maneuvers chapter of the QRH.

Administrative Information

Insert this bulletin behind the Bulletin Record page in Volume 1 of your Flight Crew Operations Manual (FCOM). Amend the FCOM Bulletin Record page to show bulletin TBC-23 R1 "In Effect" (IE).

This anomaly is corrected by Boeing Service Bulletin 737-34-1616. This FCOM Bulletin will be canceled after Boeing is notified that all affected airplanes in the operator’s fleet have been modified.

Please send all correspondence regarding Flight Crew Operations Manual Bulletin status, to the 737 Manager, Flight Technical Data, through the Service Requests Application (SR App) on the MyBoeingFleet home page.

Flight Crew Operations Manual Bulletin
for
The Boeing Company

The Boeing Company
Seattle, Washington 98124-2207

737

Number: TBC-24

IssueDate: May 17, 2000

Subject: GPWS 2500 Foot Voice Callout Anomaly

Reason: To inform flight crews that the 2500 foot radio altitude voice callout may not occur.

Information in this bulletin is recommended by The Boeing Company, but may not be FAA approved at the time of writing. In the event of conflict with the FAA approved Airplane Flight Manual (AFM), the AFM shall supersede. The Boeing Company regards the information or procedures described herein as having a direct or indirect bearing on the safe operation of this model airplane.

THE FOLLOWING PROCEDURE AND/OR INFORMATION IS EFFECTIVE UPON RECEIPT

Background Information

During an approach over water the GPWS voice callout TWENTY FIVE HUNDRED may not occur. A recent change to the Collins LRA 900 radio altimeter introduced an anomaly that may prevent some radio altimeters from reporting the 2500 foot signal to the GPWS when flying over water due to temporarily high signal strength conditions.

This bulletin applies to airplanes equipped with faulty Collins LRA 900 radio altimeters (Part Number 822-0334-002).

Collins Service Bulletin No. 3 (LRA 900), dated April 7, 2000, provides information on the upgrade that corrects this anomaly. It is recommended that operators contact Collins directly.

Operating Instructions

Do not rely on the voice callout TWENTY FIVE HUNDRED during an approach over water.

Administrative Information

Insert this bulletin behind the Bulletin Record page in Volume 1 of your Flight Crew Operations Manual (FCOM). Amend the FCOM Bulletin Record page to show bulletin TBC-24 "In Effect" (IE).

This bulletin will be cancelled after Boeing is notified that all affected airplanes have been modified by Collins Service Bulletin No. 3.

Please send all correspondence regarding Flight Crew Operations Manual Bulletin status, to the 737 Manager, Flight Technical Data, through the Service Requests Application (SR App) on the MyBoeingFleet home page.

Flight Crew Operations Manual Bulletin
for
The Boeing Company

The Boeing Company
Seattle, Washington 98124-2207

737

Number: TBC-27 R1

IssueDate: June 30, 2004

Subject: PSEU Fault Indications

Reason: To inform flight crews of a configuration warning anomaly.

The purpose of this reissue is to provide Service Bulletin information.

Information in this bulletin is recommended by The Boeing Company, but may not be FAA approved at the time of writing. In the event of conflict with the FAA approved Airplane Flight Manual (AFM), the AFM shall supersede. The Boeing Company regards the information or procedures described herein as having a direct or indirect bearing on the safe operation of this model airplane.

THE FOLLOWING PROCEDURE AND/OR INFORMATION IS EFFECTIVE UPON RECEIPT

Background Information

There have been several cases of nuisance landing configuration warnings on BBJ airplanes when flaps are retracted after takeoff. This configuration warning is the result of a malfunctioning flap position switch (S138) in the Flap Control Unit.

An internal short in the S138 switch can initiate a landing configuration warning horn which will sound intermittently or continuously and cannot be silenced by the Landing Gear Warning Cutout Switch. Condition of the S138 switch is monitored by the Proximity Switch Electronics Unit (PSEU). Current PSEU logic incorrectly identifies this fault as a dispatchable condition. Detection of an internal short in the S138 switch on the ground results in a PSEU light which will illuminate on RECALL and extinguish during Master Caution system reset. Once airborne, the internal short causes an intermittent or continuous horn that can only be silenced by extending the flaps, lowering the landing gear, or pulling the Aural Warning circuit breaker.

Operating Instructions

Pulling the Aural Warning circuit breaker is not recommended as it disables other aural warning functions including the Autopilot Disconnect warning tone and the Cabin Altitude warning horn. Flight crews experiencing an inappropriate landing configuration warning should consider a return to landing as soon as flight conditions permit.

In addition, the PSEU Non Normal Checklist has been revised to remove the Master Caution system reset step. All PSEU light illuminations will require maintenance action prior to takeoff until further notice.

Administrative Information

Insert this bulletin behind the Bulletin Record page in Volume 1 of your Flight Crew Operations Manual (FCOM). Amend the FCOM Bulletin Record page to show bulletin TBC-27 R1 "In Effect" (IE).

This anomaly is corrected by Boeing Service Bulletin 737-32A1343. This FCOM Bulletin will be canceled after Boeing is notified that all affected airplanes in the operator’s fleet have been modified.

Please send all correspondence regarding Flight Crew Operations Manual Bulletin status, to the 737 Manager, Flight Technical Data, through the Service Requests Application (SR App) on the MyBoeingFleet home page.

Flight Crew Operations Manual Bulletin
for
The Boeing Company

The Boeing Company
Seattle, Washington 98124-2207

737

Number: TBC-29 R2

IssueDate: July 19, 2002

Subject: Emergency Airworthiness Directive 2002-08-52

Reason: This bulletin notifies flight crews of an operation limitation associated with elevator control surface vibration on 737-600/-700/-700C/-800 and BBJ airplanes.

The purpose of this reissue is to provide Service Bulletin information.

Information in this bulletin is recommended by The Boeing Company, but may not be FAA approved at the time of writing. In the event of conflict with the FAA approved Airplane Flight Manual (AFM), the AFM shall supersede. The Boeing Company regards the information or procedures described herein as having a direct or indirect bearing on the safe operation of this model airplane.

THE FOLLOWING PROCEDURE AND/OR INFORMATION IS EFFECTIVE UPON RECEIPT

Background Information

In May 2001, a 737-800 airplane experienced a significant airplane vibration event associated with speed brake deployment as the airplane descended through flight level 220 at 320 knots IAS. Additionally, vibration events were experienced during the 737-900 flight test program that were attributed to a lack of sufficient damping necessary to prevent elevator tab vibration in certain flight conditions. The 737-900 elevator tab was stiffened to provide increased damping. Based on data gathered during the 737-900 flight test program, we believe it is likely that the 737-800 vibration event noted above was similar to these events.

Recently, a 737-700 airplane also experienced a similar vibration event associated with speedbrake deployment as the airplane descended through FL195 at an airspeed of 315 KIAS.

As a result an operational limitation as noted below has been expanded to include the 737-600/-700/-700C/BBJ airplanes until stiffened elevator tabs are installed. The new elevator tab will be incorporated in production at line number 1175, scheduled for delivery in July 2002. Retrofit of in-service airplanes per Boeing Service Bulletin 737-55A1080 will begin in the third quarter of 2002. Boeing anticipates this corrective action will provide sufficient damping to eliminate vibration. This limitation is identical to that currently in effect for 737-800 airplanes.

Operating Instructions

The following AFM limitation will be placed on the 737-600/-700/-700C/-800/BBJ fleet until terminated by the installation of a stiffened elevator tab:

Do not operate the airplane at speeds in excess of 300 KIAS with speedbrakes extended.

WARNING: Use of speedbrakes at speeds in excess of 320 KIAS could result in a severe vibration, which, in turn, could cause extreme damage to the horizontal stabilizer.

The FAA confirmed that in a situation requiring an Emergency Descent, the pilot in command may deviate from subject AD in accordance with the responsibility and authority provided in FAR 91.3.

Administrative Information

Insert this bulletin behind the Bulletin Record page in Volume 1 of your Flight Crew Operations Manual (FCOM). Amend the FCOM Bulletin Record page to show bulletin TBC-29 R2 "In Effect" (IE).

This bulletin will be cancelled after Boeing is notified that all affected airplanes in your fleet have been modified by Service Bulletin 737-55-1080.

Please send all correspondence regarding Flight Crew Operations Manual Bulletin status, to the 737 Manager, Flight Technical Data, through the Service Requests Application (SR App) on the MyBoeingFleet home page.

Flight Crew Operations Manual Bulletin
for
The Boeing Company

The Boeing Company
Seattle, Washington 98124-2207

737

Number: TBC-30 R1

IssueDate: June 30, 2004

Subject: Inflight Start EGT Display

Reason: To inform flight crews that the inflight start EGT start limit and exceedance indications may not appear correctly below 20,000 feet.

The purpose of this revision is to provide Service Bulletin information.

Information in this bulletin is recommended by The Boeing Company, but may not be FAA approved at the time of writing. In the event of conflict with the FAA approved Airplane Flight Manual (AFM), the AFM shall supersede. The Boeing Company regards the information or procedures described herein as having a direct or indirect bearing on the safe operation of this model airplane.

THE FOLLOWING PROCEDURE AND/OR INFORMATION IS EFFECTIVE UPON RECEIPT

Background Information

Exhaust Gas Temperature (EGT) is normally displayed on the center instrument panel upper display unit (DU) as both a digital readout and a round dial/moving pointer indication. Maximum operating limits are indicated by redlines.

The EGT Start Limit redline is displayed during engine start when N2 is less than idle. If an exceedance is noted by the electronic engine control (EEC), the digital readout, box, pointer and indicator change color to red.

Flight testing has shown that the Exhaust Gas Temperature (EGT) Start Limit redline and associated exceedance indications may not display during inflight engine starts below 20,000 feet due to an EEC software error. An EEC software update, due early first quarter 2002, will correct the anomaly.

Operating Instructions

Monitor EGT when performing the Inflight Engine Start procedure to ensure EGT does not rise rapidly or exceed the start limit of 725°C during the start attempt.

Administrative Information

Insert this bulletin behind the Bulletin Record page in Volume 1 of your Flight Crew Operations Manual (FCOM). Amend the FCOM Bulletin Record page to show bulletin TBC-30 R1 "In Effect" (IE).

This bulletin will be canceled after Boeing is notified that all affected airplanes in your fleet have been modified by CFM 56-7B Service Bulletin 73-0082.

Please send all correspondence regarding Flight Crew Operations Manual Bulletin status, to the 737 Manager, Flight Technical Data, through the Service Requests Application (SR App) on the MyBoeingFleet home page.

Flight Crew Operations Manual Bulletin
for
The Boeing Company

The Boeing Company **Seattle, Washington 98124-2207** 737

Number: TBC-33 R1

IssueDate: November 1, 2002

Subject: Airworthiness Directive 2002-08-20, AMOC Letter 120S-02-907

Reason: This bulletin notifies flight crews of operational limitations and Non-Normal procedures associated with elevator control surface vibration (limit cycle oscillation) on the 737-600/-700/-700C/-800 and BBJ following deicing/anti-icing operations.

The purpose of this reissue is to provide flight crews with additional information from the Alternate Means of Compliance (AMOC) Letter 120S-02-907 which limits the restrictions to deicing/anti-icing with Type II or Type IV fluids.

Information in this bulletin is recommended by The Boeing Company, but may not be FAA approved at the time of writing. In the event of conflict with the FAA approved Airplane Flight Manual (AFM), the AFM shall supersede. The Boeing Company regards the information or procedures described herein as having a direct or indirect bearing on the safe operation of this model airplane.

THE FOLLOWING PROCEDURE AND/OR INFORMATION IS EFFECTIVE UPON RECEIPT

Background Information

Boeing has received reports of incidents of severe airframe vibration (limit cycle oscillation) on 737-600/-700/-800 airplanes after the horizontal stabilizer had been deiced/anti-iced with Type II or Type IV fluids. These events have been attributed to accumulation of deicing/anti-icing fluid or other residue inside the elevator balance bay and on the exterior surfaces of the elevator tab. The accumulation of fluid in the balance bays has been attributed to inadequate drainage provisions. A previous Operations Manual Bulletin provided recommendations to the flight crew to help reduce accumulation of fluid in the elevator balance bays by ensuring the stabilizer is trimmed to the full APL NOSE DOWN position prior to any deicing/anti-icing operations, in accordance with the B737 Adverse Weather Supplementary Procedures. Following application of Type II or Type IV deicing/anti-icing fluid, the control column should be cycled slowly full forward to full aft a minimum of three times to help drain residual fluid from the elevator balance bay.

Boeing believes these limit cycle oscillation (LCO) events can be attributed to a lack of sufficient elevator tab damping to prevent elevator tab vibration in certain flight conditions. An elevator tab LCO is characterized by a high frequency (approximately 40 Hz) resonant vibration. This vibration originates, and is strongest, in the aft part of the airplane, but can be felt in the entire structure. It may or may not be felt in the control wheel. If the flight deck door is open, the vibration can be heard coming from the back of the airplane. In addition, aft cabin personnel will notice a strong vibration.

Operational limitations as noted below will be required for the 737-600/-700/ -700C/-800 and BBJ airplanes following any deicing/anti-icing with Type II or Type IV fluids until stiffened elevator tabs are installed. The new elevator tabs can be distinguished from the original tabs by the six-hinge design.

Flight test of the new tabs was completed in April 2002 and was incorporated in production at line number 1175 in July 2002. Retrofit of in-service airplanes per Boeing Service Bulletin 737-55A1080 began in September 2002. Boeing anticipates this corrective action will provide sufficient damping to eliminate vibration.

Service Bulletin 737-55A1084 was released to improve draining of fluid from the elevator balance bay area and to help reduce fluid accumulation. Service Letter 737-SL-55-021 was released to provide instructions to periodically clean the external surface of the elevator tab. Service Letter 737-SL-12-017 provided cleaning instructions for the elevator balance bays.

The effects of airframe vibration can be cumulative and can affect the life of the airframe. After completion of a flight during which a suspected ice-related airframe vibration is encountered, the flight crew is encouraged to complete a vibration report. An example of a flight deck vibration event log can be found in 737-SL-02-002-D, dated July 3, 2001.

Operating Instructions

After any ground deicing/anti-icing of the horizontal stabilizer using Type II or Type IV fluids, airspeed must be limited to 270 KIAS for all follow-on flights until the applicable maintenance procedures have been accomplished. Mach limits are not affected. Once the applicable maintenance procedures have been accomplished, exceeding 270 KIAS is permissible until the next application of Type II or Type IV deicing/anti-icing fluids.

These speed restrictions are not applicable if the horizontal stabilizer was deiced only, using hot water, Type I deicing fluid, or a mixture of hot water and Type I fluid. These speed restrictions are also not applicable if the horizontal stabilizer was deiced using mechanical or infrared means.

The speed restrictions and maintenance requirements remain in effect until the new stiffened elevator tabs are installed.

If a limit cycle oscillation (LCO) is suspected in flight for any reason, immediately reduce airspeed to 270 KIAS, or until the vibration ceases, whichever indicated airspeed is lower. Do not use speedbrakes or change configuration to reduce airspeed. Remain at or below the indicated airspeed at which the vibration ceased for the remainder of the flight, but do not exceed 270 KIAS. Do not use speedbrakes for the remainder of the flight. Evaluate the need to land at the nearest practicable airport. Landing airport selection should be based on all pertinent factors such as weather, distance to destination, range available at the reduced airspeed, maximum landing weight and possible airframe damage. Ground spoilers may be used for landing.

In a situation requiring an Emergency Descent, the pilot in command may deviate from the 270 KIAS airspeed restriction and may use speedbrakes as required. If structural integrity is in doubt, limit speed as much as possible and avoid high maneuvering loads.

In the event a non-normal procedure must be performed that requires a higher airspeed (e.g., PACK/PACK TRIP OFF, etc.) the pilot in command may deviate from the 270 KIAS airspeed restriction as necessary to comply with the non-normal checklist.

Flight Crew Operations Manual Information

The following information will be included in the Limitations chapter of your Volume 1 in the next revision of the Operations Manual. This information will also be added to the Limitations chapter of the Airplane Flight Manual.

After ground deicing/anti-icing of the horizontal stabilizer using Type II or Type IV fluids, airspeed must be limited to 270 KIAS until the flight crew has been informed that applicable maintenance procedures have been accomplished that would allow exceedance of 270 KIAS. Once the applicable maintenance procedures have been accomplished, exceeding 270 KIAS is permissible until the next application of Type II or Type IV deicing/anti-icing fluids.

Administrative Information

Insert this bulletin behind the Bulletin Record page in Volume 1 of your Flight Crew Operations Manual (FCOM). Amend the FCOM Bulletin Record page to show bulletin TBC-33 R1 "In Effect" (IE).

This bulletin will be cancelled after Boeing is notified that all affected airplanes in your fleet have been modified by Service Bulletin 737-55A1080.

Please send all correspondence regarding Flight Crew Operations Manual Bulletin status, to the 737 Manager, Flight Technical Data, through the Service Requests Application (SR App) on the MyBoeingFleet home page.

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Flight Crew Operations Manual Bulletin
for
The Boeing Company

The Boeing Company
Seattle, Washington 98124-2207

737

Number: TBC-34

IssueDate: August 2, 2002

Subject: FMC MAP Display Blanking with FMC Update U10.3, U10.4 and U10.4A software

Reason: This bulletin notifies flight crews that FMC MAP display blanking has been experienced on 737 airplanes with FMC Update U10.3, U10.4 and U10.4A software installed.

Information in this bulletin is recommended by The Boeing Company, but may not be FAA approved at the time of writing. In the event of conflict with the FAA approved Airplane Flight Manual (AFM), the AFM shall supersede. The Boeing Company regards the information or procedures described herein as having a direct or indirect bearing on the safe operation of this model airplane.

THE FOLLOWING PROCEDURE AND/OR INFORMATION IS EFFECTIVE UPON RECEIPT

Background Information

Since January 2002, several operators with FMC U10.3, U10.4 and U10.4A software installed on their 737 airplanes have reported blanking of the FMC MAP display during approach at a limited number of airports. These MAP blanking events appear to occur without pilot action and are unrecoverable by manual switching.

There have also been reports of MAP RANGE DISAGREE and MAP FAIL anomalies induced when mode/range changes are made on the EFIS control panel during approach. These failures affect one or both MAP displays. The majority of these events have been recoverable.

The FMC U10.5 software upgrade scheduled for third quarter/early fourth quarter 2002 is expected to correct both of these anomalies.

Operating Instructions

Minimize MAP mode/range changes during approach with FMC Update U10.3, U10.4 or U10.4A software installed. If unrecoverable MAP display blanking occurs, use the other pilot's MAP display and/or conventional means of navigation and land as soon as practicable. After landing, have maintenance recycle power to the FMC.

Administrative Information

Insert this bulletin behind the Bulletin Record page in Volume 1 of your Flight Crew Operations Manual (FCOM). Amend the FCOM Bulletin Record page to show bulletin TBC-34 "In Effect" (IE).

This bulletin will be cancelled after Boeing is notified that all affected airplanes in your fleet have been updated to FMC Update U10.5 software.

Please send all correspondence regarding Flight Crew Operations Manual Bulletin status, to the 737 Manager, Flight Technical Data, through the Service Requests Application (SR App) on the MyBoeingFleet home page.

Flight Crew Operations Manual Bulletin
for
The Boeing Company

The Boeing Company
Seattle, Washington 98124-2207

737

Number: TBC-35 R1

IssueDate: July 14, 2004

Subject: Integrated Standby Flight Display (ISFD) Alignment Anomaly

Reason: To inform flight crews of an ISFD anomaly and provide corrective action.

The purpose of this reissue is to provide Service Bulletin information.

Information in this bulletin is recommended by The Boeing Company, but may not be FAA approved at the time of writing. In the event of conflict with the FAA approved Airplane Flight Manual (AFM), the AFM shall supersede. The Boeing Company regards the information or procedures described herein as having a direct or indirect bearing on the safe operation of this model airplane.

THE FOLLOWING PROCEDURE AND/OR INFORMATION IS EFFECTIVE UPON RECEIPT

Background Information

Boeing has received reports of incorrect attitude on the Integrated Standby Flight Display (ISFD). Subsequent investigation has found that improper alignment of the ISFD can cause attitude display anomalies. The display anomaly shows after takeoff as an obvious error in pitch and/or roll.

The Integrated Standby Flight Display (ISFD) performs a two-minute alignment immediately after the Battery switch has been positioned ON. Any change in airplane position during this alignment period may result in inaccurate attitude information not annunciated to the flight crew. The anomaly is not detectable by ISFD internal monitoring and may not show an obvious error in roll and/or pitch indications when compared to the pilots' primary flight instruments during preflight. Gust effects or movement of cabin occupants during the ISFD alignment period will not cause the anomaly.

Re-alignment can only be accomplished by cycling electrical power to the ISFD while the airplane is on the ground. This can be accomplished by removing all airplane electrical power or by an approved maintenance procedure.

The RST switch on the ISFD does not correct for inaccuracies introduced by airplane movement during the alignment process. It should only be pushed in response to the ATT:RST amber message.

Operating Instructions

An airplane Flight Manual (AFM) Limitation will be published that states:

INTEGRATED STANDBY FLIGHT DISPLAY (IF INSTALLED)

The Flight Crew must verify the airplane was not moved during Integrated Standby Flight Display alignment. If unable to verify, then the power up alignment process must be reinitialized and completed prior to flight."

To comply with the AFM limitation, the airline must have procedures in place to assure flight crews on the first flight of the day, crew change, or after any complete airplane power down, that ISFD alignment was completed before the airplane was moved.

The following note will be added to the Flight Deck Safety Inspection – Captain or First Officer normal procedure:

Battery Switch .... ON

Guard – Down

Note: Do not move the airplane until ISFD alignment is complete.

The following will be included in the Flight Deck Preparation – Captain normal procedure:

Integrated Standby Flight Display ....Check

Approach Mode Display – Blank

Set local altimeter setting

Verify flight instrument indications are correct

Verify no flags or messages are displayed.

Administrative Information

Insert this bulletin behind the Bulletin Record page in Volume 1 of your Flight Crew Operations Manual (FCOM). Amend the FCOM Bulletin Record page to show bulletin TBC-35 R1 "In Effect" (IE).

This bulletin will be canceled after Boeing is notified that all affected airplanes in your fleet have been modified by Service Bulletin 737-34-1720.

Please send all correspondence regarding Flight Crew Operations Manual Bulletin status, to the 737 Manager, Flight Technical Data, through the Service Requests Application (SR App) on the MyBoeingFleet home page.

Flight Crew Operations Manual Bulletin
for
The Boeing Company

The Boeing Company
Seattle, Washington 98124-2207

737

Number: TBC-37

IssueDate: September 16, 2002

Subject: AD-2002-19-51, Flight Control Modules

Reason: This bulletin informs flight crews of the potential for failure of a flight control module. This bulletin also provides operating instructions for flight crews.

Information in this bulletin is recommended by The Boeing Company, but may not be FAA approved at the time of writing. In the event of conflict with the FAA approved Airplane Flight Manual (AFM), the AFM shall supersede. The Boeing Company regards the information or procedures described herein as having a direct or indirect bearing on the safe operation of this model airplane.

THE FOLLOWING PROCEDURE AND/OR INFORMATION IS EFFECTIVE UPON RECEIPT

Background Information

Flight control module failures have been reported on 737-600/-700/-700C/-800/-900/BBJ airplanes since June 2002. The majority of the failures have occurred during preflight checks prior to delivery acceptance test flights, but failures have also been reported on four in-service airplanes. Discussions with the supplier indicate the potential for this condition is most likely isolated to Flight Control Module Part Number 65-44891-7, Serial Numbers 8726 through 8936, installed on airplanes delivered after May 21, 2002. The FAA has issued Emergency Telegraphic AD 2002-19-51 to address required operator action.

There are two identical flight control modules on each airplane. Each module controls hydraulic fluid distribution from its respective hydraulic system to the aileron, elevator and rudder. The failure mode is a partial or complete blockage in the return passage of the module resulting in inadequate differential pressure available to flight control power control actuators (ailerons, elevators, rudder). Failure of one flight control module in flight may result in an increase in flight control forces. Failure of a second flight control module could result in serious degradation of airplane controllability, including high control forces.

Because the blockage is in the return passage, the associated Flight Control LOW PRESSURE Light remains extinguished for the affected flight control module. The Hydraulic LOW PRESSURE Light also remains extinguished. The most likely flight deck indication is failure of both Autopilot A and B to engage. Other indications include possible increase in flight control forces (similar to manual reversion) and possible yaw damper disengagement.

Airplanes with two suspect modules are not to be flown until at least one non-suspect module has been installed.

In order to help identify a flight control module failure prior to flight, Boeing has developed Flight Control and Autopilot preflight checks to be performed on airplanes with a suspect flight control module installed. These checks can be performed anytime after the Electric Hydraulic Pump A and B Switches are positioned ON and prior to Engine Start. If MEL dispatch with one or both autopilot channels inoperative is planned, it is acceptable not to perform the Autopilot check on the inoperative channel(s).

If it is determined that a flight control module has failed, subsequent flights must not be made until the failed module has been removed and replaced.

Operating Instructions

Preflight Check:

The following Flight Control and Autopilot checks must be performed prior to each flight on an airplane with a suspect flight control module installed. These checks can be performed anytime after the Electric Hydraulic Pump A and B Switches are positioned ON and prior to Engine Start. Ensure ground personnel are clear of all control surfaces.

Note: These checks are only designed to detect a failed flight control module.

Flight Control Check

1. Ensure FLT CONTROL A & B Switches are ON
2. FLT CONTROL A Switch . . . . OFF
   - Verify Flight Control LOW PRESSURE Light illuminates within 2 seconds
3. FLT CONTROL A Switch . . . . ON
   - Verify Flight Control LOW PRESSURE Light extinguishes
4. FLT CONTROL B Switch . . . . OFF
   - Verify Flight Control LOW PRESSURE Light illuminates within 2 seconds
5. FLT CONTROL B Switch . . . . ON

Autopilot Check

If MEL dispatch with one or both autopilot channels inoperative is planned, it is acceptable not to perform the Autopilot check on the inoperative channel(s).

1. Ensure both IRUs are in the NAV Mode
2. A/P ENGAGE Switch . . . . CMD A
   • Wait 10 seconds and verify autopilot CMD mode engages
3. Disengage Autopilot A
4. A/P ENGAGE Switch . . . . CMD B
   • Wait 10 seconds and verify autopilot CMD mode engages
5. Disengage Autopilot B
6. To fail this test, one autopilot will fail to engage and the other will fail to remain engaged

Note: Failure of the autopilots to engage as described in Step 6 may indicate a failure of a flight control module.

Note: If either Flight Control Module Preflight Check fails, do not takeoff until the failed module has been replaced.

In-flight Failure

Failure of both Autopilot A and B to engage may indicate a failure of the module in flight. Other indications include possible increase in flight control forces (similar to manual reversion) and possible yaw damper disengagement.

Failure of a second flight control module in flight could result in serious degradation of airplane controllability, including high control forces. If a failure is suspected in flight:

- Plan to land at the nearest suitable airport
- Crosswind capability may be reduced
- Do not turn off any Flight Control Switches
- Plan a flaps 15 landing
- Use VREF 15 + 5 or VREF ICE + 5
- Place the GROUND PROXIMITY FLAP INHIBIT Switch to FLAP INHIBIT

Administrative Information

Insert this bulletin behind the Bulletin Record page in Volume 1 of your Flight Crew Operations Manual (FCOM). Amend the FCOM Bulletin Record page to show bulletin TBC-37 "In Effect" (IE).

This bulletin will be cancelled after Boeing has been notified that no suspect flight control modules are installed in any airplanes in your fleet.

Please send all correspondence regarding Flight Crew Operations Manual Bulletin status, to the 737 Manager, Flight Technical Data, through the Service Requests Application (SR App) on the MyBoeingFleet home page.

Flight Crew Operations Manual Bulletin
for
The Boeing Company

The Boeing Company
Seattle, Washington 98124-2207

737

Number: TBC-38 R1

IssueDate: November 1, 2004

Subject: Flight Director and Autopilot Mode Entry Failures

Reason: This bulletin informs flight crews of flight director and autopilot anomalies that may be seen on airplanes equipped with the Collins Enhanced Digital Flight Control System (EDFCS).

The purpose of this reissue is to provide Service Bulletin information.

Information in this bulletin is recommended by The Boeing Company, but may not be FAA approved at the time of writing. In the event of conflict with the FAA approved Airplane Flight Manual (AFM), the AFM shall supersede. The Boeing Company regards the information or procedures described herein as having a direct or indirect bearing on the safe operation of this model airplane.

THE FOLLOWING PROCEDURE AND/OR INFORMATION IS EFFECTIVE UPON RECEIPT

Background Information

Boeing has received reports of failure of the flight director (F/D) to enter takeoff mode and failure of the autopilot and flight director to enter pitch cruise modes on airplanes equipped with the Collins Enhanced Digital Flight Control System (EDFCS).

In certain scenarios, an error in the Collins FCC software may leave the glide slope engage logic set internally in either FCC without a corresponding G/S flight mode annunciation (FMA) on that side. This will cause the F/D takeoff mode and some autopilot or F/D pitch cruise modes to be inhibited.

This condition may also occur when an autopilot or F/D approach is discontinued using means other than autopilot or F/D go-around.

This anomaly will be corrected in a future FCC software upgrade.

Operating Instructions

Prior to takeoff, turn both flight director (F/D) switches OFF. Cycle F/D A ON then OFF. Cycle F/D B ON then OFF. At the completion of these steps, resume normal AFDS operations. This procedure should be accomplished whether the F/Ds are used for takeoff or not.

If an ILS approach is exited after G/S capture by means other than using the TO/GA switch, turn the autopilot and both F/D switches OFF. Cycle F/D A ON then OFF. Cycle F/D B ON then OFF. At the completion of these steps, resume normal AFDS operations.

Administrative Information

Insert this bulletin behind the Bulletin Record page in Volume 1 of your Flight Crew Operations Manual (FCOM). Amend the FCOM Bulletin Record page to show bulletin TBC-38 R1 "In Effect" (IE).

This bulletin will be canceled after Boeing is notified that all affected airplanes in your fleet have been modified by Service Bulletin 737-22A1164. If you do not plan to modify all your airplanes and would like to have the contents of this bulletin incorporated in your FCOM, please advise Boeing accordingly.

Please send all correspondence regarding Flight Crew Operations Manual Bulletin status, to the 737 Manager, Flight Technical Data, through the Service Requests Application (SR App) on the MyBoeingFleet home page.

Flight Crew Operations Manual Bulletin
for
The Boeing Company

The Boeing Company
Seattle, Washington 98124-2207

737

Number: TBC-39 R1

IssueDate: November 1, 2004

Subject: Autopilot Altitude Acquire/Altitude Capture Anomaly

Reason: This bulletin informs flight crews of an anomaly reported in the Collins Enhanced Digital Flight Control System (EDFCS).

The purpose of this reissue is to provide Service Bulletin information.

Information in this bulletin is recommended by The Boeing Company, but may not be FAA approved at the time of writing. In the event of conflict with the FAA approved Airplane Flight Manual (AFM), the AFM shall supersede. The Boeing Company regards the information or procedures described herein as having a direct or indirect bearing on the safe operation of this model airplane.

THE FOLLOWING PROCEDURE AND/OR INFORMATION IS EFFECTIVE UPON RECEIPT

Background Information

Boeing has received a report of excessive pitch up and speed loss on an airplane equipped with the Collins Enhanced Digital Flight Control System (EDFCS) after selection of a new MCP altitude during an autopilot Altitude Acquire (ALT ACQ) maneuver.

Normally, if a new altitude is selected while in ALT ACQ, the Flight Control Computer (FCC) will automatically transition to vertical speed (V/S), synchronizing to the existing airplane vertical speed. If the selection is made after transition to Altitude Hold (ALT HLD), the FCC will remain in ALT HLD at the previously selected altitude.

It has been determined that if a new altitude selection is made when the FCC is in the final transition between ALT ACQ and ALT HLD (within a 200 msec window), an altitude somewhere between the previously selected MCP altitude and the new MCP altitude will be stored as the reference ALT HLD altitude. The FCC will command a pitch maneuver in the direction of this new altitude. This new pitch command may be excessive and if the autopilot is engaged, may require flight crew intervention to return the airplane to a normal flight path.

This anomaly will be corrected in a future FCC software upgrade.

Operating Instructions

If the MCP altitude is adjusted during ALT ACQ or when ALT HLD is first displayed, monitor autopilot and flight director commands. The autopilot or flight director should transition to V/S or continue to level in ALT HLD at the previously selected altitude. If autopilot or flight director pitch commands are excessive, ensure proper flight path control and select a new pitch mode if required.

Administrative Information

Insert this bulletin behind the Bulletin Record page in Volume 1 of your Flight Crew Operations Manual (FCOM). Amend the FCOM Bulletin Record page to show bulletin TBC-39 R1 "In Effect" (IE).

This bulletin will be canceled after Boeing is notified that all affected airplanes in your fleet have been modified by Service Bulletin 737-22A1164. If you do not plan to modify all your airplanes and would like to have the contents of this bulletin incorporated in your FCOM, please advise Boeing accordingly.

Please send all correspondence regarding Flight Crew Operations Manual Bulletin status, to the 737 Manager, Flight Technical Data, through the Service Requests Application (SR App) on the MyBoeingFleet home page.

Flight Crew Operations Manual Bulletin
for
The Boeing Company

The Boeing Company
Seattle, Washington 98124-2207

737

Number: TBC-41 R1

IssueDate: November 1, 2004

Subject: Target Speed Anomaly with Flaps Extended and VNAV Engaged

Reason: This bulletin informs flight crews of target speed anomalies on airplanes equipped with the Collins Enhanced Digital Flight Control System (EDFCS) when flaps are extended and operating in VNAV.

The purpose of this reissue is to provide Service Bulletin information.

Information in this bulletin is recommended by The Boeing Company, but may not be FAA approved at the time of writing. In the event of conflict with the FAA approved Airplane Flight Manual (AFM), the AFM shall supersede. The Boeing Company regards the information or procedures described herein as having a direct or indirect bearing on the safe operation of this model airplane.

THE FOLLOWING PROCEDURE AND/OR INFORMATION IS EFFECTIVE UPON RECEIPT

Background Information

Boeing has received reports of target speed anomalies with flaps extended when operating in VNAV during approach. The anomaly may occur at any flap setting from Flaps 2 to Flaps 40, but the discrepancy is most likely to occur at Flaps 15 due to system tolerances.

The Flight Management Computer (FMC) uses flap position data as output by the Flight Control Computer (FCC). Due to an implementation error in the Collins Enhanced Digital Flight Controls System (EDFCS), the FCC sends uncorrected flap position data rather than adjusted data. The FMC switches to the next higher flap setting when it receives a signal that the flap position has increased more than 0.5 degrees above the selected flap detent. With the flap handle at Flaps 15, the uncorrected flap position data may be as high as 19.5 degrees depending on airplane installation and tolerances. Similar differences between uncorrected and adjusted data exist for other flap settings, but the system tolerances are much smaller. As a result, the anomaly is less likely to occur at flap settings other than Flaps 15.

When Flaps 15 is selected, the target speed initially indicates the correct airspeed for the flap setting as the flaps transition from 10.5 to 15 degrees. If the tolerances at this flap setting result in an uncorrected output greater than 15.5 degrees, the target speed (magenta bug) may reduce to a speed consistent with Flaps 25 and the autothrottles will adjust to capture this lower speed. This results in the aircraft slowing to near minimum maneuver speed for Flaps 15.

When flying a VNAV approach on airplanes equipped with speed intervention (SPD INTV), the flight crew should select SPD INTV prior to the initial flap selection and manually set the correct flap speed on the MCP. The autothrottles will adjust to capture the MCP speed. SPD INTV should be used for the duration of the approach.

On airplanes without speed intervention, VNAV must be disengaged and the approach flown in another mode if the anomaly is observed. When landing flaps are selected, VNAV may be re-engaged.

On airplanes equipped with the Head-Up Display (HUD), the AOA approach band may not be correctly displayed with Flaps 15 selected. When Flaps 30 or 40 have been selected, the AOA approach band will be correctly displayed on the HUD.

This anomaly will be corrected in a future FCC software upgrade targeted for early 2004.

Operating Instructions

When flying VNAV approaches on airplanes equipped with speed intervention (SPD INTV), select SPD INTV prior to the initial flap selection and manually select the correct speed on the MCP. Remain in SPD INTV for the duration of the approach.

On airplanes without speed intervention, disengage VNAV and fly the approach in another mode if the anomaly is observed. When landing flaps are selected, VNAV may be re-engaged.

On airplanes equipped with HUD, if the AOA approach band is not correctly displayed at Flaps 15, do not use this information.

Administrative Information

Insert this bulletin behind the Bulletin Record page in Volume 1 of your Flight Crew Operations Manual (FCOM). Amend the FCOM Bulletin Record page to show bulletin TBC-41 R1 "In Effect" (IE).

This bulletin will be canceled after Boeing is notified that all affected airplanes in your fleet have been modified by Service Bulletin 737-22A1164. If you do not plan to modify all your airplanes and would like to have the contents of this bulletin incorporated in your FCOM, please advise Boeing accordingly.

Please send all correspondence regarding Flight Crew Operations Manual Bulletin status, to the 737 Manager, Flight Technical Data, through the Service Requests Application (SR App) on the MyBoeingFleet home page.

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Flight Crew Operations Manual Bulletin
for
The Boeing Company

The Boeing Company
Seattle, Washington 98124-2207

737

Number: TBC-42 R2

IssueDate: November 1, 2004

Subject: FMC Navigation Anomaly

Reason: This bulletin informs flight crews of an FMC navigation anomaly on airplanes equipped with dual FMCs and FMC Updates U10.3, U10.4, U10.4a or U10.5.

The purpose of this reissue is to provide Service Bulletin information.

Information in this bulletin is recommended by The Boeing Company, but may not be FAA approved at the time of writing. In the event of conflict with the FAA approved Airplane Flight Manual (AFM), the AFM shall supersede. The Boeing Company regards the information or procedures described herein as having a direct or indirect bearing on the safe operation of this model airplane.

THE FOLLOWING PROCEDURE AND/OR INFORMATION IS EFFECTIVE UPON RECEIPT

Background Information

Boeing has received reports of FMC map shifts on 737-400 airplanes equipped with dual FMCs and FMC Update U10.4a. The root cause of the problem has not been determined, but Boeing and Smiths Industries believe the anomaly may be possible on all 737 airplanes with dual FMCs and FMC Updates U10.3, U10.4, U10.4a or U10.5. The problem can occur on both GPS and non-GPS equipped airplanes.

Each of the reported map shifts was accompanied by a “VERIFY POSITION” alert message and a displayed ACTUAL navigation performance value that was less than the RNP value. In these events, the “VERIFY POSITION” message indicated an actual FMC position error.

The “VERIFY POSITION” message is triggered by differences in FMC and/or sensor positions and RNP. The “UNABLE REQD NAV PERF - RNP” message is generated when ACTUAL navigation performance does not satisfy the RNP criteria. POS SHIFT page 3/3 provides the relative FMC, GPS (if installed), IRS and RADIO positions, as well as RNP and ACTUAL navigation performance.

For at least one of the reported events, map shifts occurred on both displays due to the FMC position aligning with the average IRS position. Each FMC's internal position then reverted to its onside IRS position. When the FMC positions exceeded the RNP criteria, the “VERIFY POSITION” message was triggered.

The ACTUAL navigation performance computation did not reflect the FMC reversion to inertial only operation. Since the computed ACTUAL navigation performance was based on the available, but unused, radio and GPS position data, it was less than the RNP, and the “UNABLE REQD NAV PERF - RNP” message was not displayed.

If the FMC Source Select Switch is positioned to BOTH ON L or BOTH ON R (i.e., equivalent to single FMC operation), the FMC position is updated from available onside sensors with the correct ACTUAL navigation performance. The “VERIFY POSITION” message will then clear if the resulting FMC position is within the RNP. With the anomaly present, the problem will recur when the FMCs are switched back to NORMAL (dual FMC operation) and the “VERIFY POSITION” message will again be displayed.

Whenever flight crews encounter a “VERIFY POSITION” message, the message should not be manually cleared from the FMC scratchpad. If the message appeared shortly after manually entering an approach RNP of 0.2 NM or less while in cruise, or during descent above 15,000 feet, the message may be due to delays in sensor updating rather than an FMC navigation anomaly. If there is no FMC anomaly, the message will self-clear after the airplane is slowed below approximately 250 knots.

However, an anomaly is indicated if the “VERIFY POSITION” message is displayed during either of the following conditions:

- within 60 seconds after descending through 15,000 feet (terminal navigation environment, default RNP = 1.0 NM), or
- within 10 seconds after passing within two NM of the initial approach fix (approach navigation environment, default RNP = 0.5 NM or with the NPS option, default RNP = 0.3 NM).

In the event of an FMC navigation anomaly, RNAV (RNP) operations should not be conducted while the “VERIFY POSITION” message is displayed. The FMC Source Select Switch should be positioned to BOTH ON L or BOTH ON R to cause the FMC to return to updating from available onside sensors. The FMC Source Select Switch should remain in the selected position for the remainder of the flight to prevent the anomaly from recurring.

After landing, a long-term power interrupt of 15 seconds or longer will be necessary to at least one FMC to clear the anomalies. This can be accomplished by removing all airplane electrical power or by an approved maintenance procedure.

This problem remains under investigation. Boeing and Smiths Industries are evaluating the need for an intermediate FMC Update (U10.5a) that would be targeted for second quarter 2004.

Operating Instructions

If the “VERIFY POSITION” message appears, do not clear the message from the FMC scratchpad. Do not conduct RNAV (RNP) operations while the message is displayed.

If the “VERIFY POSITION” message appears shortly after manually entering an approach RNP of 0.2 NM or less while in cruise or during descent above 15,000 feet, slow the airplane to 250 knots or less. If the message is due to delays in sensor updating the message will self-clear.

If the “VERIFY POSITION” message is displayed when descending through 15,000 feet, or after passing within two NM of the initial approach fix, position the FMC Source Select Switch to BOTH ON L or BOTH ON R for the remainder of the flight.

After landing, a long-term power interrupt (15 seconds or longer) must be performed on at least one FMC to clear the anomalies.

Administrative Information

Insert this bulletin behind the Bulletin Record page in Volume 1 of your Flight Crew Operations Manual (FCOM). Amend the FCOM Bulletin Record page to show bulletin TBC-42 R2 "In Effect" (IE).

This bulletin will be canceled after Boeing is notified that all affected airplanes in your fleet have been modified by Service Bulletin 737-34A1801. If you do not plan to modify all your airplanes and would like to have the contents of this bulletin incorporated in your FCOM, please advise Boeing accordingly.

Please send all correspondence regarding Flight Crew Operations Manual Bulletin status, to the 737 Manager, Flight Technical Data, through the Service Requests Application (SR App) on the MyBoeingFleet home page.

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Flight Crew Operations Manual Bulletin
for
The Boeing Company

The Boeing Company
Seattle, Washington 98124-2207

737

Number: TBC-44 R1

IssueDate: October 21, 2005

Subject: Flight Director Anomaly

Reason: This bulletin informs flight crews of a Flight Director anomaly during Flight Director Takeoffs on airplanes equipped with the Collins Enhanced Digital Flight Control System (EDFCS).

The purpose of this reissue is to provide Service Letter information.

Information in this bulletin is recommended by The Boeing Company, but may not be FAA approved at the time of writing. In the event of conflict with the FAA approved Airplane Flight Manual (AFM), the AFM shall supersede. The Boeing Company regards the information or procedures described herein as having a direct or indirect bearing on the safe operation of this model airplane.

THE FOLLOWING PROCEDURE AND/OR INFORMATION IS EFFECTIVE UPON RECEIPT

Background Information

Boeing has discovered a flight director anomaly on airplanes equipped with the Collins Enhanced Digital Flight Control System (EDFCS). The anomaly may occur if the TO/GA switch is pressed a second time after liftoff while the flight director is already in takeoff mode. This anomaly only occurs during a flight director takeoff. Go-around mode is not affected, nor is operation with the autopilot engaged.

If LNAV has been selected prior to takeoff and a TO/GA switch has been pushed, pushing a TO/GA switch a second time after liftoff results in loss of flight director roll guidance and roll mode annunciation. Flight director roll guidance will be removed from view on those airplanes equipped with the split axis flight director and both pitch and roll flight director guidance will be removed from view on those airplanes equipped with the integrated cue flight director. This anomaly will occur any time the airplane is in takeoff mode, regardless of altitude. LNAV or another roll mode can be re-selected at any time above 400 feet AGL and the correct flight director information will be displayed.

In addition, on those airplanes with the Heading Select-on-Takeoff option, pushing a TO/GA switch a second time while in Takeoff Heading Select mode above 400 feet AGL, will also result in loss of flight director roll guidance and roll mode annunciation. The flight director bar(s) will be removed from view. The correct flight director information will be displayed after re-selecting a roll mode.

This anomaly is present on all airplanes equipped with the Collins EDFCS, regardless of software load (i.e., P1.1 or P2.0). It will be corrected in a future FCC software upgrade targeted for first quarter 2005.

Operating Instructions

If roll mode annunciation and flight director guidance (roll, or pitch and roll) is lost following a second push of a TO/GA switch, reselect the appropriate roll mode when above 400 feet AGL.

Administrative Information

Insert this bulletin behind the Bulletin Record page in Volume 1 of your Flight Crew Operations Manual (FCOM). Amend the FCOM Bulletin Record page to show bulletin TBC-44 R1 "In Effect" (IE).

This bulletin will be canceled after Boeing is notified that all affected airplanes in your fleet have been modified by Service Letter 737-SL-22-056-B.

Please send all correspondence regarding Flight Crew Operations Manual Bulletin status, to the 737 Manager, Flight Technical Data, through the Service Requests Application (SR App) on the MyBoeingFleet home page.

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Flight Crew Operations Manual Bulletin
for
The Boeing Company

The Boeing Company
Seattle, Washington 98124-2207

737

Number: TBC-45 R4

IssueDate: December 7, 2023

Subject: Predictive Windshear System Anomaly

Reason: This bulletin informs flight crews of the susceptibility of certain airports to false Predictive Windshear System (PWS) alerts.

This bulletin is being revised to update the list of affected airport/runway combinations.

Information in this bulletin is recommended by The Boeing Company, but may not be FAA approved at the time of writing. In the event of conflict with the FAA approved Airplane Flight Manual (AFM), the AFM shall supersede. The Boeing Company regards the information or procedures described herein as having a direct or indirect bearing on the safe operation of this model airplane.

THE FOLLOWING PROCEDURE AND/OR INFORMATION IS EFFECTIVE UPON RECEIPT

Background Information

Airlines have reported false Predictive Windshear System (PWS) alerts at a number of airports. The anomaly is only applicable to PWS alerts; all reactive windshear alerts which occur are valid. These false alerts are limited to airplanes equipped with the Honeywell weather radar with the following PWS weather radar processor part numbers:

- 066-50008-0406 (All listed airports)
- 066-50008-0408 (All listed airports)
- 930-1000-001 (SBRJ airport only)
- 930-1000-002 (SBRJ airport only)
- 930-1000-003 (SBRJ airport only)

Honeywell has reviewed data provided by the affected airlines and has attempted to determine if particular airports and runways may be susceptible to “false alerts”. In addition, data have been analyzed to determine if the alerts are more likely during takeoff or on approach.

Honeywell has accumulated sufficient data to suggest that the following airport/runway combinations are susceptible to false PWS alerts:

- EHAM (Amsterdam), Runway 9, Takeoff
- GCRR (Lanzerote), Runway 3, Approach
- KBOS (Boston), Runway 27, Approach
- KOAK (Oakland), Runway 29, Approach
- KPHL (Philadelphia), Runway 35, Approach
- KSNA (John Wayne Orange County), Runway 19R, Approach
- KSTL (St. Louis), Runway 12 (L and R), Approach
- LEBL (Barcelona), Runway 25, Approach
- LFMN (Nice), Runway 4L, Approach
- LGSR (Santorini), Runway 34R, Approach
- LGTS (Thessaloniki), Runway 10, Approach
- RJTT (Tokyo, Haneda), Runways 16 and 22, Approach
- RKPK (Busan, Gimhae), Runways 36L and 36R, Takeoff
- RKSI (Seoul, Incheon), Runway 33R, Approach
- SBRJ (Rio de Janeiro), Runway 20L, Approach

Although these particular airports appear to be more susceptible to false alerts, the data indicates the majority of operations at these airports do not experience false PWS alerts.

Flight crews should use the following criteria to help determine if windshear exists:

- reports of windshear from other aircraft
- visual indications
- tower windshear alerts
- differences between computed winds in the airplane and reported winds from the tower.

Honeywell has developed software modifications that should significantly reduce the occurrences of false PWS alerts. These modifications also include numerous other changes and enhancements. Service Letters 737-SL-34-188 and 737-SL-34-189 provide additional information about these changes.

As Honeywell continues to develop a software solution and to process data, operators are encouraged to continue reporting incidents to Honeywell and Boeing in order to provide the most effective solution possible to this anomaly.

Operating Instructions

If windshear is encountered, perform the Windshear Escape Maneuver.

It is recommended operators establish policies for flight crews operating into one of the suspect airport/runway combinations in the event a PWS alert occurs. The following windshear criteria may be beneficial in establishing policies:

- reports of windshear from other aircraft
- visual indications
- tower windshear alerts
- differences between computed winds in the airplane and reported winds from the tower.

Administrative Information

This bulletin replaces bulletin TBC-45 R3 , dated May 17, 2021. Revise the Bulletin Record Page to show bulletin TBC-45 R3 as “CANCELLED” (CANC).

Insert this bulletin behind the Bulletin Record page in Volume 1 of your Flight Crew Operations Manual (FCOM). Amend the FCOM Bulletin Record page to show bulletin TBC-45 R4 "In Effect" (IE).

Please send all correspondence regarding Flight Crew Operations Manual Bulletin status, to the 737 Manager, Flight Technical Data, through the Service Requests Application (SR App) on the MyBoeingFleet home page.

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Flight Crew Operations Manual Bulletin
for
The Boeing Company

The Boeing Company
Seattle, Washington 98124-2207

737

Number: TBC-46 R1

IssueDate: November 1, 2004

Subject: FMC Arc Leg Sequencing Anomaly

Reason: This bulletin informs flight crews of a problem reported in the U10 series FMC.

The purpose of this reissue is to provide Service Bulletin information.

Information in this bulletin is recommended by The Boeing Company, but may not be FAA approved at the time of writing. In the event of conflict with the FAA approved Airplane Flight Manual (AFM), the AFM shall supersede. The Boeing Company regards the information or procedures described herein as having a direct or indirect bearing on the safe operation of this model airplane.

THE FOLLOWING PROCEDURE AND/OR INFORMATION IS EFFECTIVE UPON RECEIPT

Background Information

Boeing has recently discovered a FMC U10 Series problem associated with sequencing waypoints with either DME Arcs to a Fix (AF legs) or Constant Radius to a Fix (RF legs). This problem only can occur if two sequential AF legs are in the route whereas this problem may occur with only one RF leg in the route.

An AF leg or RF leg is used to create an arcing route between waypoints. On the LEGS page, arc legs are identified by title containing the arc distance in nautical miles (7.3) followed by the letter L (left) or R (right), for example 7.3 L or 10.4 R. Examples of sequential DME arcs can be found on Jeppesen charts for KYKM, Yakima Washington USA, 13-1, VOR DME or GPS Rwy 27; MGGT, Guatemala, 11-3, ILS DME Arc Rwy 01; EGBB, Birmingham, UK, 11-1, ILS DME Rwy 15. The recommended method of identifying routes with DME arcs is to use the published charts as well as the FMC LEGS page.

RF legs are only used by a few operators who have tailored navigation databases associated with very low RNP operations.

If this problem occurs, the FMC does not properly sequence the waypoint at the termination of the arc and continues to provide lateral guidance commands to continue flying the arc radius. The route shown on the HSI map is not changed and appears normal but the airplane will begin deviating from the magenta flight path since lateral guidance continues to follow the arc radius. Lab testing indicates that during this condition, LNAV will remain engaged. If Navigation Performance Scales (NPS) are installed, they provide an erroneous display of flight technical error because lateral deviation is based on continuing to follow the arc rather than the displayed magenta path. This problem has been reported during a non-revenue flight test and during flight simulator testing. Boeing is not aware of any in-service reports of this problem.

A remedy for this problem is planned to be incorporated in the next FMC software update, U10.5A. As a result, we plan to delay the previously scheduled certification date of U10.5A from May 2004 to approximately June 2004.

Operating Instructions

Boeing recommends that in either IMC or VMC conditions, flight crews monitor routes with DME arcs (AF legs) to insure the airplane follows the published route. Until a remedy has been incorporated, we recommend flight crews not use Constant Radius Arcs (RF legs) unless in VMC.

Administrative Information

Insert this bulletin behind the Bulletin Record page in Volume 1 of your Flight Crew Operations Manual (FCOM). Amend the FCOM Bulletin Record page to show bulletin TBC-46 R1 "In Effect" (IE).

This bulletin will be canceled after Boeing is notified that all affected airplanes in your fleet have been modified by Service Bulletin 737-34A1801 which installs FMC Update U10.5A or when Boeing is notified that a later software version has been installed.

Please send all correspondence regarding Flight Crew Operations Manual Bulletin status, to the 737 Manager, Flight Technical Data, through the Service Requests Application (SR App) on the MyBoeingFleet home page.

Flight Crew Operations Manual Bulletin
for
The Boeing Company

The Boeing Company
Seattle, Washington 98124-2207

737

Number: TBC-47

IssueDate: May 24, 2004

Subject: Lack of "GLIDESLOPE" Alert During Approach

Reason: This bulletin informs flight crews the “GLIDESLOPE” alert will not sound if the airplane deviates below the glideslope or glide path in certain conditions.

Information in this bulletin is recommended by The Boeing Company, but may not be FAA approved at the time of writing. In the event of conflict with the FAA approved Airplane Flight Manual (AFM), the AFM shall supersede. The Boeing Company regards the information or procedures described herein as having a direct or indirect bearing on the safe operation of this model airplane.

THE FOLLOWING PROCEDURE AND/OR INFORMATION IS EFFECTIVE UPON RECEIPT

Background Information

Boeing has discovered the Mode 5 “GLIDESLOPE” alert will not sound on airplanes equipped with the Integrated Approach Navigation (IAN) option or the GPS Landing System (GLS) option in certain approach conditions.

Normally, the alert will sound if a glideslope or glide path capable approach is selected, the airplane is established on the glideslope or glide path below 1000 feet radio altitude, and the airplane then deviates more than 1.3 dots below the vertical path. The Enhanced Ground Proximity Warning System (EGPWS) monitors deviation data from both Multi-Mode Receivers (MMR) or Flight Management Computers (FMC).

Due to an implementation error, the EGPWS on airplanes with IAN or GLS monitors deviation data from the left MMR or left FMC only. If the right VHF navigation radio is appropriately tuned for the approach but the left VHF navigation radio is not tuned for the approach, the “GLIDESLOPE” alert will not sound if the airplane deviates below the glideslope or glide path. This anomaly will be corrected in a future software upgrade.

Operating Instructions

During an approach that uses a ground based navigation radio signal for either or both vertical guidance (G/S) or lateral guidance (VOR/LOC or BCRS), ensure the left VHF navigation radio is tuned appropriately for the approach being flown and the approach information is shown on the captain's display.

Affected flight modes are:

- ILS - VOR/LOC and G/S
- ILS with G/S selected OFF, LOC, LDA or SDF - VOR/LOC and G/P
- Localizer back course - BCRS and G/P
- GLS - VOR/LOC and G/S

Administrative Information

Insert this bulletin behind the Bulletin Record page in Volume 1 of your Flight Crew Operations Manual (FCOM). Amend the FCOM Bulletin Record page to show bulletin TBC-47 "In Effect" (IE).

This FCOM bulletin will be revised to include Service Bulletin information when available.

Please send all correspondence regarding Flight Crew Operations Manual Bulletin status, to the 737 Manager, Flight Technical Data, through the Service Requests Application (SR App) on the MyBoeingFleet home page.

Flight Crew Operations Manual Bulletin
for
The Boeing Company

The Boeing Company
Seattle, Washington 98124-2207

737

Number: TBC-48 R1

IssueDate: April 3, 2007

Subject: Center Tank Fuel System Changes

Reason: This bulletin provides information about center tank fuel system changes for 737-600/-700/-800/-900 airplanes.

The purpose of this revision is to provide visibility for the fuel usage procedures contained in the Flight Crew Operations Manual (FCOM) Normal Procedures.

Information in this bulletin is recommended by The Boeing Company, but may not be FAA approved at the time of writing. In the event of conflict with the FAA approved Airplane Flight Manual (AFM), the AFM shall supersede. The Boeing Company regards the information or procedures described herein as having a direct or indirect bearing on the safe operation of this model airplane.

THE FOLLOWING PROCEDURE AND/OR INFORMATION IS EFFECTIVE UPON RECEIPT

Background Information

Boeing introduced center tank fuel system changes in production, at Production Line Number 1494 and on, with deliveries starting in May 2004. These revisions included a Master Caution system logic change, center tank fuel pump auto shutoff and CONFIG alert logic change. These system updates were made available for post-production retrofit via Boeing Service Bulletin 737-28A1206, dated 11 January 2006.

The Master Caution system logic has been revised so the Master Caution lights and the FUEL system annunciator light illuminate when either center tank fuel pump indicates low pressure, as opposed to the original Master Caution system logic that requires both center tank fuel pumps to indicate low pressure before the Master Caution lights and the FUEL system annunciator light illuminate. As a result of this system logic change, Master Caution light recall will no longer cause the Master Caution and FUEL annunciator lights to illuminate if one center tank fuel pump switch is positioned OFF and the other is positioned ON.

To limit the potential for prolonged dry running of the center tank fuel pumps, a Center Tank Boost Pump Auto Shutoff system has been installed to automatically turn the affected center tank fuel pump off after 15 seconds of continuous low fuel pressure indication. The center tank fuel pump switch will remain in the ON position and LOW PRESSURE will be illuminated until the flight crew positions the fuel pump switch to OFF. The auto shutoff feature will individually control the center tank fuel pumps and can be manually reset by turning the respective center tank fuel pump switch OFF, then ON. If no fuel is available, the pump will again turn off after 15 seconds of continuous low pressure. This system is intended to be a backup to normal flight crew procedures.

The CONFIG alert logic has been changed so that the alert is illuminated when center tank quantity is greater than 1600 pounds/726 kilograms, either engine is running and both center tank fuel pump switches are positioned OFF.

As a result of these changes, new normal procedures were developed for airplanes with the center tank fuel system changes installed. However, operators may continue to use the procedures contained in AD 2002-19-52 and AD 2002-24-51, or the procedures approved in FAA Approval Letter 140S-03-189 as an Alternative Method of Compliance (AMOC), until all center tank fuel pumps have been inspected and all airplanes in their fleet have been modified. All three fuel usage procedures have been incorporated into the Before Takeoff, Climb and Cruise, and Descent Procedures in the Flight Crew Operations Manual (FCOM).

A step was added to the Before Start Procedure for all operators to ensure the integrity of the pressure sensor and indication system of the center tank fuel pumps. Flight crews are directed to turn the left and right center tank fuel pump switches to ON if the center fuel tank contains more than 1000 pounds/453 kilograms. The crew should verify the amber LOW PRESSURE lights illuminate momentarily and then extinguish. If an amber light remains illuminated, the associated center tank fuel pump switch must be turned OFF. These procedures are applicable to all airplanes, regardless of which of the three fuel usage procedures have been adopted.

Flight crews should be aware when flying airplanes equipped with the auto shutoff system that it is possible for the center tank pump inlets to be uncovered long enough to trigger the auto shutoff system while in climb, descent, acceleration, deceleration, or during maneuvers when the center tank fuel quantity is low but the tank not empty. If this occurs, the affected center tank fuel pump(s) should be selected OFF when the center tank fuel pump LOW PRESSURE light illuminates. Per the normal procedures, once the airplane is in level flight, with fuel remaining in the center tank, the center tank fuel pump(s) should be selected ON again. When the center tank fuel pump LOW PRESSURE light(s) once again illuminates, the pump(s) should be selected OFF.

Operating Instructions

Refer to the FCOM Normal Procedures for fuel usage procedures for Before Start, Before Takeoff, Climb and Cruise, and Descent.

Administrative Information

Insert this bulletin behind the Bulletin Record page in Volume 1 of your Flight Crew Operations Manual (FCOM). Amend the FCOM Bulletin Record page to show bulletin TBC-48 R1 "In Effect" (IE).

This bulletin will be cancelled in a future revision of the FCOM.

Please send all correspondence regarding Flight Crew Operations Manual Bulletin status, to the 737 Manager, Flight Technical Data, through the Service Requests Application (SR App) on the MyBoeingFleet home page.

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Flight Crew Operations Manual Bulletin
for
The Boeing Company

The Boeing Company
Seattle, Washington 98124-2207

737

Number: TBC-50 R2

IssueDate: March 18, 2021

Airplane Effectivity: 737-600/-700/-800/-900 with Stall Management Yaw Damper (SMYD) Computer 285A1010-6/-106 and Older.

Subject: Nuisance Stall Warning Stick Shaker Events

Reason: This bulletin provides information about nuisance stall warning stick shaker events experienced on 737-600/700/800/900 airplanes.

This bulletin is being revised to add airplane effectivity and to provide cancellation information.

Information in this bulletin is recommended by The Boeing Company, but may not be FAA approved at the time of writing. In the event of conflict with the FAA approved Airplane Flight Manual (AFM), the AFM shall supersede. The Boeing Company regards the information or procedures described herein as having a direct or indirect bearing on the safe operation of this model airplane.

THE FOLLOWING PROCEDURE AND/OR INFORMATION IS EFFECTIVE UPON RECEIPT

Background Information

A nuisance stall warning stick shaker event is one in which the stick shaker activates although the airplane is not near a stall condition. In-service incidents have revealed corners of the operating envelope where turbulence or additional maneuver loads can result in momentary nuisance stick shaker events. Boeing has determined the following flight conditions can lead to nuisance stick shaker events:

1. Encountering moderate to severe turbulence when operating at or near the Maximum Operating Altitude.
2. Maneuvering during flap retraction from Flaps 1 to Flaps Up after takeoff or during a missed approach when Engine Anti-Ice is ON or when Wing Anti-Ice has been selected ON after liftoff.
3. Maneuvering at V2 speed following an engine failure on takeoff when Wing Anti-Ice has been selected ON after liftoff.

Boeing is investigating design changes to the Stall Management/Yaw Damper (SMYD) computer logic to minimize the frequency of these events.

Operating Instructions

Scenario 1: Moderate to severe turbulence is encountered when operating at or near the Maximum Operating Altitude.

Crew Action:

No change in operations is required. Flight crews should be aware stall warning stick shaker events have occurred in moderate turbulence, particularly when flying near the lower amber band when at or near maximum operating altitudes.

Scenario 2: After takeoff or missed approach, the airplane is maneuvered during flap retraction from Flaps 1 to Flaps Up with Engine Anti-Ice ON or Wing Anti-Ice selected ON after liftoff.

Crew Action:

During flap retraction from Flaps 1 to Flaps Up, limit bank angle to 15 degrees and avoid higher maneuver loading of the aircraft until the Leading Edge Flaps Transit light has extinguished. If a higher bank angle is required during this time, avoid the selection of Flaps 1 to Flaps Up until maneuvering is complete or bank angles are 15 degrees or less.

Note: A non-maneuvering segment of approximately 1 nm during all-engine operations or approximately 2.5 nm for an engine-out operation will allow for flaps to be retracted from Flaps 1 to Flaps Up.

Scenario 3: The airplane is maneuvered at V2 speed following an engine failure on takeoff when Wing Anti Ice has been selected ON after liftoff.

Crew Action:

Do not turn Wing Anti-Ice ON until airspeed has increased to at least V2+15 knots.

Administrative Information

This bulletin replaces bulletin TBC-50 R1 , dated April 15, 2005. Revise the Bulletin Record Page to show bulletin TBC-50 R1 as “CANCELLED” (CANC).

Insert this bulletin behind the Bulletin Record page in Volume 1 of your Flight Crew Operations Manual (FCOM). Amend the FCOM Bulletin Record page to show bulletin TBC-50 R2 "In Effect" (IE).

This FCOM Bulletin will be canceled when an operator reports to Boeing that all airplanes in their fleet have SMYD part number 285A1010-7/-107 or newer. Refer to Service Letter 737-SL-27-193-A for additional information.

Please send all correspondence regarding Flight Crew Operations Manual Bulletin status, to the 737 Manager, Flight Technical Data, through the Service Requests Application (SR App) on the MyBoeingFleet home page.

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Flight Crew Operations Manual Bulletin
for
The Boeing Company

The Boeing Company
Seattle, Washington 98124-2207

737

Number: TBC-52 R1

IssueDate: July 25, 2008

Subject: Master Caution System Anomaly

Reason: This bulletin provides information about a Master Caution system anomaly during the Light Test.

The purpose of this reissue is to provide Service Letter information.

Information in this bulletin is recommended by The Boeing Company, but may not be FAA approved at the time of writing. In the event of conflict with the FAA approved Airplane Flight Manual (AFM), the AFM shall supersede. The Boeing Company regards the information or procedures described herein as having a direct or indirect bearing on the safe operation of this model airplane.

THE FOLLOWING PROCEDURE AND/OR INFORMATION IS EFFECTIVE UPON RECEIPT

Background Information

A Master Caution system anomaly has been found on 737-600/700/800/900 airplanes at Production Line Number 1640 thru Production Line Number 2168. These airplanes have provisions for GLS capability and have been equipped with a new Mode Control Unit (MCU).

When the Master LIGHTS switch is moved to the TEST position during the Light Test, all system lights and system annunciators will illuminate correctly. If the Master Caution “PUSH TO RESET” is pressed and released during the test, all system annunciators on the annunciator panel will extinguish, with the exception of the IRS annunciation, and the MASTER CAUTION light will re-illuminate. The MASTER CAUTION light and IRS light will extinguish when the Master LIGHTS switch is moved out of the TEST position.

This anomaly is present on Production Line Number 1640 thru Production Line Number 2168. To correct this anomaly, Boeing installed the P/N 69-37399-13 Mod A MCU starting at Production Line Number 2169.

Boeing Service Letter 737-SL-34-191 provides information on the upgrade that corrects this anomaly.

Administrative Information

Insert this bulletin behind the Bulletin Record page in Volume 1 of your Flight Crew Operations Manual (FCOM). Amend the FCOM Bulletin Record page to show bulletin TBC-52 R1 "In Effect" (IE).

This Flight Crew Operations Manual Bulletin will be cancelled after Boeing is notified that all affected airplanes in the operator's fleet have been modified by Boeing Service Letter 737-SL-34-191. If the operator does not plan to modify all the airplanes and would like to have the contents of this Bulletin incorporated in the Flight Crew Operations Manual, please advise Boeing accordingly.

Please send all correspondence regarding Flight Crew Operations Manual Bulletin status, to the 737 Manager, Flight Technical Data, through the Service Requests Application (SR App) on the MyBoeingFleet home page.

Flight Crew Operations Manual Bulletin
for
The Boeing Company

The Boeing Company
Seattle, Washington 98124-2207

737

Number: TBC-53 R2

IssueDate: April 26, 2023

Subject: Unwanted "GLIDESLOPE" Advisory During Approaches On Airplanes Equipped with the Integrated Approach Navigation (IAN) Option

Reason: This bulletin informs flight crews of the potential for receiving an unwanted or nuisance "GLIDESLOPE" advisory on IAN-equipped airplanes in certain unique conditions.

This bulletin is being revised to make editorial changes and to update the Administrative Information section.

Information in this bulletin is recommended by The Boeing Company, but may not be FAA approved at the time of writing. In the event of conflict with the FAA approved Airplane Flight Manual (AFM), the AFM shall supersede. The Boeing Company regards the information or procedures described herein as having a direct or indirect bearing on the safe operation of this model airplane.

THE FOLLOWING PROCEDURE AND/OR INFORMATION IS EFFECTIVE UPON RECEIPT

Background Information

Operators have reported occurrences of a nuisance GLIDESLOPE advisory at low height above the runway when an FMC-generated glidepath is present on approach. This advisory can occur anytime an approach other than ILS or GLS is selected in the FMC, the active waypoint is the runway/missed approach point and the airplane is below 1000 ft AGL. The approach (APP) mode does not need to be selected for this advisory to occur. Boeing has analyzed these events and has concluded these unwanted advisories typically occur when the barometric altimeter setting varies from the actual station pressure as the result of the use of an old altimeter setting, as a result of rapidly varying barometric pressure changes which lead to an outdated altimeter setting, or as a result of warmer than standard outside air temperature (OAT). A change in barometric pressure or warmer than standard OAT can cause the VNAV path to be slightly different than the Visual Glide Slope Indicator (VGSI), i.e., PAPI or VASI.

When these situations occur and the crew elects to modify the flight path below the FMC-generated path in order to follow the VGSI, the IAN glideslope protection feature can issue a GLIDESLOPE advisory even though the airplane may be on a safe and appropriate flight path in visual conditions. This is because the barometric VNAV path may not exactly coincide with the VGSI path.

The barometric VNAV path can be sensitive to changes in barometric pressure and/or temperature. A small difference in barometric pressure can alter the barometric VNAV path. For example, a .02 inches difference in pressure due to use of an old or incorrect altimeter setting can alter the FMC generated glide path by approximately 20 feet as the airplane approaches the runway.

Flight crews should be aware that differences in barometric pressure are a common occurrence and that air traffic facilities do not necessarily update the altimeter setting information when small changes in pressure occur, particularly when the weather is VFR. While most normal operations using good operating practice for altimeter settings will provide nuisance free operations regarding this type of GLIDESLOPE advisory, crews should be aware that such an advisory nonetheless can, in rare instances, occur.

This condition occurs only on airplanes equipped with the IAN option when an old or erroneous altimeter setting is used, a warmer than standard OAT exists at the airport, or in instances where the VGSI and the FMC generated glidepath are not coincident. These cases can lead to a VNAV path which does not correspond to the VGSI path.

Operating Instructions

- During an approach use the most current altimeter setting for the destination airport. Ensure the appropriate barometric pressure setting is set on each altimeter. At higher temperatures (approximately 25 degrees C and higher), the FMC-generated glide path may be noticeably higher than the guidance provided by the runway VGSI.
- At and below applicable minima with suitable visual references established, transition to use of the VGSI path for continuation of the approach to landing.
- In the event an IAN related GLIDESLOPE advisory occurs while in VMC at low altitude, after confirming the airplane is on a safe path, the crew may elect to do one or more of the following:
  - Silence the GLIDESLOPE advisory and continue on the VGSI path,
  - Re-establish the FMC based barometric VNAV path and transition to a visual approach and landing in the touchdown zone, or
  - Discontinue the approach.

Administrative Information

This bulletin replaces bulletin TBC-53 R1 , dated July 31, 2014. Revise the Flight Crew Operations Manual Bulletin Record Page to show bulletin TBC-53 R1 as “CANCELLED” (CANC).

Insert this bulletin behind the Bulletin Record page in Volume 1 of your Flight Crew Operations Manual. Amend the Flight Crew Operations Manual Bulletin Record to show bulletin TBC-53 R2 "In Effect" (IE).

This bulletin remains in effect until further notice.

Please send all correspondence regarding Flight Crew Operations Manual Bulletin status, to Flight Technical Data, through the Service Requests Application (SR App) on the MyBoeingFleet home page.

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Flight Crew Operations Manual Bulletin
for
The Boeing Company

The Boeing Company
Seattle, Washington 98124-2207

737

Number: TBC-54 R1

IssueDate: April 11, 2006

Subject: FMC Update 549849-015 U10.6 Prediction Errors

Reason: This bulletin informs flight crews of a potential for erroneous ETA, RTA, fuel remaining and Mach number predictions.

The purpose of this reissue is to provide Service Bulletin information.

Information in this bulletin is recommended by The Boeing Company, but may not be FAA approved at the time of writing. In the event of conflict with the FAA approved Airplane Flight Manual (AFM), the AFM shall supersede. The Boeing Company regards the information or procedures described herein as having a direct or indirect bearing on the safe operation of this model airplane.

THE FOLLOWING PROCEDURE AND/OR INFORMATION IS EFFECTIVE UPON RECEIPT

Background Information

Smiths Aerospace has discovered an error in the Update 549849-015 U10.6 FMC software. The software incorrectly processes wind data for certain downstream route legs which can result in erroneous values for ETA and fuel remaining for downstream waypoints. This anomaly also affects the ability of the FMC to control to a Required Time of Arrival (RTA) at a downstream waypoint. The error is a function of the entered/sensed wind, leg length, and course change between the incoming leg and outgoing leg for a downstream waypoint.

The 549849-015 U10.6 FMC predictions will be incorrect for leg segments that follow intermediate waypoints with a less than a two degree course change between the incoming and outgoing leg, for non-flyover points. The error will occur for leg segments with less than a ten degree course change for flyover points. This results in the FMC incorrectly applying winds for the particular leg. Depending on the magnitude and direction of the wind and the length and direction of the leg, the error in the ETA can range from nothing at all to more than 40 minutes. Fuel predictions and Mach targets will also be proportionally affected. This anomaly does not occur when there is a greater than two degree course change (ten-degree change for flyover waypoints) between the incoming and outgoing legs.

Flight crews should not use FMC downstream predictions for ETA, RTA, fuel remaining or Mach number target when operating with 549849-015 U10.6 FMC software. All predictions should be verified by conventional methods.

Boeing plans to revise, certify and deliver new 549849-016 U10.6 FMC software. Until that time, Boeing recommends all operators re-install U10.5A FMC software on those airplanes that delivered with 549849-015 U10.6.

Operating Instructions

When operating with 549849-015 U10.6 FMC software, do not use FMC predictions for ETA, RTA, fuel remaining or target Mach number. Verify all predictions by conventional methods.

Administrative Information

Insert this bulletin behind the Bulletin Record page in Volume 1 of your Flight Crew Operations Manual (FCOM). Amend the FCOM Bulletin Record page to show bulletin TBC-54 R1 "In Effect" (IE).

This bulletin will be cancelled after Boeing is notified that all affected airplanes in your fleet have been modified by Boeing Service Bulletin 737-34-1768 which installs FMC software U10.6 part number 549849-016. If you do not plan to modify all your airplanes and would like to have the contents of this bulletin incorporated in your Operations Manual, please advise Boeing accordingly.

Please send all correspondence regarding Flight Crew Operations Manual Bulletin status, to the 737 Manager, Flight Technical Data, through the Service Requests Application (SR App) on the MyBoeingFleet home page.

Flight Crew Operations Manual Bulletin
for
The Boeing Company

The Boeing Company
Seattle, Washington 98124-2207

737

Number: TBC-59

IssueDate: April 1, 2006

Subject: Flight Deck Display Unit Blanking Anomaly

Reason: This bulletin informs flight crews of the potential for multiple flight deck display units blanking on PFD/ND airplanes with Navigation Performance Scales (NPS) enabled.

Information in this bulletin is recommended by The Boeing Company, but may not be FAA approved at the time of writing. In the event of conflict with the FAA approved Airplane Flight Manual (AFM), the AFM shall supersede. The Boeing Company regards the information or procedures described herein as having a direct or indirect bearing on the safe operation of this model airplane.

THE FOLLOWING PROCEDURE AND/OR INFORMATION IS EFFECTIVE UPON RECEIPT

Background Information

An operator has reported events of both Inboard Display Units (DU's) and parts of the Center Upper and Center Lower DU's blanking during flight. During the DU blanking events multiple other indications/faults occurred, including MACH TRIM FAIL, SPEED TRIM FAIL, SPD LIM, EEC ALTN and the inability to engage the second autopilot during approach. DU blanking events have lasted from several minutes to a few hours in duration, with the DU's recovering automatically. When the DU's recovered, all other related indications/faults also cleared.

These events occur when the Right Outboard DU overheats. The overheat condition causes an invalid calculation in the Common Display System (CDS) software.

The root cause of the Right Outboard DU overheat is accumulation of dust in the DU vent holes, preventing effective draw-through cooling. Previous to the subject events, Boeing released Maintenance Tip 737 MT 31-005 that recommends operators check and clean the DU vents.

This anomaly is present on all PFD/ND airplanes with NPS enabled. A solution for this anomaly is planned to be incorporated in CDS Block Point 2006.

Operating Instructions

If multiple flight deck DU's blank, together with the associated indications/faults listed above, the Captain's EFIS Control Panel should be selected to VOR or APP mode. Since NPS is not active in the VOR or APP mode, this action will restore the DU's and clear the associated indications/faults.

If the Right Outboard DU cools sufficiently for the DU's to recover automatically, normal Navigation Display mode selection may be resumed.

Administrative Information

Insert this bulletin behind the Bulletin Record page in Volume 1 of your Flight Crew Operations Manual (FCOM). Amend the FCOM Bulletin Record page to show bulletin TBC-59 "In Effect" (IE).

This FCOM bulletin will remain in effect until CDS Block Point 2006 is delivered and Boeing is notified that all affected airplanes in your fleet have it installed.

Please send all correspondence regarding Flight Crew Operations Manual Bulletin status, to the 737 Manager, Flight Technical Data, through the Service Requests Application (SR App) on the MyBoeingFleet home page.

Flight Crew Operations Manual Bulletin
for
The Boeing Company

The Boeing Company   **Seattle, Washington 98124-2207**   737

Number: TBC-61

IssueDate: August 4, 2006

Subject: Head-Up Display (HUD) Software Anomaly

Reason: This bulletin informs flight crews of a discrepancy between the airspeed indications on the HUD and on the EFIS or PFD for 737-800/900 airplanes.

> Information in this bulletin is recommended by The Boeing Company, but may not be FAA approved at the time of writing. In the event of conflict with the FAA approved Airplane Flight Manual (AFM), the AFM shall supersede. The Boeing Company regards the information or procedures described herein as having a direct or indirect bearing on the safe operation of this model airplane.

THE FOLLOWING PROCEDURE AND/OR INFORMATION IS EFFECTIVE UPON RECEIPT

Background Information

In Common Display System (CDS) Block Points 2004 and on, the VREF+15 (white) bug on the EFIS Mach/Airspeed Indicator and on the PFD speed tape is changed to a VREF+20 (white) bug for 737-800/900 airplanes. This change provides the appropriate tail clearance margin during a one engine inoperative flaps 15 landing.

The Head-Up Display (HUD) has a VREF+15 (PRI in flight mode) bug for all 737-600/700/800/900 airplanes.

A fix for 737-800/900 airplanes is being considered for a future update of the HUD software.

Operating Instructions

On 737-800/900 airplanes with CDS Block Points 2004 and later, do not use the HUD indication of VREF+15 for a one engine inoperative flaps 15 landing. Use the EFIS Mach/Airspeed Indicator or PFD speed tape indication of VREF+20.

Administrative Information

Insert this bulletin behind the Bulletin Record page in Volume 1 of your Flight Crew Operations Manual (FCOM). Amend the FCOM Bulletin Record page to show bulletin TBC-61 "In Effect" (IE).

This FCOM bulletin will remain in effect until the new HUD software has been delivered and Boeing is notified that all affected airplanes in your fleet have it installed.

Please send all correspondence regarding Flight Crew Operations Manual Bulletin status, to the 737 Manager, Flight Technical Data, through the Service Requests Application (SR App) on the MyBoeingFleet home page.

Flight Crew Operations Manual Bulletin
for
The Boeing Company

The Boeing Company **Seattle, Washington 98124-2207**	737

Number: TBC-62

IssueDate: October 16, 2006

Subject: FMC Update U10.6 Erroneous Holding Pattern

Reason: This bulletin informs flight crews of the potential for an erroneous holding pattern.

Information in this bulletin is recommended by The Boeing Company, but may not be FAA approved at the time of writing. In the event of conflict with the FAA approved Airplane Flight Manual (AFM), the AFM shall supersede. The Boeing Company regards the information or procedures described herein as having a direct or indirect bearing on the safe operation of this model airplane.

THE FOLLOWING PROCEDURE AND/OR INFORMATION IS EFFECTIVE UPON RECEIPT

Background Information

Several operators have reported events of unusually large holding patterns being shown on the FMC MAP display. In each case, the holding pattern was initially shown correctly but when either the DECEL was sequenced prior to the hold or the airplane was established in the hold, the holding pattern became larger than expected. When LNAV was engaged, the autopilot or flight director commanded very shallow bank angles during the turns. In addition, the scratchpad message "UNABLE HOLD AIRSPACE" was shown prior to entering the holding pattern. In all events, the flight crew had made a manual airspeed, not Mach speed, entry on the RTE HOLD page.

Boeing and Smiths Aerospace have confirmed that the anomaly was introduced in the U10.6 FMC software update and affects U10.6 only. This anomaly occurs when a manual airspeed entry is made on the RTE HOLD page and, in all cases, the anomaly results in display of the FMC alerting message "UNABLE HOLD AIRSPACE".

The unusually large holding pattern can be returned to normal by deleting the airspeed entry from the SPD/TGT ALT line on the RTE HOLD page.

Operating Instructions

Do not enter an airspeed on the RTE HOLD page.

If an airspeed is entered on the RTE HOLD page and an unusually large holding pattern is shown on the FMC MAP display, delete the airspeed entry from the SPD/TGT ALT line on the RTE HOLD page. After the airspeed entry is deleted, the holding pattern will be sized correctly.

If a holding airspeed change is required, use the SPD INTV switch (if installed), or discontinue VNAV flight and use the IAS/MACH selector on the MCP.

Administrative Information

Insert this bulletin behind the Bulletin Record page in Volume 1 of your Flight Crew Operations Manual (FCOM). Amend the FCOM Bulletin Record page to show bulletin TBC-62 "In Effect" (IE).

This anomaly has been corrected in the U10.7 FMC software update. This FCOM bulletin will remain in effect until the new U10.7 FMC software has been delivered and Boeing is informed that all affected airplanes in your fleet have it installed.

Please send all correspondence regarding Flight Crew Operations Manual Bulletin status, to the 737 Manager, Flight Technical Data, through the Service Requests Application (SR App) on the MyBoeingFleet home page.

Flight Crew Operations Manual Bulletin
for
The Boeing Company

The Boeing Company
Seattle, Washington 98124-2207

737

Number: TBC-63

IssueDate: November 13, 2006

Subject: NO LAND 3 Annunciation After Landing

Reason: This bulletin informs flight crews of the potential for an erroneous NO LAND 3 message after landing following an autopilot disconnect inflight.

Information in this bulletin is recommended by The Boeing Company, but may not be FAA approved at the time of writing. In the event of conflict with the FAA approved Airplane Flight Manual (AFM), the AFM shall supersede. The Boeing Company regards the information or procedures described herein as having a direct or indirect bearing on the safe operation of this model airplane.

THE FOLLOWING PROCEDURE AND/OR INFORMATION IS EFFECTIVE UPON RECEIPT

Background Information

A discrepancy has been discovered on airplanes equipped with Fail Operational capability which may result in display of the NO LAND 3 message after landing.

A timing issue exists between the MCP autopilot disengage warning light output and the monitor of this output in the FCC. When the autopilot is disengaged, the MCP output toggles on and off to flash the warning light. On airplanes equipped with Fail Operational capability, the FCC monitors this output and if the warning is not detected, the FCC will fault the MCP and set the warning itself. If the initial warning pulse from the MCP is too short for the FCC to detect, the MCP is faulted erroneously and a NO LAND 3 latched fault is set. No flight deck effect or system downgrade will occur in flight. However, after landing, NO LAND 3 will annunciate on the Upper Display Unit when wheel speed decreases below 60 knots.

This anomaly will be corrected in the next Collins FCC software update, currently scheduled for release in the first quarter of 2007.

Operating Instructions

If NO LAND 3 annunciates after landing, the event should be entered into the aircraft log. If the fault is not reset by Maintenance, subsequent approaches are limited to LAND 2.

Administrative Information

Insert this bulletin behind the Bulletin Record page in Volume 1 of your Flight Crew Operations Manual (FCOM). Amend the FCOM Bulletin Record page to show bulletin TBC-63 "In Effect" (IE).

This FCOM bulletin will remain in effect until the new FCC software has been delivered and Boeing is informed that it has been installed on all affected airplanes.

Please send all correspondence regarding Flight Crew Operations Manual Bulletin status, to the 737 Manager, Flight Technical Data, through the Service Requests Application (SR App) on the MyBoeingFleet home page.

Flight Crew Operations Manual Bulletin
for
The Boeing Company

The Boeing Company
Seattle, Washington 98124-2207

737

Number: TBC-64 R1

IssueDate: January 17, 2007

Subject: FMC Failure

Reason: This bulletin informs flight crews of the potential for failure of the FMC with Update U10.5, U10.5a or U10.6 software installed.

The purpose of this revision is to provide new operating instructions.

Information in this bulletin is recommended by The Boeing Company, but may not be FAA approved at the time of writing. In the event of conflict with the FAA approved Airplane Flight Manual (AFM), the AFM shall supersede. The Boeing Company regards the information or procedures described herein as having a direct or indirect bearing on the safe operation of this model airplane.

THE FOLLOWING PROCEDURE AND/OR INFORMATION IS EFFECTIVE UPON RECEIPT

Background Information

Operators have reported events in which the FMC has momentarily failed and then returned with an inactive route. When the route was again activated, the FMC failed a second time.

Analysis of the events has revealed an anomaly in the Smiths Aerospace FMC U10.5, U10.5a and U10.6 software which can prevent correct implementation of flight plan legs longer than approximately 1000 NM. When a leg over 1000 NM becomes the active leg for any reason (planned or modified route), an incorrect FMC speed prediction can cause the FMC(s) to fail. FMC function will return but the route will be inactive and a discontinuity will be inserted on the CDU before the previously entered route. If the same route is once again selected, the FMC(s) may fail a second time. FMC function will return a second time; however, all of the route information will be lost. If the leg is entered into the FMC again within two minutes of the original failure, the FMC(s) may fail a third time. A third FMC failure causes a latched failure and the FMC(s) will not be available for the remainder of the flight. This failure can occur with either single or dual FMC installation. With the dual FMC installation, both FMCs will fail.

Further investigation has revealed the potential for this anomaly is extremely rare.

Flight conditions must be such that the predicted speed is limited by current conditions (e.g., thrust limited) to a value less than the target speed. Because the target speed is not reached, the prediction routine exceeds its maximum number of iterations and a FMC restart occurs. If the speeds are not near a limiting boundary, the failure will not occur. It is therefore possible to fly the same flight plan many times with no failure, and then experience a failure on a different flight. If the criteria for the anomaly exist, the failure will occur when the route is modified whether or not the modification is executed.

The anomaly exists in Smiths FMC Update U10.5, U10.5a and U10.6 software. It has been corrected in FMC Update U10.7 software which is scheduled to be available via Service Bulletin in the first quarter of 2007.

Operating Instructions

If a re-route is desired and the route modification results in a leg greater than 1000 NM:

1. Prior to entry into the CDU, modify the route to ensure no leg exceeds 1000 NM. Confirm and execute the desired route.
2. If the FMC(s) fails after the route is modified and then returns with an inactive route, do not recreate the route that caused the failure. Advise ATC that you are unable to accept the re-routing and request clearance to an intermediate waypoint that results in a leg length less than 1000 NM.
3. In the event of a latched failure, accomplish the FMC FAIL Non-Normal Checklist.

Administrative Information

Insert this bulletin behind the Bulletin Record page in Volume 1 of your Flight Crew Operations Manual (FCOM). Amend the FCOM Bulletin Record page to show bulletin TBC-64 R1 "In Effect" (IE).

This FCOM bulletin will be remain in effect until FMC Update U10.7 software has been delivered and Boeing is informed that it has been installed on all affected airplanes.

Please send all correspondence regarding Flight Crew Operations Manual Bulletin status, to the 737 Manager, Flight Technical Data, through the Service Requests Application (SR App) on the MyBoeingFleet home page.

Flight Crew Operations Manual Bulletin
for
The Boeing Company

The Boeing Company
Seattle, Washington 98124-2207

737

Number: TBC-65

IssueDate: February 12, 2007

Subject: Incorrect Implementation of TO/GA to LNAV Feature with CDS Blockpoint 06 (BP06) and FMC Update U10.5 or U10.5A Installed.

Reason: This bulletin informs flight crews of incorrect implementation of the optional TO/GA to LNAV feature when CDS BP06 is installed in conjunction with FMC Update U10.5 or U10.5A.

Information in this bulletin is recommended by The Boeing Company, but may not be FAA approved at the time of writing. In the event of conflict with the FAA approved Airplane Flight Manual (AFM), the AFM shall supersede. The Boeing Company regards the information or procedures described herein as having a direct or indirect bearing on the safe operation of this model airplane.

THE FOLLOWING PROCEDURE AND/OR INFORMATION IS EFFECTIVE UPON RECEIPT

Background Information

During production flight test of an airplane with FMC Update U10.5A and CDS Blockpoint 06 (BP06) installed, flight crews noticed the optional TO/GA to LNAV mode (Go-Around Roll Mode – LNAV) was unexpectedly armed after flaps were extended. Further investigation revealed CDS BP06 software can inadvertently enable the TO/GA to LNAV mode when installed in conjunction with FMC Update U10.5 or U10.5A software. If CDS BP06 is installed with FMC Update U10.6, the TO/GA to LNAV mode is correctly implemented and is only available if the option has been purchased by an operator. If CDS BP06 is installed with FMC Update U10.5 or U10.5A, however, the TO/GA to LNAV mode is armed whenever the leading edge devices are extended to the commanded position, an FMC approach has been selected and the logic for LNAV arm is satisfied.

Boeing did not intend the TOGA to LNAV feature to be enabled with FMC Update U10.5 or U10.5A, and this software combination has never been certified by the FAA. Because the function may be confusing to the flight crew when it is inadvertently enabled, Boeing recommends operators ensure CDS BP06 is not installed with FMC Update U10.5 or U10.5A. Operators should install FMC Update U10.6 with CDS BP06 or install an earlier CDS BP with FMC Update U10.5A and earlier. Operators should be aware, however, that FMC Update U10.6 is required for correct implementation of all short field performance features.

Operating Instructions

If CDS BP06 is installed with FMC Update U10.5 or U10.5A:

1. On the ground, if LNAV arm is displayed in white on the FMA without selection of LNAV prior to TOGA, there is no operational effect. The indication is a nuisance display only and will extinguish when TO/GA is pressed. No crew action is required.
2. On the ground, if LNAV is selected prior to TO/GA, all FMA indications and LNAV operation are correct. No additional crew action is required.
3. During approach:

Collins FCCs installed

If LNAV arm is displayed in white on the FMA, the go-around roll mode will automatically transition from track hold to LNAV above 50 feet RA during a flight director missed approach. During an autopilot go-around, LNAV will engage when the airplane is above 400 feet AGL. Below these transition altitudes, the roll mode will be TO/GA (flight director or autopilot commands track hold).

Honeywell -709 FCCs installed

If LNAV arm is displayed in white on the FMA, the go-around roll mode will automatically transition from track hold to LNAV above 400 feet RA during a flight director or autopilot go-around. Below this transition altitude, the roll mode will be TO/GA (flight director or autopilot commands track hold).

With either FCC software installed, the flight crew must be aware the flight director will provide roll guidance to the LNAV path. If an alternate missed approach has been assigned, the PF must maintain the correct course manually. A different roll mode can be selected above 400 feet AGL.

Administrative Information

Insert this bulletin behind the Bulletin Record page in Volume 1 of your Flight Crew Operations Manual (FCOM). Amend the FCOM Bulletin Record page to show bulletin TBC-65 "In Effect" (IE).

This FCOM bulletin will remain in effect until Boeing is informed that all affected airplanes in your fleet have the correct FMC and CDS BP software combinations installed.

Please send all correspondence regarding Flight Crew Operations Manual Bulletin status, to the 737 Manager, Flight Technical Data, through the Service Requests Application (SR App) on the MyBoeingFleet home page.

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Flight Crew Operations Manual Bulletin
for
The Boeing Company

The Boeing Company **Seattle, Washington 98124-2207**	**737**

Number: TBC-66

IssueDate: March 16, 2007

Subject: Instrument Procedure, Transition Altitude and FMC Loss of Flight Information (FMC Update U10.6)

Reason: This bulletin informs flight crews of the potential for FMC software restarts on airplanes with FMC Update U10.6 installed.

Information in this bulletin is recommended by The Boeing Company, but may not be FAA approved at the time of writing. In the event of conflict with the FAA approved Airplane Flight Manual (AFM), the AFM shall supersede. The Boeing Company regards the information or procedures described herein as having a direct or indirect bearing on the safe operation of this model airplane.

THE FOLLOWING PROCEDURE AND/OR INFORMATION IS EFFECTIVE UPON RECEIPT

Background Information

Operators of B737 airplanes with FMC Update U10.6 installed have reported events in which instrument departure procedures (SIDs or DPs) have triggered FMC software restarts when using altimeter settings above standard. This FMC restart anomaly has, in rare instances, occurred both on the ground and inflight at a very limited number of airports which have instrument procedures in which an FMC path prediction step terminates at an altitude that is within a specified altitude block below the transition altitude.

Further investigation has determined the anomaly is related to FMC vertical predictions being affected by a combination of barometric setting, transition altitude and other altitudes used by the FMC prediction routine. The anomaly does not exist at altitudes above the transition altitude or during cruise and descent.

FMC predictions are done in steps that are calculated based on altitude, speed, or distance. Each step predicts flight parameters up to a waypoint, a deceleration, a restriction altitude, or something similar. Some of these terminations are visible points in a flight plan and some are not. Some represent entered data; some do not. Each new step starts where the previous one ended.

If the local barometric setting is greater than 29.92 inches Hg (1013 mB) and any prediction step terminates at an altitude that is within a specified altitude block below the transition altitude, the anomaly may occur. The FMC will be unable to complete its prediction and will force a restart. During the restart, all FMC functionality, including vertical and lateral guidance, will be lost. If the flight crew continuously attempts to re-enter FMC data while below transition altitude, a total FMS failure may occur and the FMC will not be available for the remainder of the flight. Once the airplane has climbed above the transition altitude, “FMC” can be selected on the MENU page, FMC data can be re-entered and executed, and the FMC will operate normally.

This anomaly is corrected in FMC Update U10.7 and does not exist in Update U10.5/U10.5A. The software retrofit, Boeing Service Bulletin 737-34-1918, is scheduled for release in early second quarter 2007.

Operating Instructions

The anomaly will not occur if the local barometric setting is equal to or less than 29.92 inches Hg (1013 mB). No crew action is required.

If the local barometric setting is greater than 29.92 inches Hg (1013 mB), Boeing recommends operators consider one or more of the following:

1. If an instrument departure procedure (SID or DP) has been identified as one in which this type of FMC restart has occurred or is believed to have occurred, do not use the instrument procedure. Use an alternate SID or DP, or plan to use non-FMS dependent navigation methods until climbing above the transition level. If the procedure can be flown using ground based navigation aids by conventional means, do so. Do not enter the departure into the FMC. Fly the procedure using conventional navigation methods.
2. If an affected departure procedure must be flown and the method described above is not possible, a workaround may be used. If the local barometric setting is greater than 29.92 inches Hg (1013 mB), overwrite the transition altitude (TRANS ALT) on the PERF INIT page with an altitude 1000 feet above the cruise altitude. If the cruise altitude is subsequently raised, the transition altitude in the FMC must also be raised. Flight crews must be aware that all altitudes on the FMC LEGS pages will now be displayed in thousands of feet rather than Flight Levels.

   The standard barometric setting must be selected on the altimeters as usual when passing through the actual transition altitude. On those airplanes with the PFD/ND display, the barometric indication will not turn boxed amber to indicate the local barometric setting is still set and the airplane is climbing above the actual transition altitude.

The correct transition altitude can be entered on the PERF INIT page at any time after climbing through the actual transition altitude. The correct value for the descent transition level can be entered on the DES FORECASTS page at any time, including during preflight.

3. If a departure procedure not previously identified as susceptible to FMC restarts is flown and an FMC restart occurs during the climb, do not attempt to re-enter FMC data until the airplane has climbed above the transition altitude. Resume conventional navigation using ground based navigation aids. If a total FMC failure occurs and the FMC is no longer available (e.g., no “FMC” prompt on the MENU page), accomplish the FMC FAIL Non-Normal Checklist.

Administrative Information

Insert this bulletin behind the Bulletin Record page in Volume 1 of your Flight Crew Operations Manual (FCOM). Amend the FCOM Bulletin Record page to show bulletin TBC-66 "In Effect" (IE).

This FCOM bulletin will remain in effect until Boeing is informed that all affected airplanes in your fleet have FMC Update U10.7 installed.

Please send all correspondence regarding Flight Crew Operations Manual Bulletin status, to the 737 Manager, Flight Technical Data, through the Service Requests Application (SR App) on the MyBoeingFleet home page.

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Flight Crew Operations Manual Bulletin for The Boeing Company

The Boeing Company
Seattle, Washington 98124-2207

737

Number: TBC-67

IssueDate: March 5, 2007

Subject: Spoiler Retraction Failure on Airplanes with the Short Field Performance Package

Reason: This bulletin informs flight crews of the potential for the flight spoilers to fail to retract fully on airplanes equipped with the Short Field Performance package.

Information in this bulletin is recommended by The Boeing Company, but may not be FAA approved at the time of writing. In the event of conflict with the FAA approved Airplane Flight Manual (AFM), the AFM shall supersede. The Boeing Company regards the information or procedures described herein as having a direct or indirect bearing on the safe operation of this model airplane.

THE FOLLOWING PROCEDURE AND/OR INFORMATION IS EFFECTIVE UPON RECEIPT

Background Information

An operator of a B737 airplane equipped with the Short Field Performance package has informed Boeing of failures of flight spoilers to retract after the speedbrake handle was moved to the DOWN position after landing. The spoiler was discovered in the full extended position during a routine maintenance walk-around. The spoiler remained in the full extended position after cycling of the speedbrake handle.

Further investigation has determined the failure can occur during a rejected takeoff maneuver, during a rejected landing or during a full stop landing, following deployment of the speedbrakes, either automatically or manually.

If the failure is not detected prior to takeoff, the takeoff configuration warning will not sound if any flight spoiler remains extended with the speedbrake handle in the DOWN position.

The cause of the failure has been identified as interference within the actuator main control valve. Boeing and the actuator supplier are actively working to modify the system and to provide new actuators to the fleet. Service Bulletin information will be provided as soon as it is available.

Operating Instructions

The following operating instructions are intended to prevent a takeoff with one or more spoiler panels extended:

1. A visual inspection of spoiler position must be conducted after landing prior to turning the electric motor driven hydraulic pumps off. This inspection can be conducted by qualified ground personnel or flight crew.

   After landing, ensure the speedbrake handle is in the DOWN position. Prior to engine shutdown, configure the airplane to maintain electric power via APU or ground source. Do not shut down the electric motor driven hydraulic pumps. After engine shutdown, with hydraulic power on, visually verify all spoilers are properly stowed. If any spoilers remain in the UP position with the speedbrake handle in the DOWN position, contact maintenance.
2. Conduct a visual inspection as discussed above following any rejected takeoff maneuver in which spoilers have been deployed to verify all spoilers are properly stowed.

Administrative Information

Insert this bulletin behind the Bulletin Record page in Volume 1 of your Flight Crew Operations Manual (FCOM). Amend the FCOM Bulletin Record page to show bulletin TBC-67 "In Effect" (IE).

This condition is temporary until the cause of the anomaly is identified and the system is modified. This FCOM bulletin will be revised to include Service Bulletin information when available.

Please send all correspondence regarding Flight Crew Operations Manual Bulletin status, to the 737 Manager, Flight Technical Data, through the Service Requests Application (SR App) on the MyBoeingFleet home page.

Flight Crew Operations Manual Bulletin
for
The Boeing Company

The Boeing Company **Seattle, Washington 98124-2207**	737

Number: TBC-68

IssueDate: April 16, 2007

Subject: Unintentional Initiation of the FMC Engine Out Mode (FMC Update U10.7)

Reason: This bulletin informs flight crews of the potential for the FMC to unintentionally enter the ENG OUT mode on airplanes with FMC Update U10.7 installed.

Information in this bulletin is recommended by The Boeing Company, but may not be FAA approved at the time of writing. In the event of conflict with the FAA approved Airplane Flight Manual (AFM), the AFM shall supersede. The Boeing Company regards the information or procedures described herein as having a direct or indirect bearing on the safe operation of this model airplane.

THE FOLLOWING PROCEDURE AND/OR INFORMATION IS EFFECTIVE UPON RECEIPT

Background Information

During production flight test of an airplane with FMC Update U10.7 installed, the flight crew inadvertently set a condition in which the FMC transitioned into the “ENG OUT” mode while on the ground. The event occurred when one thrust lever was advanced to stow the speedbrakes, to verify the autostow function, while the ground speed was greater than 30 knots.

The difference in thrust lever position is sensed by the FMC and when the difference exceeds 52 degrees, the FMC will transition into the ENG OUT mode if ground speed is greater than 30 knots. Subsequently, the ALL ENG prompt will be displayed in LSK 4L on the CLB page.

Further investigation has determined that the FMC will not transition back into the ALL ENG mode until one of the following occurs:

1. The flight crew selects the ALL ENG prompt in LSK 4L on the CLB page and the page is executed,
2. The airplane becomes airborne and the FMC transitions into CRZ mode, or
3. The FMC is powered down completely and re-powered on the ground.

As a result, if the ENG OUT mode is set during taxi and the crew neglects to select and execute ALL ENG on the CLB page or remove power from the FMC, VNAV will remain in the ENG OUT mode during climb and provide climb target speeds that are lower than normally expected in the ALL ENG mode.

This anomaly exists only in FMC Update U10.7. A correction to the software is planned for U10.8.

Operating Instructions

To prevent inadvertent transition into the “ENG OUT” mode while on the ground:

1. Do not stow the speedbrake lever following a normal landing or a rejected takeoff by advancing one thrust lever. Manually stow the speedbrake lever.
2. Avoid taxi speeds above 30 knots when accomplishing a single engine taxi.
3. Do not split the thrust levers when operating at taxi speeds at or above 30 knots.

If an inadvertent transition into the “ENG OUT” mode has occurred:

1. On the ground or inflight, select the ALL ENG prompt in LSK 4L on the CLB page and execute, or
2. On the ground, remove all power from the FMC prior to the next takeoff.

Administrative Information

Insert this bulletin behind the Bulletin Record page in Volume 1 of your Flight Crew Operations Manual (FCOM). Amend the FCOM Bulletin Record page to show bulletin TBC-68 "In Effect" (IE).

This bulletin will remain in effect until Boeing is informed that all affected airplanes in your fleet have FMC Update U10.8 installed.

Please send all correspondence regarding Flight Crew Operations Manual Bulletin status, to the 737 Manager, Flight Technical Data, through the Service Requests Application (SR App) on the MyBoeingFleet home page.

Flight Crew Operations Manual Bulletin
for
The Boeing Company

The Boeing Company
Seattle, Washington 98124-2207

737

Number: TBC-70

IssueDate: June 11, 2007

Subject: Arming VNAV on the Ground (FMC Update U10.7)

Reason: This bulletin informs flight crews of the inconsistencies associated with arming VNAV on the ground and provides flight crew instructions to not arm VNAV prior to takeoff.

Information in this bulletin is recommended by The Boeing Company, but may not be FAA approved at the time of writing. In the event of conflict with the FAA approved Airplane Flight Manual (AFM), the AFM shall supersede. The Boeing Company regards the information or procedures described herein as having a direct or indirect bearing on the safe operation of this model airplane.

THE FOLLOWING PROCEDURE AND/OR INFORMATION IS EFFECTIVE UPON RECEIPT

Background Information

Boeing has received reports of inconsistencies associated with the arming of VNAV prior to takeoff on 737NG airplanes equipped with FMC Update U10.7. These inconsistencies can occur even on those airplanes with the configuration specified in Service Bulletin 737-34-1918 installed, i.e., FMC Update U10.7, CDS Blockpoint 06 and Collins Autopilot P4.0.

Additionally, VNAV may incorrectly engage rather than arm if an FCC version earlier than Collins FCC P4.0 or Honeywell -710 is installed. For FCC P4.0 or Honeywell -710 or later installations, VNAV may engage rather than arm under certain conditions when the departure is not aligned within 5 degrees of the runway. With VNAV engaged on the ground, when TOGA is pressed VNAV will disengage and the MCP IAS/MACH display will open and display 120 knots (Collins FCC) or 100 knots (Honeywell FCC).

This anomaly exists only with FMC Update U10.7. It will be corrected in a future software upgrade of the FMC and/or FCC.

Operating Instructions

1. Do not attempt to arm VNAV on the ground prior to takeoff.

2. In the event the VNAV button is pressed inadvertently on the ground, turn both flight director (F/D) switches OFF. Turn the F/D switch ON for the pilot flying first and then turn the F/D switch ON for the pilot monitoring. Verify the correct V2 speed is entered in the MCP IAS/MACH display.
3. Once airborne, VNAV can be selected after flaps and slats retraction is complete.

Administrative Information

Insert this bulletin behind the Bulletin Record page in Volume 1 of your Flight Crew Operations Manual (FCOM). Amend the FCOM Bulletin Record page to show bulletin TBC-70 "In Effect" (IE).

This FCOM bulletin will remain in effect until Boeing is informed that all affected airplanes in your fleet have the correct FMC and FCC software upgrade installed.

Please send all correspondence regarding Flight Crew Operations Manual Bulletin status, to the 737 Manager, Flight Technical Data, through the Service Requests Application (SR App) on the MyBoeingFleet home page.

Flight Crew Operations Manual Bulletin
for
The Boeing Company

The Boeing Company **Seattle, Washington 98124-2207**	737

Number: TBC-71 R3

IssueDate: November 16, 2007

Subject: APU Electrical Bus Disconnect

Reason: This bulletin informs flight crews of the potential for the APU to drop off the bus if powering an AC transfer bus in flight and descending from altitudes above FL260. This revision provides corrective action, corrects MMEL information and provides additional information about which airplanes are no longer affected by this bulletin.

Information in this bulletin is recommended by The Boeing Company, but may not be FAA approved at the time of writing. In the event of conflict with the FAA approved Airplane Flight Manual (AFM), the AFM shall supersede. The Boeing Company regards the information or procedures described herein as having a direct or indirect bearing on the safe operation of this model airplane.

THE FOLLOWING PROCEDURE AND/OR INFORMATION IS EFFECTIVE UPON RECEIPT

Background Information

During production flight test, Boeing flight crews have recently experienced an increase in the number of instances in which the APU is automatically disconnected from the bus when powering an AC transfer bus in flight during descent from altitudes above FL260. Engineering analysis has determined this fault is due to a change in the APU fuel system that was introduced in production at airplane Line Number 2299 and on. The first airplane with the new APU fuel system is scheduled for delivery 25 June 2007.

The change was made to address an APU fuel system problem that resulted in fuel leaks into the APU compartment due to pressure buildup between the fuel flow manifold solenoid shutoff valve and a check valve in the secondary APU fuel manifold. To address this issue, the positions of the shutoff valve and the check valve were reversed.

When the APU is operating above FL250, the APU fuel system automatically shuts off fuel to the secondary manifold. The system transitions back to the secondary manifold when the airplane descends through approximately FL260.

With the recent fuel system change, when this switching occurs, fuel flow to the secondary manifold results in a momentary decrease in fuel flow to the primary manifold. The APU fuel control logic does not maintain an adequate fuel pressure in the combined fuel manifold, resulting in the APU speed momentarily dropping below the AC transfer bus cutoff frequency. The APU generator is automatically disconnected from the bus and the Master Caution, ELEC system annunciator and amber SOURCE OFF lights illuminate.

In response to the speed drop, the APU control system increases fuel flow and the APU system will again be available to supply electrical power to an AC transfer bus within 4 seconds. The blue APU GEN OFF BUS light will illuminate to indicate the APU is available. The APU generator can be selected ON and the APU will remain connected to the bus for the remainder of the flight. It should be noted that while the APU speed is below the AC bus cutoff frequency, the blue APU GEN OFF BUS light is extinguished, indicating the APU is not available to power a bus.

Honeywell originally proposed an APU Engine Control Unit (ECU) software change. That decision was reconsidered and Honeywell has released Service Bulletin 131-49-7949, Rev. 1, to provide information to change the revised plumbing back to the original configuration. 737NG Production Line Number 2297 and the majority of Production Line Numbers 2299 through 2396, with APU Serial Numbers P-7535 through P-7637, have been converted by incorporating the referenced Honeywell Service Bulletin. Honeywell is working with operators of the remaining in-service airplanes to ensure all affected APUs are converted. This bulletin does not apply to airplanes with Honeywell Service Bulletin 131-49-7949, Rev. 1 incorporated.

All 737NG Production Line Numbers 2397 and on were delivered with APUs built with the original fuel flow divider (APU Serial Numbers P-7638 and on.) This bulletin does not apply to these airplanes. The MMEL has been revised to restrict single main engine IDG dispatch (MMEL item 24-1) for the affected airplanes to flight altitudes at or below FL220.

The MMEL revision will only permit airplanes with APU serial number P-7534 and lower, or those with Honeywell Service Bulletin 131-49-7949 or the production equivalent (APU Serial Number P-7638 and higher) incorporated, to have 3-day MMEL dispatch relief per MMEL 24-1 that is unrestricted by altitude.

Operating Instructions

If the APU is operating and connected to an AC bus in flight and the Master Caution, ELEC system annunciator and amber SOURCE OFF lights illuminate during descent, select the APU generator switch ON when the blue APU GEN OFF BUS light illuminates. It will require approximately 4 seconds for the APU generator to be available following an automatic disconnect.

Administrative Information

Insert this bulletin behind the Bulletin Record page in Volume 1 of your Flight Crew Operations Manual (FCOM). Amend the FCOM Bulletin Record page to show bulletin TBC-71 R3 "In Effect" (IE).

This FCOM bulletin will remain in effect until Boeing is informed that all affected airplanes in your fleet have had Honeywell Service Bulletin 131-49-7949, Rev. 1 incorporated to change the revised APU plumbing back to the original fuel flow divider configuration.

Please send all correspondence regarding Flight Crew Operations Manual Bulletin status, to the 737 Manager, Flight Technical Data, through the Service Requests Application (SR App) on the MyBoeingFleet home page.

Intentionally
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Flight Crew Operations Manual Bulletin
for
The Boeing Company

The Boeing Company
Seattle, Washington 98124-2207

737

Number: TBC-73

IssueDate: January 28, 2008

Subject: FMC Lockup with Selection of a Standard Instrument Departure (SID) on Missed Approach (FMC Update U10.0 and later)

Reason: This bulletin informs flight crews of the potential for the FMC to lockup following selection of a SID during a missed approach procedure.

Information in this bulletin is recommended by The Boeing Company, but may not be FAA approved at the time of writing. In the event of conflict with the FAA approved Airplane Flight Manual (AFM), the AFM shall supersede. The Boeing Company regards the information or procedures described herein as having a direct or indirect bearing on the safe operation of this model airplane.

THE FOLLOWING PROCEDURE AND/OR INFORMATION IS EFFECTIVE UPON RECEIPT

Background Information

During simulator testing, a Boeing flight crew experienced an FMC lockup and subsequent reset following selection of an engine out (EO) standard instrument departure (SID) procedure while flying an LNAV missed approach. The FMC reset shortly after the lockup and all entered data was retained. The crew was able to select the desired active waypoint and re-capture the LNAV route by using the INTC ARC function.

Further discussions with GE Aerospace have determined the problem can occur when the leg after the active waypoint in the flight plan for the missed approach is an arc leg, and a SID (normal or EO) is selected to create a modified flight plan.

This anomaly exists in FMC Update U10.0 and later. The anomaly will be corrected in FMC Update U10.8.

Boeing recommends operators evaluate this information to determine if it is applicable to their flight operations. A decision can then be made as to whether it is necessary to release this bulletin to Flight Crew.

Operating Instructions

Do not select a SID (normal SID or EO SID) while flying an LNAV missed approach procedure.

Administrative Information

Insert this bulletin behind the Bulletin Record page in Volume 1 of your Flight Crew Operations Manual (FCOM). Amend the FCOM Bulletin Record page to show bulletin TBC-73 "In Effect" (IE).

This FCOM bulletin will remain in effect until Boeing is informed that all affected airplanes in your fleet have FMC Update U10.8 installed.

Please send all correspondence regarding Flight Crew Operations Manual Bulletin status, to the 737 Manager, Flight Technical Data, through the Service Requests Application (SR App) on the MyBoeingFleet home page.

Flight Crew Operations Manual Bulletin
for
The Boeing Company

The Boeing Company
Seattle, Washington 98124-2207

737

Number: TBC-74

IssueDate: September 22, 2008

Subject: Hand Microphone Use With Flight Deck PC Power Outlets

Reason: To inform flight crews of a new restriction on using the flight deck PC power outlets when the hand microphone is used.

Information in this bulletin is recommended by The Boeing Company, but may not be FAA approved at the time of writing. In the event of conflict with the FAA approved Airplane Flight Manual (AFM), the AFM shall supersede. The Boeing Company regards the information or procedures described herein as having a direct or indirect bearing on the safe operation of this model airplane.

THE FOLLOWING PROCEDURE AND/OR INFORMATION IS EFFECTIVE UPON RECEIPT

Background Information

Boeing has received customer complaints of interference when using hand held microphones both on the ground and in flight. Investigation has shown interference may be caused by items plugged into the PC power outlets on the flight deck. Any item plugged into a PC power outlet, whether turned on or not, can cause interference. AC 91-21.1B prohibits the use of items that cause interference with communications.

Boeing is issuing placards that state: “WHEN USING HAND MIC REMOVE PWR CORD FROM OUTLET.”

Operating Instructions

Remove any power cord from the flight deck PC power outlet before using the hand microphone

Administrative Information

Insert this bulletin behind the Bulletin Record page in Volume 1 of your Flight Crew Operations Manual (FCOM). Amend the FCOM Bulletin Record page to show bulletin TBC-74 "In Effect" (IE).

This condition is temporary until the system is modified. This FCOM bulletin will be revised to include Service Bulletin information when available.

This bulletin will be canceled after Boeing is notified that all affected airplanes in your fleet have been modified by Service Bulletin.

Please send all correspondence regarding Flight Crew Operations Manual Bulletin status, to the 737 Manager, Flight Technical Data, through the Service Requests Application (SR App) on the MyBoeingFleet home page.

Flight Crew Operations Manual Bulletin
for
The Boeing Company

The Boeing Company
Seattle, Washington 98124-2207

737

Number: TBC-75 R1

IssueDate: April 30, 2009

Subject: Cabin Altitude Warning Indications and Procedures Briefing

Reason: This revision is to inform flight crews that the FAA has agreed to an Alternative Method of Compliance (AMOC) to the takeoff briefing mandated by AD 2008-23-07. The requirement to don oxygen masks only applies when the intermittent warning horn sounds and the airplane flight altitude is above 10,000 feet MSL.

Information in this bulletin is recommended by The Boeing Company, but may not be FAA approved at the time of writing. In the event of conflict with the FAA approved Airplane Flight Manual (AFM), the AFM shall supersede. The Boeing Company regards the information or procedures described herein as having a direct or indirect bearing on the safe operation of this model airplane.

THE FOLLOWING PROCEDURE AND/OR INFORMATION IS EFFECTIVE UPON RECEIPT

Background Information

The B737 cabin altitude warning system consists of an intermittent warning horn that sounds when cabin altitude exceeds 10,000 feet. Both the cabin altitude warning and takeoff configuration warning use the same intermittent horn.

Following a fatal accident in August 2005, the FAA initiated planned Airworthiness Directive (AD) action to provide additional cabin altitude warning information for B737 flight crews.

To support this planned AD, Boeing has designed a change to the warning system to provide separate “CABIN ALTITUDE” and “TAKEOFF CONFIG” warning lights to accompany the existing dual-purpose intermittent warning horn. This design change is now available on production airplanes. Service bulletin information to support the planned AD will become available in mid-2009.

To help mitigate any possible confusion associated with the B737 cabin altitude warning system, the FAA issued AD 2006-13-13 which required changes to the AFM procedures in Section 2 for responding to the intermittent cabin altitude/ configuration warning horn. These AFM changes and associated Flight Crew Operations Manual (FCOM) Quick Reference Handbook (QRH) non-normal checklist changes were intended to make it easier for flight crews to determine whether the intermittent horn was sounding for cabin altitude or for takeoff configuration.

The FAA believed, however, that additional interim action was necessary until such time as the new warning lights could be fully implemented in the B737 fleet.

In mid-2008, the FAA determined that the most practical interim solution was to issue AD 2008-23-07. This AD requires flight crews to brief cabin altitude warning indications and procedures as part of the takeoff briefing before engine start on the first flight of the day or following a flight crew member change. This briefing is required in any B737 in which the CABIN ALTITUDE and TAKEOFF CONFIG lights are not installed, or are installed but not activated.

Following further discussions, the FAA has agreed that a need exists for crews to recognize the difference between an intermittent warning horn sounding in flight below 10,000 feet MSL, as opposed to sounding at or above 10,000 feet MSL. In flight below 10,000 feet MSL, the intermittent warning horn is associated with an inflight failure of the Air-Ground Sensor switch. At or above 10,000 feet MSL, sounding of the intermittent warning horn requires the crew to immediately don oxygen masks and set regulators to 100%.

The FAA has therefore approved an Alternative Method of Compliance (AMOC) to the Non-Normal Procedures mandated by AD 2006-13-13 and to the Takeoff Briefing mandated by AD 2008-23-07. The AMOC was approved by FAA Approval Letter 130S-09-134a dated April 28, 2009.

AD 2006-13-13

The current WARNING HORN – CABIN ALTITUDE OR CONFIGURATION Non-Normal Procedure in the AFM will be revised as follows:

1. The title will be changed to WARNING HORN OR WARNING LIGHT – CABIN ALTITUDE OR TAKEOFF CONFIGURATION.

2. The condition statement and the procedure will include reference to the CABIN ALTITUDE and TAKEOFF CONFIG lights.

3. The requirement to don oxygen masks, establish crew communications and do the CABIN ALTITUDE or Rapid Depressurization checklist will only apply if the intermittent warning horn sounds or a CABIN ALTITUDE light illuminates in flight at an airplane flight altitude above 10,000 feet MSL.

4. Reference to the steady horn in the condition statement will be deleted. The corresponding step in the procedure will be deleted.

A new AFM Non-Normal Procedure, LANDING CONFIGURATION, will be created to direct crews to assure correct landing configuration if the steady horn sounds in flight.

The current WARNING HORN – CABIN ALTITUDE OR CONFIGURATION QRH non-normal checklist will be revised in a future revision of the FCOM QRH to include the changes defined in the AMOC. In addition, a new checklist, titled LANDING CONFIGURATION will be added. The QRH checklists may not be an exact replica of the AFM procedures, but will be written for consistency with the Boeing format.

AD 2008-23-07

The Cabin Altitude Warning Takeoff Briefing in Section 3 of the AFM will be revised to clarify that immediate donning of oxygen masks and accomplishment of the subsequent memory item steps from the WARNING HORN OR WARNING LIGHT – CABIN ALTITUDE OR TAKEOFF CONFIGURATION non-normal checklist are only required if the intermittent warning horn sounds in flight at an aircraft flight altitude above 10,000 feet MSL.

The Takeoff briefing in the Before Start Procedure in the Normal Procedures section of the FCOM will be updated in a future revision to reflect this change.

Operating Instructions

To further reduce the risk of flight crew incapacitation due to hypoxia following loss of cabin pressurization, cabin altitude warning indications and memory item procedures must be briefed on airplanes in which the CABIN ALTITUDE and TAKEOFF CONFIG lights are not installed, or are installed but not activated. This briefing will be included as an additional item on the Takeoff briefing before engine start for the first flight of the day or following any change of either flight crew member.

The briefing must include the following:

- Whenever the intermittent warning horn sounds in flight at an airplane flight altitude above 10,000 feet MSL:

1. Immediately, don oxygen masks and set regulators to 100%.
2. Establish crew communications.
3. Do the CABIN ALTITUDE WARNING or Rapid Depressurization non-normal checklist.

- Both pilots must verify on the overhead Cabin Altitude Panel that the cabin altitude is stabilized at or below 10,000 feet before removing oxygen masks.

Operators may want to seek an Alternative Method of Compliance (AMOC) to develop a new crew briefing or to utilize current approved briefings to meet the compliance of this AD.

Administrative Information

Insert this bulletin behind the Bulletin Record page in Volume 1 of your Flight Crew Operations Manual (FCOM). Amend the FCOM Bulletin Record page to show bulletin TBC-75 R1 "In Effect" (IE).

This FCOM bulletin will remain in effect until Boeing is informed that all affected airplanes in your fleet have the CABIN ALTITUDE and TAKEOFF CONFIG lights installed and activated.

Please send all correspondence regarding Flight Crew Operations Manual Bulletin status, to the 737 Manager, Flight Technical Data, through the Service Requests Application (SR App) on the MyBoeingFleet home page.

Flight Crew Operations Manual Bulletin
for
The Boeing Company

The Boeing Company
Seattle, Washington 98124-2207

737

Number: TBC-76

IssueDate: April 13, 2009

Subject: Instrument Approach Procedures with an FMC Missed Approach Altitude Constraint Above 10,000 feet MSL

Reason: This bulletin informs flight crews of an anomaly associated with approaches having a missed approach with an altitude constraint above 10,000 feet MSL in the FMC.

Information in this bulletin is recommended by The Boeing Company, but may not be FAA approved at the time of writing. In the event of conflict with the FAA approved Airplane Flight Manual (AFM), the AFM shall supersede. The Boeing Company regards the information or procedures described herein as having a direct or indirect bearing on the safe operation of this model airplane.

THE FOLLOWING PROCEDURE AND/OR INFORMATION IS EFFECTIVE UPON RECEIPT

Background Information

During simulator testing, an anomaly was identified when attempting to fly an instrument approach using VNAV for an RNAV (RNP) procedure having a missed approach point with an altitude constraint above 10,000 feet MSL.

The FMC builds the descent path upward and back in the direction of the Final Approach Fix (FAF) by starting at the location of the missed approach waypoint (MAP) and its associated altitude constraint. The FMC calculates this path using the coded Glide Path (GP) angle, also called the vertical angle. The MAP is normally shown on the LEGS page as an RWxx or MXxx waypoint. When the MAP is the runway threshold, the altitude constraint is typically the threshold elevation plus threshold crossing height.

For a missed approach point with an altitude constraint above 10,000 feet MSL, the FMC does not consider the altitude constraint to be valid. The FMC uses the airport elevation rather than the MAP altitude as the starting altitude for path construction. The difference between the missed approach point altitude constraint and the airport elevation results in an incorrect VNAV path.

This anomaly exists in FMC Updates U7.1 and later. The anomaly will be corrected in FMC Update U11, currently scheduled for release in the 4th quarter of 2010.

Boeing recommends operators evaluate this information to determine if it is applicable to their flight operations by reviewing their approach procedures to airports with an elevation above 9000 feet. A decision can then be made as to whether it is necessary to release this bulletin to Flight Crew.

Operating Instructions

1. On an approach procedure that has a missed approach point with an altitude constraint above 10,000 feet MSL, do not use VNAV after the Final Approach Fix (FAF). LNAV or other appropriate roll modes may be used through the approach procedure.
2. Do not use the VNAV path deviation indication on the MAP display or the Vertical Deviation (VERT DEV) information on the FMC Descent page for descent rate guidance after passing the FAF.
3. Ensure compliance with each minimum altitude constraint on the final approach segment (step-down fixes).

Administrative Information

Insert this bulletin behind the Bulletin Record page in Volume 1 of your Flight Crew Operations Manual (FCOM). Amend the FCOM Bulletin Record page to show bulletin TBC-76 "In Effect" (IE).

This FCOM bulletin will remain in effect until Boeing is informed that all affected airplanes in your fleet have FMC Update U11 installed.

Please send all correspondence regarding Flight Crew Operations Manual Bulletin status, to the 737 Manager, Flight Technical Data, through the Service Requests Application (SR App) on the MyBoeingFleet home page.

Flight Crew Operations Manual Bulletin
for
The Boeing Company

The Boeing Company
Seattle, Washington 98124-2207

737

Number: TBC-77

IssueDate: April 27, 2009

Subject: Nuisance Predictive Windshear (PWS) Fail Annunciations with the Honeywell RDR-4000 Weather Radar

Reason: This bulletin informs flight crews of a nuisance PWS FAIL annunciation on airplanes with the Honeywell RDR-4000 weather radar system installed.

Information in this bulletin is recommended by The Boeing Company, but may not be FAA approved at the time of writing. In the event of conflict with the FAA approved Airplane Flight Manual (AFM), the AFM shall supersede. The Boeing Company regards the information or procedures described herein as having a direct or indirect bearing on the safe operation of this model airplane.

THE FOLLOWING PROCEDURE AND/OR INFORMATION IS EFFECTIVE UPON RECEIPT

Background Information

Boeing Flight Test has experienced PWS FAIL annunciations after landing due to qualifier faults on takeoff, missed approach and go-around on B737 airplanes with the Honeywell RDR-4000 weather radar (WXR) system installed.

In order to ensure the WXR is actively scanning for windshear events ahead of the airplane during takeoff and landing, Boeing and Honeywell have incorporated qualifiers to automatically activate the WXR in the event the pilots do not have it selected on at least one Navigation Display. If a qualifier check fails during takeoff, missed approach or go-around, the PWS will continue to function correctly for the current flight. The PWS FAIL annunciation will display when the airplane is below 25 feet AGL and the airspeed is below 60 KCAS.

Honeywell is scheduled to release a software modification in the 3rd quarter of 2009 to address these faults.

Operating Instructions

If PWS FAIL is annunciated after landing, when the airplane decelerates below 60 KCAS, inform maintenance personnel of the annunciation upon completion of the flight.

Administrative Information

Insert this bulletin behind the Bulletin Record page in Volume 1 of your Flight Crew Operations Manual (FCOM). Amend the FCOM Bulletin Record page to show bulletin TBC-77 "In Effect" (IE).

This FCOM bulletin will remain in effect until Boeing is informed that all affected airplanes in your fleet have the Honeywell software Mod 5 installed.

Please send all correspondence regarding Flight Crew Operations Manual Bulletin status, to the 737 Manager, Flight Technical Data, through the Service Requests Application (SR App) on the MyBoeingFleet home page.

Flight Crew Operations Manual Bulletin
for
The Boeing Company

The Boeing Company
Seattle, Washington 98124-2207

737

Number: TBC-79

IssueDate: June 26, 2009

Subject: VNAV Not to Be Used for Approach Operations with FMC Update U10.8 Installed

Reason: This bulletin informs flight crews that VNAV approaches are no longer authorized with FMC Update U10.8 software installed.

Information in this bulletin is recommended by The Boeing Company, but may not be FAA approved at the time of writing. In the event of conflict with the FAA approved Airplane Flight Manual (AFM), the AFM shall supersede. The Boeing Company regards the information or procedures described herein as having a direct or indirect bearing on the safe operation of this model airplane.

THE FOLLOWING PROCEDURE AND/OR INFORMATION IS EFFECTIVE UPON RECEIPT

Background Information

An operator with FMC Update U10.8 installed has reported incidents in which an inappropriate STEEP DESCENT AFTER XXXXX message is displayed, where XXXXX is the name of a waypoint in the flight plan. Upon reaching the specified waypoint, the autoflight system commands the airplane to descend below the expected path on approach. GE has been able to reproduce the anomaly and has identified that the issue is due to incorrect prediction logic.

The VNAV descent path is predicted backwards, starting at the destination and ending at cruise altitude. GE has determined that an error in FMC Update U10.8 results in the VNAV path being built to the wrong waypoint, specifically to a waypoint with an AT constraint upstream of the waypoint where the steep descent takes place.

This can occur during descent or approach where a waypoint with an AT OR ABOVE constraint is between two waypoints with AT constraints. It is possible that an error in the prediction logic will calculate an incorrect path between the AT waypoints that is lower than the published navigation database (NDB) path. Under these conditions, the published NDB path is not honored, and after sequencing the waypoint with the AT OR ABOVE constraint, the aircraft may attempt to dive to capture the incorrect predicted path.

During analysis, it was determined that the STEEP DESCENT message may not always be displayed when this anomaly occurs. The STEEP DESCENT message only indicates that the vertical path discrepancy is 200 feet or more. A discrepancy of less than 200 feet will not be annunciated by the STEEP DESCENT message.

This anomaly exists only in FMC Update U10.8; VNAV approaches can still be flown with FMC Update U10.7 and earlier. A correction to the software is planned for U10.8A.

Operating Instructions

With FMC Update U10.8 installed, do not fly any instrument approach using VNAV.

Use a conventional approach, if available. If an RNAV approach without GP or VNAV guidance is absolutely required, consider flying the approach using V/S by selecting the approach procedure from the arrivals page of the FMC. Do not use the VNAV path deviation indication on the map display for descent rate guidance. Ensure compliance with all minimum altitude constraints on the approach (step-down fixes).

LNAV is still available. IAN and VSD are not affected by this anomaly.

Administrative Information

Insert this bulletin behind the Bulletin Record page in Volume 1 of your Flight Crew Operations Manual (FCOM). Amend the FCOM Bulletin Record page to show bulletin TBC-79 "In Effect" (IE).

This FCOM bulletin will remain in effect until Boeing is informed that all affected airplanes in your fleet have FMC Update U10.7 and earlier, or U10.8A installed.

Please send all correspondence regarding Flight Crew Operations Manual Bulletin status, to the 737 Manager, Flight Technical Data, through the Service Requests Application (SR App) on the MyBoeingFleet home page.

Flight Crew Operations Manual Bulletin
for
The Boeing Company

The Boeing Company
Seattle, Washington 98124-2207

737

Number: TBC-80

IssueDate: July 17, 2009

Subject: Reversion from FMC Update U10.8 to Update U10.7 or earlier

Reason: This bulletin informs flight crews of information in the Flight Crew Operations Manual and QRH that will no longer be applicable following removal of FMC Update U10.8.

Information in this bulletin is recommended by The Boeing Company, but may not be FAA approved at the time of writing. In the event of conflict with the FAA approved Airplane Flight Manual (AFM), the AFM shall supersede. The Boeing Company regards the information or procedures described herein as having a direct or indirect bearing on the safe operation of this model airplane.

THE FOLLOWING PROCEDURE AND/OR INFORMATION IS EFFECTIVE UPON RECEIPT

Background Information

In accordance with Service Bulletin SB 737-34A2207 dated 29 June 2009, Boeing Multi-Operator Message (MOM) MOM-MOM-09-0338-01B dated 15 June 2009, and Fleet Team Digest article 737NG-FTD-34-09007 dated 09 July 2009, FMC Update U10.8 software should be removed from all 737NG airplanes. In addition, an information notice has been released against U10.8 retrofit bulletin 737-34A2104 to advise operators that U10.8 should not be retrofitted in the 737NG. Operators should reinstall FMC Update U10.7 or the operator's previous FMC software configuration.

Upon deactivation of U10.8, the following Flight Crew Operations Manual (FCOM) and QRH sections are no longer in effect. All other content will apply.

Volume 1

1. Normal Procedures, Amplified Procedures. Section NP21: "Before Start Procedure". The step "Arm VNAV" is not applicable. Arming VNAV on the ground is not authorized with FMC Update U10.7 or earlier.
2. Normal Procedures, Amplified Procedures. Section NP21: "Takeoff Procedure". The procedure associated with arming VNAV on the ground is not applicable.

Volume 2

1. (For revisions dated June 5, 2009 and later) Chapter 11. Section 32: Flight Management Computer. The section "Software Exception Handling Logic" is not applicable.
2. Chapter 11. Section 40: FMC Preflight (Identification Page) Update 10.8 (U10.8)
3. Chapter 11. Section 41: FMC Takeoff and Climb. The following paragraphs from the section "VNAV Armed for Takeoff" are not applicable. Arming VNAV on the ground is not authorized with FMC Update U10.7 or earlier.

   (For revisions dated June 5, 2009 and later)

   "The CDS will annunciate VNAV armed on the FMA when VNAV is selected prior to takeoff and it is capable of being armed. On takeoff and after reaching 400 feet above the runway, the FCC will automatically engage VNAV if armed."

   "To prevent the FCC from engaging on-ground in VNAV SPD mode, if the FCC engages on-ground, the FMC will clear its VNAV valid discrete, which will force the FCC to disengage. The FMC will retain the last valid MCP speed that was above 60 knots that existed prior to the FCC engaging, and will output that as the FMC speed."

   (For revisions dated June 5, 2009 and later)

   "The FMC engine-out mode will not be set when the groundspeed is less than 60 knots. If the engine-out mode is set while on the ground, the FMC will exit the mode when the speed drops below 60 knots. Engine-out speeds will be available if an engine fails on takeoff after 60 knots."

   (For revisions dated June 5, 2009 and later)

   "Prediction displays will be blanked on the MCDU pages when engine failure is detected and airspeed is over 60 knots of ground speed. Route (RTE) data, estimated time of arrival (ETA) data and top of climb (TOC) data displayed on the CDS Navigation Display will be blanked when an engine-out condition has been detected by the FMC. Engine-out will be cleared and the target speed and predictions will return to normal two engine values when the crew selects and EXECutes the ALL ENGINE prompt on the CLB page, or the CRZ or DES phase is entered, or a Flight Complete occurs, regardless of how many engines are running."

   (For revisions dated June 5, 2009 and later)

   "A new FMC CDU message (ENTER EO CRZ SPD AND ALT) will be displayed when the engine-out operation is terminated due to reaching cruise altitude or the pilot depresses the ALL ENGINE prompt button on the climb page."

4. (For revisions dated June 5, 2009 and later) Chapter 11. Section 41: FMC Takeoff and Climb. The following paragraphs from the section “Engine Out Operation” are not applicable.

   • “Improved Engine-Out logic addresses the unintentional initiation of the FMC Engine-Out mode

   • FMC Engine-Out mode will not be set when the groundspeed is less than 60 kt. If Engine-Out mode is set while on the ground, the FMC will exit the mode when the speed drops below 60 kts.

   • Engine-Out speeds will be available if an engine fails on takeoff after 60 knots of ground speed.

   • Predictions will be blanked on the MCDU pages when an engine failure is detected and airspeed is over 60 knots groundspeed. Route (RTE) data, Estimated Time of Arrival (ETA) data and Top of Climb (T/C) data displayed on the CDS Navigation Display will be blanked when an engine-out condition has been detected by the FMC.

   • Engine-out will be cleared and the target speed and predictions will return to normal two engine values when the crew selects and EXECutes the ALL ENGINE prompt on the CLB page, or CRZ or DES phase is entered, or a Flight Complete occurs, regardless of how many engines are running.

   • A new FMC CDU message (ENTER EO CRZ SPD AND ALYT) will be displayed when the Engine Out operation is terminated due to reaching cruise altitude or by the pilot pressing the ALL ENGINE prompt on the climb page.”

5. Chapter 11 Section 60: FMC Messages. The following FMC Alerting Messages are not applicable.

   • ENTER EO CRZ SPD AND ALT

   • INVALID INACTIVE PLAN

   • INVALID MOD PLAN

   • VNAV INVALID-PERF

   (For revisions dated June 5, 2009 and later)

   • FMC DISAGREE (U10.8 and later)

QRH

(Applies to all Revision dates)

1. Maneuvers, Flight Patterns: “Takeoff Procedure”. The procedure associated with arming VNAV on the ground is not applicable. Arming VNAV on the ground is not authorized with FMC Update U10.7 or earlier.

Administrative Information

Insert this bulletin behind the Bulletin Record page in Volume 1 of your Flight Crew Operations Manual (FCOM). Amend the FCOM Bulletin Record page to show bulletin TBC-80 "In Effect" (IE).

This bulletin will be cancelled in a future revision of the FCOM.

Please send all correspondence regarding Flight Crew Operations Manual Bulletin status, to the 737 Manager, Flight Technical Data, through the Service Requests Application (SR App) on the MyBoeingFleet home page.

Flight Crew Operations Manual Bulletin
for
The Boeing Company

The Boeing Company
Seattle, Washington 98124-2207

737

Number: TBC-81

IssueDate: March 26, 2010

Subject: Inflight Elevator Tab Vibration

Reason: This bulletin informs 737NG flight crews of the potential for elevator tab vibration that may lead to significant structural damage.

Information in this bulletin is recommended by The Boeing Company, but may not be FAA approved at the time of writing. In the event of conflict with the FAA approved Airplane Flight Manual (AFM), the AFM shall supersede. The Boeing Company regards the information or procedures described herein as having a direct or indirect bearing on the safe operation of this model airplane.

THE FOLLOWING PROCEDURE AND/OR INFORMATION IS EFFECTIVE UPON RECEIPT

Background Information

Boeing has recently received a report from an operator that the failure of the aft attach lugs on the left elevator tab control mechanism resulted in unwanted elevator vibration during flight. The flight crew diverted from the intended route and made an uneventful landing.

Investigation revealed that the fractured aft attach lugs on the elevator tab control mechanism allowed free-play of the aft end of the mechanism, which in turn allowed movement of the forward end of the elevator tab control rods. The result of this condition was unexpected vibration of the elevator during flight.

Flight crews should be aware that there are many causes of airframe vibration, including free-play in movable surfaces, system or engine malfunctions, and environmental factors. Elevator tab vibration can occur during any phase of flight and is characterized as a clearly noticeable moderate to severe vertical motion in the flight deck and aft cabin. This vibration is characterized as a low frequency vertical vibration in which motion of items attached to airplane structure, such as sun visors, may be noticeable. In some cases, pilots have reported feeling vibration in the control column and rudder pedals as this vertical motion is transmitted through the structure and cables to the controls. If the cause of the vibration is suspected to be due to empennage control surfaces, the discrepancy should be corrected prior to further revenue flight.

Boeing recommends that operators aggressively investigate, identify, and correct the cause of the vibration prior to returning the airplane to revenue service. If exposed to recurrent or chronic vibration, control surfaces can experience significant structural damage.

Operating Instructions

If vibration is suspected due to the elevator tab, reduce airspeed smoothly until the vibration stops, using the thrust levers and pitch attitude. Do not use speed brakes or change airplane configuration to reduce airspeed. Do not reduce airspeed below the minimum speed for the existing flap setting and gross weight. Consider landing at the nearest suitable airport.

Stay at or below the reduced airspeed at which the vibration stopped for the rest of the flight. Limit bank angle to 15° until below 20,000 feet.

Do not deploy the speedbrakes for the remainder of the flight.

Flaps and landing gear can be extended normally during the approach and landing. The speedbrake can be armed for landing.

The vibration occurrence should be reported to maintenance for resolution before further flight. The logbook entry should emphasize that the vibration is suspected to be in the area of the elevator tab and tab control system.

Administrative Information

Insert this bulletin behind the Bulletin Record page in Volume 1 of your Flight Crew Operations Manual (FCOM). Amend the FCOM Bulletin Record page to show bulletin TBC-81 "In Effect" (IE).

Please send all correspondence regarding Flight Crew Operations Manual Bulletin status, to the 737 Manager, Flight Technical Data, through the Service Requests Application (SR App) on the MyBoeingFleet home page.

Flight Crew Operations Manual Bulletin
for
The Boeing Company

The Boeing Company
Seattle, Washington 98124-2207

737

Number: TBC-85

IssueDate: January 10, 2011

Subject: Impact of Arming VNAV on the Ground on the Windshear Escape Maneuver (FMC Update 10.8 and 10.8A)

Reason: This bulletin informs 737NG flight crews of the need to revise the windshear escape maneuver if VNAV has been armed on the ground for takeoff (FMC Update 10.8 and 10.8A).

Information in this bulletin is recommended by The Boeing Company, but may not be FAA approved at the time of writing. In the event of conflict with the FAA approved Airplane Flight Manual (AFM), the AFM shall supersede. The Boeing Company regards the information or procedures described herein as having a direct or indirect bearing on the safe operation of this model airplane.

THE FOLLOWING PROCEDURE AND/OR INFORMATION IS EFFECTIVE UPON RECEIPT

Background Information

During airline simulator evaluations of FMC Update 10.8A, an unintended consequence of arming VNAV for takeoff was discovered with respect to the windshear escape maneuver. If VNAV is armed on the ground, it will remain armed even if TO/GA is pressed below 400 feet AFE in accordance with the windshear escape maneuver. At 400 feet AFE, VNAV will engage and windshear guidance will be lost. TO/GA must be pressed a second time when above 400 feet AFE in order to regain the appropriate windshear guidance.

This condition exists on FMC Update 10.7, 10.8 and 10.8A. Arming VNAV on the ground is not permitted prior to Update 10.8, however.

Boeing and GE are discussing a potential fix for this anomaly in a future FMC software update.

Operating Instructions

Arming VNAV on the ground is not permitted with FMC Update 10.7 or earlier.

With U10.8 or 10.8A installed, if unstable weather conditions are present prior to takeoff, consider not arming VNAV for takeoff.

If VNAV has been armed for takeoff and windshear is encountered, press either TO/GA switch and accomplish the Windshear Escape Maneuver. If windshear conditions continue above 400 feet AFE, press either TO/GA switch a second time when above 400 feet AFE. Verify TO/GA engagement and continue the Windshear Escape Maneuver.

Administrative Information

Insert this bulletin behind the Bulletin Record page in Volume 1 of your Flight Crew Operations Manual (FCOM). Amend the FCOM Bulletin Record page to show bulletin TBC-85 "In Effect" (IE).

This FCOM bulletin will be revised to include Service Bulletin information when available.

Please send all correspondence regarding Flight Crew Operations Manual Bulletin status, to the 737 Manager, Flight Technical Data, through the Service Requests Application (SR App) on the MyBoeingFleet home page.

Flight Crew Operations Manual Bulletin
for
The Boeing Company

The Boeing Company
Seattle, Washington 98124-2207 737

Number: TBC-86 R1

IssueDate: June 5, 2013

Subject: U10.8A FMC Restarts from ATS (Air Traffic Services) or AOC (Aeronautical Operational Control) Datalink issues

Reason: This bulletin informs 737NG/BBJ flight crews of the possibility of the FMC resetting or of the FMC prompt on the MCDU Menu page flashing when using ATS or AOC Datalink.

Information in this bulletin is recommended by The Boeing Company, but may not be FAA approved at the time of writing. In the event of conflict with the FAA approved Airplane Flight Manual (AFM), the AFM shall supersede. The Boeing Company regards the information or procedures described herein as having a direct or indirect bearing on the safe operation of this model airplane.

THE FOLLOWING PROCEDURE AND/OR INFORMATION IS EFFECTIVE UPON RECEIPT

Background Information

ATS Datalink issue:

A condition present in the Update 10.8A FMC software may cause any of the following anomalies:

- FMC software to perform a restart
- Flashing of the FMC prompt on the MCDU Menu page when using ADS
- Significant slowdown of FMC operation.

The condition is due to the FMC retaining unused ADS downlink messages in its Air Traffic message queue. These messages can be erroneously retained in the FMC queue after an unexpected loss of the HF or SATCOM data link between the airplane and the ground.

This condition has been reported to occur during operation of the FMC FANS-1 ATS data link.

The following is required for the condition to occur:

The airplane is equipped with an FMC that has ATS data link functionality enabled in its OPC (Operational Program Configuration) software. If the airplane has logged onto an Air Traffic Services (ATS) connection, the FMC attempts to send an ADS downlink via HF or SATCOM. If the data link transmission medium (either HF or SATCOM) is interrupted and the FMC message is not cleared by the FMC (due to transmission interruption or data conflict between the airplane and ground station) it can remain in the FMC message queue. This can result in very sluggish FMC operation and can possibly result in the FMC performing a software restart.

AOC Datalink issue:

On airplanes with ACARS Management Unit (MU) or Communications Management Unit (CMU), if the VHF radio is used in DATA mode when the airplane is not within the range of the service provider, the automatic ACARS service provider sign-in message will not be acknowledged. The sign-in message will also not be acknowledged when the operator does not have a subscription to an ACARS service provider.

The lack of acknowledgement causes the message to be retained in the FMC queue which may result in flashing of the FMC prompt on the MCDU Menu page or slowdown of FMC operation.

A correction to the software to provide a fix for both conditions is planned for FMC Update U11.

Operating Instructions

To avoid the ATS Datalink condition, do not log onto ATS.

To avoid the AOC Datalink condition, do not use the VHF radio in DATA mode when outside the service range of the ACARS service provider, or if the airline does not have a subscription to an ACARS service provider.

On the ground:

After power up, switch the VHF radio to VOICE mode from DATA mode.

If either problem occurs in flight:

1. Select the VHF radio to VOICE mode from DATA mode
2. Set the FMC Source Select switch to BOTH ON R (if dual FMC installed). This facilitates logging off SATCOM (if installed). The switch can be set back to NORMAL after logging off
3. Logoff the SATCOM system (if installed)
4. If HF datalink is present, select the HF radio to VOICE mode from DATA mode
5. Do not use ATS or AOC Datalink for the rest of the flight

6. Record the event in the logbook for maintenance action prior to next flight to prevent reoccurrence.

Administrative Information

This bulletin replaces bulletin TBC-86 , dated March 25, 2011. Revise the Flight Crew Operations Manual Bulletin Record Page to show bulletin TBC-86 as “CANCELLED” (CANC).

Insert this bulletin behind the Bulletin Record page in Volume 1 of your Flight Crew Operations Manual (FCOM). Amend the FCOM Bulletin Record Page to show bulletin TBC-86 R1 "In Effect" (IE).

This FCOM bulletin will be revised to include Service Bulletin information when available.

Please send all correspondence regarding Flight Crew Operations Manual Bulletin status, to the 737 Manager, Flight Technical Data, through the Service Requests Application (SR App) on the MyBoeingFleet home page.

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Flight Crew Operations Manual Bulletin
for
The Boeing Company

The Boeing Company
Seattle, Washington 98124-2207

737

Number: TBC-88 R2

IssueDate: November 16, 2012

Subject: Impact of Automatic Approaches in 737NG airplanes with Fail-Operational Autoland option into ILS Runway 34, Kagoshima Airport, Japan

Reason: This bulletin informs flight crews operating 737NG airplanes with the Fail-Operational Autoland option of the potential for a hard landing or for significant deviations from the glide slope if pitch oscillations are ignored and the autopilot(s) are left engaged for approach and autoland.

This bulletin has been revised to include information about a software update that will correct this anomaly.

Information in this bulletin is recommended by The Boeing Company, but may not be FAA approved at the time of writing. In the event of conflict with the FAA approved Airplane Flight Manual (AFM), the AFM shall supersede. The Boeing Company regards the information or procedures described herein as having a direct or indirect bearing on the safe operation of this model airplane.

THE FOLLOWING PROCEDURE AND/OR INFORMATION IS EFFECTIVE UPON RECEIPT

Background Information

An operator advised Boeing that the Japanese Civil Aviation Bureau (JCAB) investigated all airlines flying 737NG into Kagoshima (RJFK/KOJ) airport runway 34. Two operators have informed Boeing that several of their 737NG aircraft experienced anomalous pitching motions while on ILS approach into KOJ runway 34.

During single or dual A/P ILS approaches on 737NG airplanes with the Fail-Operational Autoland option, the pre-runway terrain at Kagoshima Airport ILS runway 34 causes an underdamped system response starting around 1400 ft RA.

During these autopilot approaches, around 1000ft AFE (Above Field Elevation) the flight crew may experience GS deviation alerts on the PFD (Glide Slope Pointer and Deviation Scale turns amber and the pointer flashes), illumination of the amber BELOW G/S alert light, vertical speed in excess of 900 ft/min (together with a possible GPWS SINK RATE alert) and 5 deg or more pitch attitude variations.

P/N 227B-COL-AC1-08 software (commonly referred to by Boeing and Rockwell Collins as the P7.0 software) was developed primarily to improve in-service issues encountered by 737NG airplanes with the Fail-Operational Autoland option installed when performing approaches over abrupt terrain variations. If the P7.0 software has been installed, 737NG airplanes with the Fail-Operational Autoland option are capable of performing autopilot approaches below 1000 feet AFE to Kagoshima Airport ILS runway 34.

The P7.0 software update was installed in production at airplane line number 4122, and then at line number 4151 and on. Airplane line number 4122 delivered in July 2012; airplane line number 4151 delivered in August 2012. Authorization for retrofit for earlier line numbers is available.

Operating Instructions

Boeing does not recommend the use of single or dual channel approaches on 737NG airplanes with the Fail-Operational Autoland option below 1000 ft AFE (Above Field Elevation) for approaches to ILS runway 34 at Kagoshima Airport (RJFK/KOJ), Japan, if the P/N 227B-COL-AC1-08 software (P7.0 software) has not been installed.

Flight director (F/D) only, raw data or Head-Up Guidance (HUD) approaches have no restrictions.

737NG airplanes with the Fail Passive Autoland option will perform approach and autoland acceptably at Kagoshima Airport ILS runway 34.

Those operators who intend to include Kagoshima into their route shall seek regulatory approval based on this bulletin.

Administrative Information

This bulletin replaces bulletin TBC-88 R1 , dated November 23, 2011. Revise the Bulletin Record Page to show bulletin TBC-88 R1 as “CANCELLED” (CANC).

Insert this bulletin behind the Bulletin Record page in Volume 1 of your Flight Crew Operations Manual (FCOM). Amend the FCOM Bulletin Record Page to show bulletin TBC-88 R2 "In Effect" (IE).

This bulletin will be cancelled after Boeing is notified that all affected airplanes in your fleet have been retrofit with the P7.0 software.

Please send all correspondence regarding Flight Crew Operations Manual Bulletin status, to the 737 Manager, Flight Technical Data, through the Service Requests Application (SR App) on the MyBoeingFleet home page.

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Flight Crew Operations Manual Bulletin
for
The Boeing Company

The Boeing Company
Seattle, Washington 98124-2207

737

Number: TBC-89 R1

IssueDate: January 9, 2015

Subject: Reduced Engine Response Times

Reason: This bulletin informs 737NG flight crews of slow engine acceleration following thrust reduction at cruise altitude due to a recent EEC software update. The bulletin provides suggested techniques to help prevent excessive airspeed loss.

This bulletin has been revised to provide CFMI Service Bulletin information for EEC software version 7.B.W.

Information in this bulletin is recommended by The Boeing Company, but may not be FAA approved at the time of writing. In the event of conflict with the FAA approved Airplane Flight Manual (AFM), the AFM shall supersede. The Boeing Company regards the information or procedures described herein as having a direct or indirect bearing on the safe operation of this model airplane.

THE FOLLOWING PROCEDURE AND/OR INFORMATION IS EFFECTIVE UPON RECEIPT

Background Information

Boeing has received pilot reports of slow engine acceleration at high altitudes (above FL300) which have resulted in airspeed losses as high as 20 to 30 knots. These reports indicate the events have occurred after thrust is reduced and immediately re-applied. When an airplane experiences an abrupt airspeed increase at high altitude, as might be experienced when encountering a mountain wave, the engine will decelerate to a lower N1 and take longer to accelerate back to full or normal power than is desired.

Analysis of these reports indicates that this is related to the Electronic Engine Control (EEC) software revisions 7.B.U1 and 7.B.V2. Revision 7.B.U1 reduced the engine deceleration and acceleration rates for specific thrust lever transients at high altitude. Revision 7.B.V2 returned the deceleration rate back to normal but retained the reduced acceleration rate. Both versions of the EEC software reduce engine acceleration rate if the throttles are in idle for less than 60 seconds. Slowing the acceleration rate of a heat soaked engine improves engine operability (stall margin) characteristics.

The first software revision was introduced into the 737NG fleet in July 2009 and affects all 737NG airplanes with EEC software version 7.B.U1 or 7.B.V2.

EEC software version 7.B.W is now available from CFMI. When both engines are providing ECS bleed air to the airplane, 7.B.W restores the high altitude accelerations rates to the same rates that were present prior to the reduction introduced in 7.B.U1.

Operating Instructions

Until 7.B.W software is installed, pilots may want to use the following techniques to avoid excessive speed loss due to slow engine acceleration:

1. Use the autopilot and autothrottle as much as possible.
2. When established at cruise altitude, manually select either CLB or CONT on the FMC N1 Limit page. This will ensure maximum available thrust.
3. If the airplane experiences a sudden increase in airspeed that causes the autothrottle to reduce thrust, manually guard the thrust levers to maintain a minimum of 60% N1, if possible. If thrust is reduced below 60% N1, a significantly longer time will be required for the engines to spool up if the time at idle thrust is less than 60 seconds.
4. If the airplane experiences a sudden increase in airspeed, consider using smooth extension of the speed brakes to increase drag and to avoid large thrust reductions.
5. No specific crew actions are needed if the thrust remains at idle for longer than 60 seconds or if the descent is to an altitude below FL300. Normal engine acceleration can be expected in these cases.

Administrative Information

This bulletin replaces bulletin TBC-89 , dated October 1, 2012. Revise the Flight Crew Operations Manual Bulletin Record Page to show bulletin TBC-89 as “CANCELLED” (CANC).

Insert this bulletin behind the Bulletin Record page in Volume 1 of your Flight Crew Operations Manual. Amend the Bulletin Record to show bulletin TBC-89 R1 "In Effect" (IE).

This FCOM bulletin will be cancelled when an operator reports EEC software version 7.B.W has been installed via the applicable CFMI Service Bulletins on all 737NGs in their fleet.

The applicable CFMI Service Bulletins are:

·CFM56-7B S/B 73-0204 “ENGINE FUEL AND CONTROL - Electronic Control Unit (73-21-60) - New Software Versions 7.B.WF3 for SAC and DAC Engines and 7.B.WF2 for SAC Engines” or

·CFM56-7B S/B 73-0203 “ENGINE FUEL AND CONTROL - Electronic Control Unit (73-21-60) - New Software Version 7.B.WF2 for DAC Engines”

Boeing Service Letter 737-73-013-U provides additional information.

Please send all correspondence regarding Flight Crew Operations Manual Bulletin status, to the 737 Manager, Flight Technical Data, through the Service Requests Application (SR App) on the MyBoeingFleet home page.

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Flight Crew Operations Manual Bulletin
for
The Boeing Company

The Boeing Company
Seattle, Washington 98124-2207

737

Number: TBC-90 R1

IssueDate: January 14, 2013

Subject: Thrust Instability Events

Reason: This bulletin informs 737NG flight crews of the possibility of encountering an engine Thrust Instability Event (TIE). The bulletin provides background information and operating instructions to consider when such an event is encountered.

This bulletin has been revised to provide additional information. The operating instructions have been expanded to allow an engine restart in accordance with non-normal checklist guidance after encountering a TIE if deemed necessary.

Information in this bulletin is recommended by The Boeing Company, but may not be FAA approved at the time of writing. In the event of conflict with the FAA approved Airplane Flight Manual (AFM), the AFM shall supersede. The Boeing Company regards the information or procedures described herein as having a direct or indirect bearing on the safe operation of this model airplane.

THE FOLLOWING PROCEDURE AND/OR INFORMATION IS EFFECTIVE UPON RECEIPT

Background Information

Since 2008, a small number of 737NGs operated by three airlines have experienced Thrust Instability Events (TIE). Investigation has led Boeing, GE/CFMI and other specialists involved to suspect intermittent fuel contamination as the most likely, prevailing causal factor.

TIE characteristics of transient thrust oscillations are as follows:

- The thrust instability events can be identified as N1 or N2 oscillations, sometimes resulting in overspeeds. In some cases, rollbacks to sub-idle have been observed after crews retard the thrust to idle during application of memory steps. Data review of the events has shown that retarding the thrust lever to the mid range has supported avoidance of sub-idle exposure and potential engine shutdown.
- Engine parameters fluctuate and generally follow thrust lever movement.

- Events do not result in sustained, un-commanded, upward thrust runaways.
- The difference between Thrust Instability Events and surges is that a surging engine will not exceed the commanded thrust setting, whereas an engine experiencing thrust instability will oscillate both above and below the commanded thrust.

TIE events to date have the following common characteristics:

- All airplanes were fueled at Seattle Tacoma (SEATAC) airport within the month prior to the event.
- Fuel was being supplied from the wing tanks during the events.
- Most events occurred during climb in a non-critical phase of flight. No event has occurred during takeoff or approach.
- Events have not shown to cause engine damage. Therefore, a restart in accordance with the non-normal checklist can be attempted on engines which are shutdown or ran sub-idle.

The root cause of these events is still under investigation, and further information will be provided as soon as a permanent solution is determined.

Operating Instructions

Operators and flight crews should consider the following techniques to appropriately mitigate these events:

- Accomplish the Engine Limit or Surge or Stall non-normal checklist. During the memory items, retard the thrust lever continuously and smoothly, rather than incrementally and/or rapidly. Analysis has shown that gradual thrust lever movement may reduce the duration of the event. During critical flight phases, controlling the airplane is the first priority.
- Allow sufficient time for the affected engine to stabilize prior to making a decision whether to shut down the engine.
- When the engine recovers, smoothly and deliberately advance the thrust levers to attain the desired airspeed.
- If an engine was shut down during a Thrust Instability Event, a restart may be attempted in accordance with the non-normal checklist guidance.

Administrative Information

This bulletin replaces bulletin TBC-90 , dated December 10, 2012. Revise the Bulletin Record Page to show bulletin TBC-90 as “CANCELLED” (CANC).

Insert this bulletin behind the FCOM Bulletin Record page in Volume 1 of your Flight Crew Operations Manual (FCOM). Amend the FCOM Bulletin Record page to show bulletin TBC-90 R1 "In Effect" (IE).

This FCOM bulletin will be revised to include Service Bulletin information when available.

Please send all correspondence regarding Flight Crew Operations Manual Bulletin status, to the 737 Manager, Flight Technical Data, through the Service Requests Application (SR App) on the MyBoeingFleet home page.

Flight Crew Operations Manual Bulletin
for
The Boeing Company

The Boeing Company
Seattle, Washington 98124-2207

737

Number: TBC-92 R1

IssueDate: January 9, 2015

Subject: Thrust Shortfall Condition Caused by Electronic Engine Control (EEC) Software Version 7BV4

Reason: This bulletin informs 737NG flight crews of the possibility of encountering an engine thrust shortfall during the setting of takeoff thrust due to inadvertent activation of the ground over-thrust protection logic in EEC software version 7BV4. The bulletin provides background information and operating instructions to consider when such an event is encountered.

This bulletin has been revised to provide CFMI Service Bulletin information for EEC software version 7.B.W.

Information in this bulletin is recommended by The Boeing Company, but may not be FAA approved at the time of writing. In the event of conflict with the FAA approved Airplane Flight Manual (AFM), the AFM shall supersede. The Boeing Company regards the information or procedures described herein as having a direct or indirect bearing on the safe operation of this model airplane.

THE FOLLOWING PROCEDURE AND/OR INFORMATION IS EFFECTIVE UPON RECEIPT

Background Information

In September 2013, EEC software version 7BV4 was introduced to help maintain thrust during Thrust Instability Events (TIE). As part of the EEC 7BV4 software upgrade, the logic that prevents engine over-thrust on the ground if the engine experiences an upward thrust runaway was also revised.

In some rare instances, and on the ground only, this ground over-thrust protection logic is erroneously triggered during engine start. This will result in a thrust shortfall on the affected engine when the thrust levers are advanced for takeoff. The affected engine will exhibit noticeably slower N1 response and as much as a 35% reduction in N1 (up to a 60% thrust loss) compared to the takeoff thrust target.

In an attempt to provide the demanded thrust, the autothrottle advances the thrust lever of the affected engine further than that of the good engine. This results in a thrust lever split of 1- to 2-knob widths. The engine indications will clearly show the thrust shortfall condition, and the tactile yaw of the airplane due to asymmetric thrust will be obvious.

Since September 2013, four 737NGs with 7BV4 installed have experienced this thrust shortfall on one engine during the takeoff roll prior to 60 knots. Three events resulted in a rejected takeoff, while the fourth event resulted in an air turn back after the takeoff was continued. If the takeoff is continued with the thrust shortfall, performance targets may not be met, and in flight, the thrust shortfall will continue and will not be able to be eliminated by normal crew action.

The possibility for this thrust shortfall condition has only been identified with EEC software version 7.B.V4; prior software versions are not affected.

EEC software version 7.B.W is now available from CFMI. 7.B.W introduced modifications which will inhibit erroneous activation of this logic while the engines are sub idle.

Operating Instructions

The Flight Crew Operations Manual (FCOM) Takeoff Procedure directs both the Pilot Flying (PF) and the Pilot Monitoring (PM) to verify that the correct takeoff thrust is set. The PM monitors engine instruments during the takeoff roll and calls out any abnormal indications.

If a thrust abnormality, as described above, is encountered during the takeoff roll, the takeoff should be rejected. Controlling the thrust levers manually will not fix the thrust shortfall.

The affected engine response can be expected to be slower during the rejected takeoff maneuver. Some thrust asymmetry can be anticipated during thrust reverser operation.

Maintenance action should be taken after this malfunction.

Administrative Information

This bulletin replaces bulletin TBC-92 , dated January 30, 2014. Revise the Flight Crew Operations Manual Bulletin Record Page to show bulletin TBC-92 as “CANCELLED” (CANC).

Insert this bulletin behind the Bulletin Record page in Volume 1 of your Flight Crew Operations Manual (FCOM). Amend the FCOM Bulletin Record page to show bulletin TBC-92 R1 "In Effect" (IE).

This FCOM bulletin will be cancelled when an operator reports EEC software version 7.B.W has been installed via the applicable CFMI Service Bulletins on all 737NGs in their fleet.

The applicable CFMI Service Bulletins are:

·CFM56-7B S/B 73-0204 “ENGINE FUEL AND CONTROL - Electronic Control Unit (73-21-60) - New Software Versions 7.B.WF3 for SAC and DAC Engines and 7.B.WF2 for SAC Engines” or

·CFM56-7B S/B 73-0203 “ENGINE FUEL AND CONTROL - Electronic Control Unit (73-21-60) - New Software Version 7.B.WF2 for DAC Engines”

Boeing Service Letter 737-73-013-U provides additional information.

Please send all correspondence regarding Flight Crew Operations Manual Bulletin status, to the 737 Manager, Flight Technical Data, through the Service Requests Application (SR App) on the MyBoeingFleet home page.

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Flight Crew Operations Manual Bulletin
for
The Boeing Company

The Boeing Company
Seattle, Washington 98124-2207

737

Number: TBC-93

IssueDate: April 1, 2014

Subject: Airspeed Low Aural Alert Anomaly

Reason: This bulletin informs 737NG flight crews of the possibility that the Airspeed Low aural alert may not sound even though airspeed has decreased into the amber band.

Information in this bulletin is recommended by The Boeing Company, but may not be FAA approved at the time of writing. In the event of conflict with the FAA approved Airplane Flight Manual (AFM), the AFM shall supersede. The Boeing Company regards the information or procedures described herein as having a direct or indirect bearing on the safe operation of this model airplane.

THE FOLLOWING PROCEDURE AND/OR INFORMATION IS EFFECTIVE UPON RECEIPT

Background Information

On the 737NG, the airspeed readout box surrounding the current airspeed changes to amber and flashes for 10 seconds when current airspeed decreases 30% or more into the minimum maneuver speed amber band. If the condition persists after ten seconds, the readout box changes color to solid amber until the airspeed is greater than the top of the amber band. On airplanes equipped with the Airspeed Low aural alert, the voice alert annunciates "Airspeed Low, Airspeed Low" at the onset of the condition.

Flight testing has shown that on those airplanes equipped with the Honeywell Mark V-A (MKV-A) EGPWS Software Part Number 69000940-101, the Airspeed Low aural alert may not sound even though airspeed has decreased into the amber band. The airspeed box turns amber reflecting a drop in airspeed 30% or more into the amber band with no corresponding aural alert.

This anomaly can only be present if the airspeed decreases into the amber band while the amber band is rising, e.g., during flap/slat retraction, turbulence, change in load factor, etc. The crew may not receive the Airspeed Low aural alert although the current speed is below the threshold for the alert.

The Honeywell Mark V-A (MKV-A) EGPWS Software Part Number 69000940-101 was installed on Production Line Number 4763 (delivered January 2014), and on Production Line Number 4777 and on. Honeywell plans to issue EGPWS Software Part Number 69000940-102 to correct this condition.

Operating Instructions

Flight crews should monitor airspeed during all phases of flight and call out deviations or changes to instruments during all conditions. If installed, the Air Speed Low aural is a supplemental means of awareness to the visual indication represented to the flight crew on the primary flight display. With or without the Airspeed Low aural, flight crews are expected to monitor the airspeed and call out any unplanned or unexpected deviations in accordance with the Stabilized Approach Criteria and Recommended Callouts listed in the Flight Crew Training Manual.

Crew response to an airspeed low condition will be same with or without the aural alert. At the onset of this condition, flight crews are expected to promptly correct the airspeed to increase the speed above the amber band as indicated on the Primary Flight Display.

Crews should be especially observant of airspeed when operating near or in the amber minimum maneuver speed band.

Administrative Information

Insert this bulletin behind the FCOM Bulletin Record Page in Volume 1 of your Flight Crew Operations Manual (FCOM). Amend the FCOM Bulletin Record Page to show bulletin TBC-93 "In Effect" (IE).

This FCOM bulletin will be cancelled when an operator reports to Boeing that the Honeywell EGPWS Software Part Number 69000940-102 has been installed on all affected 737NGs in their fleet.

Please send all correspondence regarding Flight Crew Operations Manual Bulletin status, to the 737 Manager, Flight Technical Data, through the Service Requests Application (SR App) on the MyBoeingFleet home page.

Flight Crew Operations Manual Bulletin
for
The Boeing Company

The Boeing Company
Seattle, Washington 98124-2207

737

Number: TBC-97 R2

IssueDate: September 19, 2016

Subject: Window Heat Control Unit (WHCU) Initialization Indications

Reason: A new WHCU will be installed on 737NG airplanes at line number 5830 and on. This new WHCU goes through an initialization process when the WINDOW HEAT switches are selected to ON. The initialization process produces indications that could be misinterpreted as abnormal.

This bulletin is being revised to update the functionality of the WHCU during electrical power transfers, and to update the affected line numbers.

Information in this bulletin is recommended by The Boeing Company, but may not be FAA approved at the time of writing. In the event of conflict with the FAA approved Airplane Flight Manual (AFM), the AFM shall supersede. The Boeing Company regards the information or procedures described herein as having a direct or indirect bearing on the safe operation of this model airplane.

THE FOLLOWING PROCEDURE AND/OR INFORMATION IS EFFECTIVE UPON RECEIPT

Background Information

Selection of the WINDOW HEAT switches to the ON position places the new WHCU into an initialization process. The amber window OVERHEAT lights illuminate along with the two master caution lights and the amber ANTI-ICE light on the system annunciator panel because during the initialization process electrical power is not being applied to the windows.

After the initialization process completes, in approximately 3 seconds, the amber window OVERHEAT lights, the two master caution lights, and the amber ANTI-ICE light on the system annunciator panel extinguish. The green window heat ON lights also illuminate.

The illumination of these amber lights during the initialization process does not change the function of the OVERHEAT light during an overheat or loss of electrical power.

Additionally, selecting a different source of electrical power with the WINDOW HEAT switches in the ON position can potentially illuminate the amber window OVERHEAT lights due to electrical current spikes.

The affected WHCU, Boeing Part # 10-61833-8, will be installed on 737NG airplanes from line numbers 5830 to 6029. Airplanes from line number 6030 and on will be delivered with an updated WHCU, Boeing Part # 10-61833-9.

Operating Instructions

The functionality of the new WHCU will affect the following procedures:

Normal Procedures - NP.21

- Preflight Procedures - First Officer

Supplementary Procedures - SP.3

- Window Heat System Tests

Quick Reference Handbook - QRH 3

- WINDOW OVERHEAT

If the window OVERHEAT lights extinguish within 5 seconds of turning the window heat ON, the WHCU is operating normally.

In order to make it easier to differentiate the temporary differences in these procedures, a revision bar has been used.

The above procedures are amended as follows until the WHCU is updated with Boeing Part # 10-61833-9.

NP.21 - PREFLIGHT PROCEDURE - FIRST OFFICER

WINDOW HEAT switches .... ON

Position switches ON at least 10 minutes before takeoff.

Verify the OVERHEAT lights extinguish within 5 seconds.

Note: The master caution and ANTI-ICE system annunciator lights can illuminate.

Verify that the ON lights are illuminated (except at high ambient temperatures).

SP.3 - WINDOW HEAT SYSTEM TESTS

Overheat Test

The overheat test simulates an overheat condition to check the overheat warning function of the window heat system.

WINDOW HEAT switches .... ON

Verify the OVERHEAT lights extinguish within 5 seconds.

Note: The master caution and ANTI-ICE system annunciator lights can illuminate.

WINDOW HEAT TEST switch .... OVHT

OVERHEAT lights - ON

On lights - Extinguish

Lights extinguish after approximately 1 minute.

MASTER CAUTION - ON

ANTI-ICE system annunciator - ON

WINDOW HEAT switches .... Reset

Position the WINDOW HEAT switches OFF, then ON.

Verify the OVERHEAT lights extinguish within 5 seconds.

Note: The master caution and ANTI-ICE system annunciator lights can illuminate.

Power Test

The power test verifies operation of the window heat system. The test may be accomplished when any of the window heat ON lights are extinguished and the associated WINDOW HEAT switch is ON.

WINDOW HEAT switches .... ON

Verify the OVERHEAT lights extinguish within 5 seconds.

Note: The master caution and ANTI-ICE system annunciator lights can illuminate.

Note: Do not perform the power test when all ON lights are illuminated.

WINDOW HEAT TEST switch .... PWR

The controller is forced to full power, bypassing normal temperature control. Overheat protection is still available.

WINDOW HEAT ON lights .... Illuminated

If any ON light remains extinguished, the window heat system is inoperative. Observe the maximum airspeed limit of 250 kts below 10,000 feet.

QRH 3 - WINDOW OVERHEAT

Condition: A window overheat occurs.

1. WINDOW HEAT switch (affected window) .... OFF
2. **Wait** 2 - 5 minutes.
3. WINDOW HEAT switch (affected window) .... ON
4. **Wait** 5 seconds

   Note: The master caution and ANTI-ICE system annunciator lights can illuminate.

5. Choose one:

   Window OVERHEAT light **stays extinguished:**

   Continue normal operation.

   (End of Checklist)

   Window OVERHEAT light **illuminates again:**

   Go to step 6

6. WINDOW HEAT switch (affected window) .... OFF

   Limit airspeed to 250 knots maximum below 10,000 feet.

7. Pull both WINDSHIELD AIR controls. This vents conditioned air to the inside of the windshield for defogging.

   (End of Checklist)

For illumination of the amber window OVERHEAT lights following electrical power transfers, the crew should cycle electrical power to the affected window by completing the above WINDOW OVERHEAT non-normal checklist.

Administrative Information

This bulletin replaces bulletin TBC-97 R1 , dated April 4, 2016. Revise the Flight Crew Operations Manual Bulletin Record Page to show bulletin TBC-97 R1 as “CANCELLED” (CANC).

Insert this bulletin behind the Bulletin Record page in Volume 1 of your Flight Crew Operations Manual (FCOM). Amend the FCOM Bulletin Record page to show bulletin TBC-97 R2 "In Effect" (IE).

This FCOM bulletin will be cancelled when the operator reports to Boeing that all the airplanes in their fleet between line numbers 5830 and 6029 have been retrofitted with the updated WHCU, Boeing Part # 10-61833-9.

Airplanes from line number 6030 and on will be delivered with an updated WHCU, Boeing Part # 10-61833-9. These WHCUs will not necessitate the use of the procedures outlined in this bulletin.

Please send all correspondence regarding Flight Crew Operations Manual Bulletin status, to the 737 Manager, Flight Technical Data, through the Service Requests Application (SR App) on the MyBoeingFleet home page.

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Flight Crew Operations Manual Bulletin
for
The Boeing Company

The Boeing Company
Seattle, Washington 98124-2207

737

Number: TBC-98

IssueDate: April 28, 2016

Subject: NPS Scales Mask ILS/GLS Localizer and Glideslope Fail Flags

Reason: This bulletin informs 737NG flight crews that the ILS/GLS Localizer (LOC) and Glideslope (GS) fail flags are masked by the Navigation Performance Scales.

Information in this bulletin is recommended by The Boeing Company, but may not be FAA approved at the time of writing. In the event of conflict with the FAA approved Airplane Flight Manual (AFM), the AFM shall supersede. The Boeing Company regards the information or procedures described herein as having a direct or indirect bearing on the safe operation of this model airplane.

THE FOLLOWING PROCEDURE AND/OR INFORMATION IS EFFECTIVE UPON RECEIPT

Background Information

Operators with the Navigation Performance Scales (NPS) option need to be aware that if there is an internal failure of the ILS or GLS component of the Multi-Mode Receiver (MMR), the LOC and/or G/S flags are masked by the NPS scales on the failed side Primary Flight Display (PFD).

There are some failures in the ILS /GLS component of the MMR, that cause the station identifier or ILS frequency/GLS channel to remain displayed in the approach reference section of the PFD despite the failure. The aural identifier may or may not be available. However, the anticipation cues (ghost pointers) are not displayed with any type of failure of the ILS/GLS component in the MMR. The approach mode (APP) is still capable of being armed, although it does not capture if the master flight director is on the failed side.

Operating Instructions

Operators with the NPS option should emphasize to their flight crews, the importance of confirming that the localizer and glideslope pointers are shown when preparing to execute an ILS/GLS approach, in accordance with ILS or GLS Landing Procedure in the FCOM. In addition, the anticipation cues should be confirmed to be in view as well. If an MMR failure is suspected, set the EFIS mode selector to APP to confirm the LOC and/or G/S fail flags are shown on the Navigation Display (ND). When a failure of the ILS or GLS component of the MMR is confirmed, select an approach other than an ILS or GLS.

Administrative Information

Insert this bulletin behind the Bulletin Record page in Volume 1 of your Flight Crew Operations Manual (FCOM). Amend the FCOM Bulletin Record page to show bulletin TBC-98 "In Effect" (IE).

This anomaly will be corrected with CDS BP15, currently scheduled for release in mid-2016.

Please send all correspondence regarding Flight Crew Operations Manual Bulletin status, to the 737 Manager, Flight Technical Data, through the Service Requests Application (SR App) on the MyBoeingFleet home page.

Flight Crew Operations Manual Bulletin
for
The Boeing Company

The Boeing Company **Seattle, Washington 98124-2207**	**737**

Number: TBC-99

IssueDate: July 1, 2016

Airplane Effectivity: 737-600/700/800/900 and BBJ Airplanes with U10.2 through U12 FMC Operational Software.

Subject: Incorrect FMC Speed/Altitude Constraints following a runway change with a Standard Terminal Arrival (STAR) and the previous runway already executed in the FMC

Reason: To inform crews on this subject and to provide guidance.

> Information in this bulletin is recommended by The Boeing Company, but may not be FAA approved at the time of writing. In the event of conflict with the FAA approved Airplane Flight Manual (AFM), the AFM shall supersede. The Boeing Company regards the information or procedures described herein as having a direct or indirect bearing on the safe operation of this model airplane.

THE FOLLOWING PROCEDURE AND/OR INFORMATION IS EFFECTIVE UPON RECEIPT

Background Information

An operator reported that during an arrival with a valid STAR and runway active in the FMC flight plan, the landing runway was changed by Air Traffic Control (ATC). After the runway change was made in the FMC, the crew noticed that the waypoint constraints associated with the new RWY selection were incorrect. The FMC software did not automatically update the speed and altitude constraints associated with the new RWY selection in the FMC, with a valid STAR/RWY combination active in the FMC flight plan. The speed/altitude constraints associated with the initial STAR and previous runway assignment remained in the active flight plan.

This results with incorrect waypoint constraints in the FMC flight plan for the STAR with the selection of a new RWY.

This condition was introduced in U10.2 and is present in all versions of FMC software from U10.2 through U12.

Operating Instructions

This condition can be resolved by re-selecting and executing the existing STAR, after the new RWY has been selected in the FMC. This method is less of a workload than manually inserting each waypoint speed/altitude constraint into the FMC. In the event it is not possible to re-enter the STAR, because the airplane is already established on a segment of the ATC-issued STAR, manual entry of each waypoint speed/altitude constraint into the FMC may be necessary. Regardless of which method is used to overcome this situation, it is critical that the pilots carefully review all airspeed and altitude constraints associated with a STAR and RWY, when either are entered or changed in the FMC flight plan.

This anomaly will be corrected in FMC software update U13.

Administrative Information

Insert this bulletin behind the Bulletin Record page in Volume 1 of your Flight Crew Operations Manual (FCOM). Amend the FCOM Bulletin Record Page to show bulletin TBC-99 "In Effect" (IE).

This anomaly will be corrected in FMC software update U13.

Please send all correspondence regarding Flight Crew Operations Manual Bulletin status, to the 737 Manager, Flight Technical Data, through the Service Requests Application (SR App) on the MyBoeingFleet home page.

Flight Crew Operations Manual Bulletin
for
The Boeing Company

The Boeing Company
Seattle, Washington 98124-2207

737

Number: TBC-100

IssueDate: October 17, 2016

Subject: NAV Display Blanking/Blinking After Installation of Common Display System (CDS) BP15

Reason: To Make Flight Crews Aware of Potential NAV Display Blanking/ Blinking with the Installation of Common Display System (CDS) BP15.

Information in this bulletin is recommended by The Boeing Company, but may not be FAA approved at the time of writing. In the event of conflict with the FAA approved Airplane Flight Manual (AFM), the AFM shall supersede. The Boeing Company regards the information or procedures described herein as having a direct or indirect bearing on the safe operation of this model airplane.

THE FOLLOWING PROCEDURE AND/OR INFORMATION IS EFFECTIVE UPON RECEIPT

Background Information

During bench testing of the Common Display System (CDS) software BP15, a combination of conditions were discovered which may cause some Display Units (DUs) to blank or blink.

This situation may manifest itself when all of the following conditions are met:

1. Two (2) functioning Display Electronics Units (DEUs).
2. DISPLAY SOURCE selector is set to AUTO.
3. Six (6) functioning Display Units (DUs).
4. Captain's ND shows MAP with Vertical Situation Display (VSD) selected on the Left Inboard DU.
5. Captain's MAIN PANEL DU and LOWER DU Display selector set to NORM.
6. First Officer's ND shows MAP with VSD selected on the Right Inboard DU.
7. First Officer's MAIN PANEL DU selector set to NORM and LOWER DU Display selector set to ND.

If all of the conditions above are met, and depending on the DEU equipment installed, one of the following anomalies may result:

A. The First Officer’s Right Inboard DU and Lower Center DU will blank or blink, or

B. The First Officer’s Right Inboard DU and Lower DU map background data will freeze or not appear, and the MAP fail flag will appear if the problem persists for more than 30 seconds.

If any of the seven (7) conditions is not met, the Display Units (DUs) will stabilize and the anomaly will stop.

Operating Instructions

On airplanes with CDS BP15 and VSD selected on the inboard DUs by both pilots, the First Officer should not select ND on the lower center display unit to avoid this situation.

Research is being conducted to confirm the root cause of this anomaly. Once the root cause is confirmed, this bulletin will be updated as necessary.

Administrative Information

Insert this bulletin behind the Bulletin Record page in Volume 1 of your Flight Crew Operations Manual. Amend the Bulletin Record to show bulletin TBC-100 "In Effect" (IE).

Please send all correspondence regarding Flight Crew Operations Manual Bulletin status, to the 737 Manager, Flight Technical Data, through the Service Requests Application (SR App) on the MyBoeingFleet home page.

Flight Crew Operations Manual Bulletin
for
The Boeing Company

The Boeing Company
Seattle, Washington 98124-2207

737

Number: TBC-101 R1

IssueDate: December 19, 2016

Subject: Cabin Pressurization Panel Blanking/Dimming Issues

Reason: To inform the crew of failures of the Cabin Pressurization Panel where the indications flicker, become too dim to read, or completely blank.

This bulletin is being revised to update the flight crew procedure in the event the FLT ALT needs to be changed to a higher altitude than the current setting due to a change in cruise altitude.

Information in this bulletin is recommended by The Boeing Company, but may not be FAA approved at the time of writing. In the event of conflict with the FAA approved Airplane Flight Manual (AFM), the AFM shall supersede. The Boeing Company regards the information or procedures described herein as having a direct or indirect bearing on the safe operation of this model airplane.

THE FOLLOWING PROCEDURE AND/OR INFORMATION IS EFFECTIVE UPON RECEIPT

Background Information

The Cabin Pressurization Panel was redesigned to replace obsolete components and was introduced on the 737NG in April 2013 beginning with line number 4413. Similar to the previous panels, it includes three displays: the FLT ALT indicator, LAND ALT indicator, and the outflow Valve Position Indicator, all of which now use LED lighting technology.

Several operators have reported occurrences where the new LED display indications either flicker, become too dim to read, or completely blank. Most of the blanking reports indicate a self-recovery of the panel after a short duration of time. The duration of the effects can vary but it is typically momentary.

The cause of these occurrences is still under investigation by the manufacturer of the Cabin Pressurization Panel but early testing points to possible Electromagnetic Interference (EMI).

The Cabin Pressurization Panel is supplied by United Technologies (UTAS) and is P/N 1019439-1-001, equivalent Boeing P/N is 10-62231-31.

Boeing is working with UTAS to determine the cause of the Cabin Pressurization Panel failures. Once the cause of the problem and the appropriate fix is confirmed it will be introduced at the factory for new airplanes. For airplanes already in service Boeing will communicate appropriate fix instructions.

Currently only the first line number is known for the affected airplanes, 4413. Once the line number for the last affected airplane is determined this FCOM bulletin will be revised. Also included in the revision will be confirmation of the cause of the Cabin Pressurization Panel failures and a time line for the fix.

Operating Instructions

If the Cabin Pressurization Panel display indications flicker, become too dim to read, or completely blank, it is important to note that the pressurization system will function as initially set by the crew. Cabin Pressurization Panel changes do not need to be made if a failure occurs and crew action is not needed or recommended.

If a Cabin Pressurization Panel failure occurs the crew should follow operator specific procedures or policies for reporting the failure.

The following action should be taken:

On the ground:

Do not takeoff.

In flight:

The Cabin Pressurization Panel failure should be momentary. Allow the Cabin Pressurization Panel to self-recover.

If the Cabin Pressurization Panel self-recovers, continue normal operation.

If the Cabin Pressurization Panel does not self-recover, avoid flight plan amendments requiring a change to the FLT ALT or LAND ALT on the Cabin Pressurization Panel.

If a situation requires a change on the Cabin Pressurization Panel to FLT ALT and the display is not visible:

Do not attempt to change the FLT ALT.

If the FLT ALT needs to be changed to a lower altitude than the current setting due to a change in cruise altitude:

No crew action is required. Operate the airplane at the new lower cruise altitude.

If the FLT ALT needs to be changed to a higher altitude than the current setting due to a change in cruise altitude:

No crew action is required. Operate the airplane at the new higher cruise altitude.

Note: Flying above the selected FLT ALT will drive the cabin to the maximum differential pressure. When the maximum cabin differential pressure is reached, the automatic control system will prioritize limiting differential pressure and will stop controlling cabin rate. If the airplane climbs after the maximum differential pressure is reached, the cabin rate will equal the airplane rate.

If a situation requires a change on the Cabin Pressurization Panel to LAND ALT and the display is not visible:

Do not attempt to change the LAND ALT.

Manually control cabin altitude when below 10,000 feet MSL or 3,000 feet above airport elevation, whichever is higher.

Landing must be accomplished with the airplane unpressurized.

Follow guidance provided in the Supplementary Procedures chapter of the Flight Crew Operations Manual (FCOM). Refer to SP.2, Air Systems, Manual Mode Operation.

Note: Verify desired outflow valve movement with changes on the cabin altimeter/differential pressure indicator and the cabin rate of climb indicator.

Administrative Information

This bulletin replaces bulletin TBC-101 , dated October 21, 2016. Revise the Flight Crew Operations Manual Bulletin Record Page to show bulletin TBC-101 as “CANCELLED” (CANC).

Insert this bulletin behind the Bulletin Record page in Volume 1 of your Flight Crew Operations Manual (FCOM). Amend the FCOM Bulletin Record page to show bulletin TBC-101 R1 "In Effect" (IE).

Please send all correspondence regarding Flight Crew Operations Manual Bulletin status, to the 737 Manager, Flight Technical Data, through the Service Requests Application (SR App) on the MyBoeingFleet home page.

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Flight Crew Operations Manual Bulletin
for
The Boeing Company

The Boeing Company
Seattle, Washington 98124-2207

737

Number: TBC-102

IssueDate: December 16, 2016

Airplane Effectivity: **B737-600/700/800/900 and BBJ Airplanes with existing FMC Software including Update U13 (scheduled to be released April 2017).**

Subject: Incorrect FMC Constraint Altitude on a Standard Terminal Arrival Route (STAR) with a Common Waypoint, after Selection of another Approach

Reason: To inform crews about the incorrect FMC Constraint Altitude, when selecting another approach that has a common waypoint with the original STAR in the active flight plan.

Information in this bulletin is recommended by The Boeing Company, but may not be FAA approved at the time of writing. In the event of conflict with the FAA approved Airplane Flight Manual (AFM), the AFM shall supersede. The Boeing Company regards the information or procedures described herein as having a direct or indirect bearing on the safe operation of this model airplane.

THE FOLLOWING PROCEDURE AND/OR INFORMATION IS EFFECTIVE UPON RECEIPT

Background Information

For airplanes with the existing FMC Software, including Update 13, when a selected approach is changed to another approach that has a common waypoint with the original STAR, the FMC will use the higher constraint altitude for the common waypoint.

Operating Instructions

When a selected approach is changed for another approach that has a common waypoint with the original STAR, verify the waypoint constraint altitude after changing the selected approach.

This anomaly will be corrected in FMC software update U14.

Administrative Information

Insert this bulletin behind the Bulletin Record page in Volume 1 of your Flight Crew Operations Manual (FCOM). Amend the FCOM Bulletin Record page to show bulletin TBC-102 as "In Effect" (IE).

This anomaly will be corrected in FMC software update U14.

Please send all correspondence regarding Flight Crew Operations Manual Bulletin status, to the 737 Manager, Flight Technical Data, through the Service Requests Application (SR App) on the MyBoeingFleet home page.

Flight Crew Operations Manual Bulletin
for
The Boeing Company

The Boeing Company
Seattle, Washington 98124-2207

737

Number: TBC-103

IssueDate: April 17, 2017

Airplane Effectivity: B737-600/700/800/900/BBJ Airplanes with FMC Software U11/U12/U13 installed

Subject: VNAV INVALID-PERF Scratchpad Message

Reason: To inform the Flight Crews of an anomaly in which the VNAV INVALID-PERF scratchpad message cannot be cleared unless an approach is selected in the active flight plan.

Information in this bulletin is recommended by The Boeing Company, but may not be FAA approved at the time of writing. In the event of conflict with the FAA approved Airplane Flight Manual (AFM), the AFM shall supersede. The Boeing Company regards the information or procedures described herein as having a direct or indirect bearing on the safe operation of this model airplane.

THE FOLLOWING PROCEDURE AND/OR INFORMATION IS EFFECTIVE UPON RECEIPT

Background Information

During a Boeing flight test the following software exception error was discovered. When certain forecast wind data is entered into the DES FORECAST page and no approach is selected in the active flight plan, FMC predictions stop, VNAV disengages, the VNAV INVALID-PERF scratchpad message shows and the FMC Alert Lights illuminate. This software exception causes the Cost Index (CI) to be replaced with box prompts on the PERF INIT page. The corrective action for VNAV INVALID-PERF scratchpad message is reentering the CI using either the previous or a new value on the PERF INIT page. Following the CI reentry, activating the data modification by pushing the execute (EXEC) key will restart FMC predictions and allow the crew to reengage VNAV.

However, it was discovered that with certain winds entered on the DES FORECAST page, it may not be possible to reenter a CI value on the PERF INIT page until an approach is selected into the active flight plan.

Note: The exact wind data entries that will trigger this anomaly are not known at this time.

Operating Instructions

When wind data is entered into the DES FORECAST page with no approach selected in the active flight plan, and the VNAV INVALID-PERF scratchpad message is shown in flight, an approach should be entered into the active flight plan. This should be followed by reentering the original CI or a new CI on the PERF INIT page. Afterwards, activating the data modification by pushing the execute (EXEC) key will restart FMC predictions and allow the crew to reengage VNAV.

The inability to reenter a CI if the VNAV INVALID-PERF scratchpad message is shown, can be avoided if an approach is selected in the active flight plan prior to the FMC-calculated Top of Descent (TOD), or if winds are not entered on the DES FORECAST page.

Administrative Information

Insert this bulletin behind the Bulletin Record page in Volume 1 of your Flight Crew Operations Manual (FCOM). Amend the FCOM Bulletin Record page to show bulletin TBC-103 as "In Effect" (IE).

This anomaly will be corrected in FMC Software Update U14, scheduled to be released in the second quarter of 2019. This FCOM Bulletin will be revised to include Service Bulletin information when available.

This Bulletin will be cancelled after Boeing is notified that all affected airplanes in your fleet have been retrofitted with FMC Software U14.

Please send all correspondence regarding Flight Crew Operations Manual Bulletin status, to the 737 Manager, Flight Technical Data, through the Service Requests Application (SR App) on the MyBoeingFleet home page.

Flight Crew Operations Manual Bulletin
for
The Boeing Company

The Boeing Company
Seattle, Washington 98124-2207

737

Number: TBC-105 R1

IssueDate: June 26, 2018

Subject: Integrated Approach Navigation (IAN) Anomaly with Localizer Backcourse Approaches

Reason: To inform flight crews operating the 737NG with the Fail-Operational Autoland option of the potential for unexpected deviations or roll oscillations during localizer backcourse approaches flown using IAN.

This bulletin is being revised to update affected airplanes and the FCC software that will correct the anomaly, and to provide Service Bulletin information.

Information in this bulletin is recommended by The Boeing Company, but may not be FAA approved at the time of writing. In the event of conflict with the FAA approved Airplane Flight Manual (AFM), the AFM shall supersede. The Boeing Company regards the information or procedures described herein as having a direct or indirect bearing on the safe operation of this model airplane.

THE FOLLOWING PROCEDURE AND/OR INFORMATION IS EFFECTIVE UPON RECEIPT

Background Information

During 737-8 flight test, while flying a backcourse localizer approach into Idaho Falls (KIDA) Runway 2, the airplane momentarily deviated from the centerline, causing the localizer deviation alert to activate (localizer pointer and deviation scale turn amber and the pointer flashes).

An analysis of the event identified a problem with the runway heading filter. The filter does not correctly account for the 180-degree difference between the course being flown and the MCP selected course during a localizer backcourse approach flown using IAN, on aircraft equipped with the Fail Operational Autoland option and Flight Control Computer (FCC) OPS P10.0 and earlier. Engineering has determined that this anomaly is possible on the 737NG as well as the 737-8.

During these approaches the autopilot/flight director system may command momentary deviations from the localizer backcourse centerline of up to approximately 3/4 of a dot after becoming established on approach, causing the localizer deviation alert to activate.

This anomaly is only possible on 737NG airplanes which have the Fail Operational Autoland and IAN options installed, have FCC OPS P10.0 or earlier, and are prior to Line Number 7154. The runway heading filter issue is expected to be corrected for retrofit with FCC OPS P11.1, scheduled for release in 3Q2018.

Operating Instructions

Do not fly a localizer backcourse approach using IAN until the runway heading filter has been corrected with the installation of FCC OPS P11.1.

Administrative Information

This bulletin replaces bulletin TBC-105 , dated April 25, 2017. Revise the Flight Crew Operations Manual Bulletin Record Page to show bulletin TBC-105 as “CANCELLED” (CANC).

Insert this bulletin behind the Bulletin Record page in Volume 1 of your Flight Crew Operations Manual (FCOM). Amend the FCOM Bulletin Record page to show bulletin TBC-105 R1 as "In Effect" (IE).

This bulletin will be canceled after Boeing is notified that all affected airplanes in your fleet have been retrofitted with the FCC OPS P11.1 software. Retrofit information will be provided by Service Bulletin 737-22A-1322 which is scheduled for release in 3Q2018.

Please send all correspondence regarding Flight Crew Operations Manual Bulletin status, to the 737 Manager, Flight Technical Data, through the Service Requests Application (SR App) on the MyBoeingFleet home page.

Flight Crew Operations Manual Bulletin
for
The Boeing Company

The Boeing Company
Seattle, Washington 98124-2207

737

Number: TBC-106

IssueDate: May 3, 2017

Airplane Effectivity: B737-600/700/800/900/BBJ with Overrun Warning (ORW) system installed

Subject: Overrun Warning (ORW) System Restriction if a Landing Runway is Not Selected or Available n the FMC

Reason: To inform flight crews to inhibit the ORW system if a landing runway is not selected in the FMC and the runway condition is less than dry.

Information in this bulletin is recommended by The Boeing Company, but may not be FAA approved at the time of writing. In the event of conflict with the FAA approved Airplane Flight Manual (AFM), the AFM shall supersede. The Boeing Company regards the information or procedures described herein as having a direct or indirect bearing on the safe operation of this model airplane.

THE FOLLOWING PROCEDURE AND/OR INFORMATION IS EFFECTIVE UPON RECEIPT

Background Information

Testing of the ORW system revealed that if a landing runway is not selected in the FMC ARRIVALS page, the ORW system will only use a DRY runway condition in the system's calculation of landing distance. Thus, if the pilot selects a runway condition that is less than DRY on APPROACH REF Page 2/2 without also selecting a landing runway, the ORW system calculation will not compute properly for the degraded runway condition.

Operating Instructions

Select a landing runway in the FMC. If a landing runway is not available in the FMC and the runway condition is less than DRY, disable the ORW system in accordance with the Overrun Warning (ORW) System Inhibit Operation supplementary procedure.

Administrative Information

Insert this bulletin behind the Bulletin Record page in Volume 1 of your Flight Crew Operations Manual (FCOM). Amend the FCOM Bulletin Record page to show bulletin TBC-106 as "In Effect" (IE).

This anomaly will be corrected in FMC Software Update U14, scheduled to be released in the second quarter of 2019. This FCOM Bulletin will be revised to include Service Bulletin information when available.

This FCOM Bulletin will be cancelled after Boeing is notified that all affected airplanes in your fleet have been retrofitted with FMC Software U14.

Please send all correspondence regarding Flight Crew Operations Manual Bulletin status, to the 737 Manager, Flight Technical Data, through the Service Requests Application (SR App) on the MyBoeingFleet home page.

Flight Crew Operations Manual Bulletin
for
The Boeing Company

The Boeing Company
Seattle, Washington 98124-2207

737

Number: TBC-107

IssueDate: July 17, 2017

Airplane Effectivity: B737-600/700/800/900/BBJ Airplanes

Subject: ADIRU P/N HG2050BC02 Position Drift and Ground Speed Errors

Reason: To inform flight crews of potential ADIRU position drift and ground speed errors when ADIRU P/N HG2050BC02 is installed.

Information in this bulletin is recommended by The Boeing Company, but may not be FAA approved at the time of writing. In the event of conflict with the FAA approved Airplane Flight Manual (AFM), the AFM shall supersede. The Boeing Company regards the information or procedures described herein as having a direct or indirect bearing on the safe operation of this model airplane.

THE FOLLOWING PROCEDURE AND/OR INFORMATION IS EFFECTIVE UPON RECEIPT

Background Information

Boeing has received reports from several 737NG operators of ADIRU position drift and ground speed errors in airplanes equipped with ADIRU P/N HG2050BC02. The root cause of these drift and groundspeed errors has been identified as a reduced accuracy performance caused by a software error in the ADIRU P/N HG2050BC02. The reduced accuracy performance errors are cumulative and increase if the ADIRU goes through a full alignment multiple times during the course of daily operations. The following FMC Alerting messages can be experienced as the drift and ground speed errors increase:

Airplanes with FMC update U10.0 to U10.6:

- “VERIFY POSITION”, or
- “UNABLE REQD NAV PERF – RNP”,

Airplanes with FMC update U10.7 to U10.8A:

- “VERIFY POSITION”,
- “UNABLE REQD NAV PERF – RNP”,
- “IRS POS/ORIGIN DISAGREE”,
- “VERIFY POS: IRS-FMC”,
- “VERIFY POS: IRS-IRS”.

Airplanes with FMC update U11 and onwards:

- "VERIFY POSITION",
- "UNABLE REQD NAV PERF – RNP",
- "IRS-L DRIFT",
- "IRS-R DRIFT",
- "IRS POS/ORIGIN DISAGREE",
- "VERIFY POS: IRS-FMC",
- "VERIFY POS: IRS-IRS".

Operating Instructions

The following procedure is recommended for B737NG airplanes with at least one HG2050BC02 ADIRU installed.

During the Preliminary Preflight Procedure perform a full IRS alignment for one or more of the following:

- On the first flight of the day
- If continuous AC electrical power is not available to the airplane during ground stops
- If 18 hours have elapsed since the last full alignment
- If before the start of a flight, 18 hours will be exceeded since the last full alignment, during the course of the next flight leg.

After alignment is complete, remain in NAV mode as long as possible.

A Fast Realignment, as described in the FCOM SP.11, Supplementary Procedures, may be performed between successive flight legs. This will reset the accumulated position and groundspeed error from the previous flight.

1. Boeing recommends checking the residual ground speed error at the end of each flight and within five (5) minutes of reaching the final parking position. The serviceable limits are:
   a. If operating two consecutive flights: less than fifteen (15) knots at the end of each flight.
   b. If operating a single flight: less than twenty one (21) knots at the end of the flight.
2. This is done by taking the following steps:
   - On the CDU select POS REF page 2/3
   - Note the residual groundspeed on IRS L and IRS R
3. If the residual ground speed error of either IRS is in excess of the serviceable limits in 1 a) and b), record in the appropriate Maintenance Document for maintenance action.

Administrative Information

Insert this bulletin behind the Bulletin Record page in Volume 1 of your Flight Crew Operations Manual (FCOM). Amend the FCOM Bulletin Record page to show bulletin TBC-107 as "In Effect" (IE).

Boeing and Honeywell are in the process of finalizing the solution for ADIRU P/N HG2050BC02. When the solution is determined, a Service Bulletin will be issued on the fix to correct this anomaly for ADIRU P/N HG2050BC02.

This FCOM Bulletin will be revised to include Service Bulletin information when available.

This FCOM Bulletin will be cancelled after Boeing is advised that all airplanes in your fleet have been modified, per the subject Service Bulletin.

Please send all correspondence regarding Flight Crew Operations Manual Bulletin status, to the 737 Manager, Flight Technical Data, through the Service Requests Application (SR App) on the MyBoeingFleet home page.

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Flight Crew Operations Manual Bulletin
for
The Boeing Company

The Boeing Company
Seattle, Washington 98124-2207

737

Number: TBC-108

IssueDate: April 20, 2018

Airplane Effectivity: B737-600/700/800/900/BBJ Airplanes with Rockwell Collins FCC Software Version P8.0 or P9.0 installed

Subject: Descent Below Glide Slope During Approach on 737NG Airplanes With Rockwell Collins Flight Control Computer (FCC) software Version P8.0 or P9.0 Installed

Reason: This bulletin informs flight crews operating 737NG airplanes equipped with Rockwell Collins FCC software P8.0 or P9.0 of the potential to descend below the glideslope during approach.

Information in this bulletin is recommended by The Boeing Company, but may not be FAA approved at the time of writing. In the event of conflict with the FAA approved Airplane Flight Manual (AFM), the AFM shall supersede. The Boeing Company regards the information or procedures described herein as having a direct or indirect bearing on the safe operation of this model airplane.

THE FOLLOWING PROCEDURE AND/OR INFORMATION IS EFFECTIVE UPON RECEIPT

Background Information

Boeing has received reports from 737NG operators that when conducting an ILS approach with the autopilot engaged, APP mode selected on the MCP, and G/S annunciated in green on the Flight Mode Annunciation (FMA), the autopilot did not properly acquire the glideslope. As the airplane descended away from the glideslope centerline the Flight Director (F/D) indicated close to the centered position and the glideslope pointer indicated the airplane below glideslope on the deviation scale.

These events occurred with the autopilot engaged while capturing the glideslope from above with high descent rates (approximately greater than 2000 feet per minute) and late arming of the APP mode. The high descent rate is maintained by the autopilot and can result in the airplane descending below the glideslope requiring flight crew intervention to return to the glideslope centerline.

Boeing has determined that the condition was introduced in FCC software versions P8.0 and P9.0 when a change was incorporated to reduce aggressive pitch-up maneuvers at glideslope capture. The result of the design change is that, following a high descent rate capture, the autopilot may not provide sufficient pitch-up command to reduce the descent rate and acquire the glideslope.

The described descents below glideslope can occur when all of the following conditions are met:

- Glideslope capture above approximately 2500 feet AGL.
- Glideslope capture from above with a descent rate in excess of approximately 2000 fpm.
- Arming the APP mode late, i.e., arming when descending through the glideslope centerline.
- Autopilot engaged (glideslope captures using F/D only are not affected)

It is important to note that even though the reported events occurred during an ILS approach, this anomaly can also occur during a GLS approach or when conducting an instrument approach using IAN.

This anomaly affects 737NG airplanes with the following FCC Operational Program Software (OPS):

P8.0 FCC OPS (227A-COL-AC1-09)

- Boeing Part Number S241A100-509
- Rockwell Collins Part Number 831-5854-180

P9.0 FCC OPS (2272-COL-AC1-10)

- Boeing Part Number S241A100-510
- Rockwell Collins Part Number 831-5854-190

Operating Instructions

Normally the glideslope is captured from below while in level flight. In the event the glideslope needs to be captured from above with the autopilot engaged, use the following recommended techniques and considerations as paraphrased from the Flight Crew Training Manual (FCTM):

- attempt to capture the glideslope prior to the Final Approach Fix (FAF)
- verify the localizer is captured before descending below the cleared altitude or the FAF altitude
- select APP on the MCP and verify that the glideslope is armed
- establish final landing configuration and set the MCP altitude no lower than 1,000 feet AFE
- select the V/S mode and set -1000 to -1500 fpm to achieve glideslope capture and be stabilized for the approach by 1,000 feet AFE. Use of the VSD (as installed) or the green altitude range arc may assist in establishing the correct rate of descent.

- monitor rate of descent and airspeed
- verify correct Flight Mode Annunciations and monitor glideslope deviations.

Note: If the glideslope is not captured or the approach is not stabilized by 1,000 feet AFE, initiate a go-around.

For complete recommended techniques and considerations refer to “Intercepting Glide Slope from Above” in the FCTM found in Chapter 5.

Administrative Information

Insert this bulletin behind the Bulletin Record page in Volume 1 of your Flight Crew Operations Manual (FCOM). Amend the FCOM Bulletin Record page to show bulletin TBC-108 as "In Effect" (IE).

This anomaly will be corrected with the following FCC OPS update which is expected to be available in 3Q2018:

P11.1 FCC OPS (2270-COL-AC2-22)

- Boeing Part Number S241A100-521
- Rockwell Collins Part Number 831-5854-211

This FCOM Bulletin will be canceled after Boeing is notified that all of the affected airplanes in your fleet have been retrofitted with FCC OPS P11.1 or newer.

Please send all correspondence regarding Flight Crew Operations Manual Bulletin status, to the 737 Manager, Flight Technical Data, through the Service Requests Application (SR App) on the MyBoeingFleet home page.

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Flight Crew Operations Manual Bulletin
for
The Boeing Company

The Boeing Company
Seattle, Washington 98124-2207

737

Number: TBC-109

IssueDate: April 23, 2018

Subject: 737 NG Approach Data Block Anomaly with GLS Channel Selected

Reason: To inform the crew of the potential for missing approach data block information when a GLS channel is selected, and prior to the IMMR receiving ground station data.

Information in this bulletin is recommended by The Boeing Company, but may not be FAA approved at the time of writing. In the event of conflict with the FAA approved Airplane Flight Manual (AFM), the AFM shall supersede. The Boeing Company regards the information or procedures described herein as having a direct or indirect bearing on the safe operation of this model airplane.

THE FOLLOWING PROCEDURE AND/OR INFORMATION IS EFFECTIVE UPON RECEIPT

Background Information

Certification flight tests of the Honeywell Integrated Multi-Mode Receiver (IMMR) revealed an anomaly with the presentation of the GLS channel number on the approach data block on the PFD. The GLS channel number can be temporarily shown but subsequently removed.

This anomaly occurs when both of the following conditions are met:

- A GLS channel is tuned and the Ground Based Augmentation System (GBAS) VHF signals are received by the IMMR.
- A new GLS channel corresponding to a different GBAS is tuned and the VHF signals are not yet received by the IMMR.

In addition to the channel number being removed, GLS deviation scales as well as all of the other information on the approach data block can also be removed, including:

- Selected GLS identifier / Selected course
- Runway ID and distance to threshold
- Navigation source reference

Proper GLS approach data block information and GLS deviation scales are restored when the IMMR receives VHF signals from the tuned GBAS.

Honeywell is currently working on a software fix. Once the software fix has been determined, Boeing will communicate appropriate fix instructions.

This anomaly affects 737NG airplanes equipped with:

- Honeywell IMMR Part Number 69002600-0101 and
- Honeywell software 34 MMR OPS P/N HNR55-2601-0501 or
- Honeywell software 34 MMR OPS P/N HNR56-2601-0601.

Operating Instructions

Do not select a GLS channel until completing the Descent Procedure. If after selecting a GLS channel the approach reference and deviation scales are removed, these indications are restored automatically when the airplane is within range of the newly tuned ground station.

Administrative Information

Insert this bulletin behind the Bulletin Record page in Volume 1 of your Flight Crew Operations Manual (FCOM). Amend the FCOM Bulletin Record page to show bulletin TBC-109 as "In Effect" (IE).

The approach data block anomaly is temporary until a fix is implemented. This OMB will be canceled when an operator reports the fix has been installed on all affected airplanes in their fleet.

Please send all correspondence regarding Flight Crew Operations Manual Bulletin status, to the 737 Manager, Flight Technical Data, through the Service Requests Application (SR App) on the MyBoeingFleet home page.

Flight Crew Operations Manual Bulletin
for
The Boeing Company

The Boeing Company
Seattle, Washington 98124-2207

737

Number: TBC-110

IssueDate: November 19, 2018

Airplane Effectivity: B737-600/700/800/900/BBJ Airplanes with FMC Software U11/U12/U13 installed

Subject: Lateral Path Exceedance On Approach Procedures With A Course Reversal

Reason: This bulletin informs flight crews of an FMC software U11, U12 and U13 anomaly which generates an LNAV lateral path exceedance when flying an approach with a course reversal to the inbound leg.

Information in this bulletin is recommended by The Boeing Company, but may not be FAA approved at the time of writing. In the event of conflict with the FAA approved Airplane Flight Manual (AFM), the AFM shall supersede. The Boeing Company regards the information or procedures described herein as having a direct or indirect bearing on the safe operation of this model airplane.

THE FOLLOWING PROCEDURE AND/OR INFORMATION IS EFFECTIVE UPON RECEIPT

Background Information

Boeing and GE have received reports from operators of FMC generated LNAV lateral path exceedances when flying an approach with a course reversal to the inbound leg. Some of these approach procedures commence the course reversal at a specified DME and have a lateral limitation not to exceed XX.X DME. In certain instances, the FMC created path may result in exceeding the DME restriction.

This condition was introduced in FMC U11 when a design change was made to prevent bypasses or discontinuities, based on procedure design of large track changes that are not flyable with high terminal ground speeds.

Operating Instructions

When executing approaches containing distance constrained course reversals on airplanes with FMC Software U11, U12 and U13, crews should be aware of this anomaly and pay particular attention that the lateral path on the Navigation Display (ND) does not exceed the limits indicated on the approach procedure. This can be done by reviewing the procedure as displayed on the ND.

To mitigate this issue, it may be necessary to complete the course reversal using Heading Select (HDG SEL) to avoid a lateral path exceedance.

Administrative Information

Insert this bulletin behind the Bulletin Record page in Volume 1 of your Flight Crew Operations Manual (FCOM). Amend the FCOM Bulletin Record page to show bulletin TBC-110 as "In Effect" (IE).

This anomaly will be corrected in FMC Software update U14.

Please send all correspondence regarding Flight Crew Operations Manual Bulletin status, to the 737 Manager, Flight Technical Data, through the Service Requests Application (SR App) on the MyBoeingFleet home page.

Flight Crew Operations Manual Bulletin
for
The Boeing Company

The Boeing Company
Seattle, Washington 98124-2207

737

Number: TBC-111 R1

IssueDate: September 19, 2019

Subject: All Six Display Units Blanking With CDS BP15 and FMC U12 or Newer Installed

Reason: To make flight crews aware that all six Display Units (DUs) can blank if a runway with a 270 degree true heading is selected on the FMC ARRIVALS page.

This bulletin is being revised to include affected runways 4500 ft or greater in length and 75 ft or greater in width, to update HUD information, and to provide Service Bulletin information.

Information in this bulletin is recommended by The Boeing Company, but may not be FAA approved at the time of writing. In the event of conflict with the FAA approved Airplane Flight Manual (AFM), the AFM shall supersede. The Boeing Company regards the information or procedures described herein as having a direct or indirect bearing on the safe operation of this model airplane.

THE FOLLOWING PROCEDURE AND/OR INFORMATION IS EFFECTIVE UPON RECEIPT

Background Information

An operator recently experienced blanking of all six DUs with a selected instrument approach to a runway with a 270 degree true heading, RWY 25 at PABR. All six DUs stayed blank until a different runway was selected on the FMC ARRIVALS page.

Boeing and Honeywell have determined that all six DUs can blank if certain runways with a 270 degree true heading are selected on the FMC ARRIVALS page and one of the conditions below is met (whichever occurs first):

- the airplane is more than 400 NM from the origin airport
- the airplane is more than half way between the origin and destination airports
- the airplane is within two minutes of the Top of Descent (T/D).

This applies only to airplanes with CDS BP15 and FMC U12 or newer installed. It is important to note that only certain runways with a true heading of 270 degrees selected in the FMC can be affected. The actual landing runway has no effect on displays. Standby instruments are not affected. The HUD (if installed) is available, but the digital barometric altitude on the HUD is referenced to 29.92 and cannot be changed.

Boeing and Honeywell are reviewing worldwide airports with a runway 4500 ft or greater in length and 75 ft or greater in width. At this point, the following runways at the airports listed below are known to be affected:

- 82V RW26 (Pine Bluffs, Wyoming, USA)
- KBJJ RW28 (Wayne County, Ohio, USA)
- KCIU RW28 (Chippewa County, Michigan, USA)
- KCNM RW26 (Cavern City, New Mexico, USA)
- PABR RW25 (Barrow, Alaska, USA)
- SKLM RW28 (La Mina, La Guajira, Colombia)
- SYCJ RW29 (Cheddi Jagan, Georgetown, Guyana)

As Honeywell continues to develop a software solution and to process data, operators are encouraged to report any DU blanking issues to Honeywell and Boeing in order to provide the most effective solution possible to this anomaly.

Operating Instructions

With CDS BP15 and FMC U12 or newer, do not select a runway listed above in the FMC.

If all six DUs blank, select a different runway on the FMC ARRIVALS page. The newly selected runway must have a different runway heading.

Administrative Information

This bulletin replaces bulletin TBC-111. Revise the Flight Crew Operations Manual Bulletin Record Page to show bulletin TBC-111 as “CANCELLED” (CANC).

Insert this bulletin behind the Bulletin Record page in Volume 1 of your Flight Crew Operations Manual (FCOM). Amend the FCOM Bulletin Record page to show bulletin TBC-111 R1 as "In Effect" (IE).

Retrofit information will be provided by Service Bulletin SB 737-31A1880, currently scheduled for release in 4Q2019. This bulletin will be canceled after Boeing is notified that all affected airplanes in your fleet have been retrofitted with CDS BP 15A software. Please report to Boeing the Line Number, Serial Number, or Tabulation Number of all airplanes for which the above has been confirmed.

Please send all correspondence regarding Flight Crew Operations Manual Bulletin status, to the 737 Manager, Flight Technical Data, through the Service Requests Application (SR App) on the MyBoeingFleet home page.

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Flight Crew Operations Manual Bulletin
for
The Boeing Company

The Boeing Company
Seattle, Washington 98124-2207

737

Number: TBC-114

IssueDate: March 22, 2021

Airplane Effectivity: 737-600/-700/-800/-900 Airplanes with Honeywell IMMR Hardware Part Number 69002600-0101.

Subject: Dual loss of GPS for airplanes equipped with Honeywell Integrated Multi-Mode Receiver (IMMR) 69002600-0101 in combination with specific IMMR software installed

Reason: To provide information to flight crews about possible loss of both GPS signals and the related effects.

Information in this bulletin is recommended by The Boeing Company, but may not be FAA approved at the time of writing. In the event of conflict with the FAA approved Airplane Flight Manual (AFM), the AFM shall supersede. The Boeing Company regards the information or procedures described herein as having a direct or indirect bearing on the safe operation of this model airplane.

THE FOLLOWING PROCEDURE AND/OR INFORMATION IS EFFECTIVE UPON RECEIPT

Background Information

There have been reports of a loss of both GPS signals, both on the ground and in flight, on airplanes equipped with Honeywell IMMR. The loss of both GPS signals can last for a couple of minutes to as long as several hours and there is no maintenance or flight crew action that can restore GPS signals. Re-acquisition of valid GPS signals occurs automatically without any flight crew action.

Honeywell has identified the problem to be improper indexing of Global Navigation Satellite System (GLONASS) signals and when all of the following occurs:

- GLONASS satellite COSMOS 2417 (SN 26) is visible
- GPS satellite NAVSTAR 66 (PRN 01) is not visible
- GPS receiver enters acquisition mode.

  Note: The IMMR enters GPS acquisition mode during power up, there are insufficient satellites in view, there is interference, or the GPS receiver enters a self-test.

When the above occurs, the GPS receivers cannot process signals until GLONASS COSMOS 2471 (SN 26) is no longer visible or GPS satellite NAVSTAR 66 (PRN 01) is visible. This can last for a couple of minutes to as long as several hours and there is no maintenance or flight crew action that can restore GPS signals. Re-acquisition of valid GPS signals occurs automatically without any flight crew action.

When a loss of both GPS signals occurs, the following flight deck effects can occur:

- GPS-L INVALID and GPS-R INVALID FMC scratch pad message
- UNABLE REQD NAV PERF-RNP FMC scratch pad and Navigation Display (ND) messages
- VERIFY POS FMC scratch pad message
- TERR POS Navigation Display (ND) message
- TERR FAIL Navigation Display (ND) message
- FMC P/RST lights on the forward panel
- GPS and GLS lights on the aft overhead panel
- GPWS and RUNWAY INOP lights on the right forward panel
- ATC FAIL light on transponder panel due to loss of ADS-B OUT
- Navigation Performance Scales (NPS) indications turn amber as a result of decrease in FMC navigation accuracy.

When a loss of both GPS signals occurs, operational impacts include:

- Inability to conduct operations that **require the use of GPS** including SIDs, enroute operations, STARS, and instrument approaches
- Inability to conduct operations that require ADS-B OUT.

A software fix has been released via Service Bulletin 737-34-3685.

This anomaly affects 737-600/-700/-800/-900 airplanes equipped with:

- Honeywell IMMR Hardware Part Number 69002600-0101 and one of the following Honeywell Software Part Numbers:
  - HNR55-2601-0501,
  - HNR56-2601-0601, or
  - HNR58-2601-0801.

Operating Instructions

If the loss of both GPS signals occurs:

On the ground:

Do not takeoff.

In Flight

Only ground based navigation aids such as VOR, DME, ADF and ILS are available.

Look ahead terrain alerts; TERRAIN TERRAIN PULL UP, CAUTION TERRAIN and TOO LOW TERRAIN are not available.

Note: GPWS alerts are based on radio altitude, barometric altitude, airspeed, glideslope deviation and airplane configuration. These alerts remain valid, and if they occur, do the respective maneuver.

Verify DME UPDATE is ON.

Administrative Information

Insert this bulletin behind the Bulletin Record page in Volume 1 of your Flight Crew Operations Manual (FCOM). Amend the FCOM Bulletin Record page to show bulletin TBC-114 as "In Effect" (IE).

This FCOM Bulletin will be canceled when an operator reports Service Bulletin completion on all affected airplanes in their fleet.

Please send all correspondence regarding Flight Crew Operations Manual Bulletin status, to the 737 Manager, Flight Technical Data, through the Service Requests Application (SR App) on the MyBoeingFleet home page.

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Flight Crew Operations Manual Bulletin
for
The Boeing Company

The Boeing Company
Seattle, Washington 98124-2207

737

Number: TBC-115

IssueDate: April 28, 2021

Airplane Effectivity: All 737-600/700/800/900/BBJ (Fail Operational) with Rockwell Collins FCC 9.0 or 11.1 or Newer

Subject: Localizer Overshoot When Using LNAV to Intercept the Localizer for Fail Operational Airplanes with Rockwell Collins FCC 9.0 or 11.1 or Newer

Reason: This bulletin informs flight crews of affected 737-600/700/800/900/BBJ (Fail Operational) airplanes with Rockwell Collins FCC 9.0 or 11.1 or newer of the potential for localizer overshoot by the Autopilot Flight Director System (AFDS) when using LNAV to intercept the localizer.

Information in this bulletin is recommended by The Boeing Company, but may not be FAA approved at the time of writing. In the event of conflict with the FAA approved Airplane Flight Manual (AFM), the AFM shall supersede. The Boeing Company regards the information or procedures described herein as having a direct or indirect bearing on the safe operation of this model airplane.

THE FOLLOWING PROCEDURE AND/OR INFORMATION IS EFFECTIVE UPON RECEIPT

Background Information

Boeing has received reports from operators of the affected 737-600/700/800/900/BBJ (Fail Operational) airplanes with Rockwell Collins FCC 9.0 or 11.1 or newer that the AFDS did not provide proper guidance when capturing a localizer from certain transitions flown in the LNAV roll mode. These incidents have occurred on transitions with large intercept angles (60 degrees or more) and have resulted in flight through the localizer path (overshoot) during capture.

Flight data have confirmed that during these overshoot events, the AFDS initially banks up to 30 degrees but then reduces bank angle during localizer capture and continues through the final approach course, even when VOR/LOC is the engaged roll mode as shown by the Flight Mode Annunciation (FMA). AFDS correction back to the localizer course may not occur within the distance available to establish a stabilized final approach.

Most overshoot events have been reported on ILS approaches with transition segments which intercept the localizer at 90-degree angles. However, some overshoots have also occurred with intercept angles less than 90 degrees. In these events, LNAV is the engaged roll mode prior to engagement of VOR/LOC during localizer capture.

In all reported overshoot events, deviation from the localizer was accurately shown by the localizer pointer and scale on the primary flight display (PFD) and the navigation display (ND), and by the airplane symbol on the ND.

Boeing has been able to reproduce the overshoot behavior in an engineering simulator and has determined the root cause. Boeing plans to correct the undesired localizer capture behavior in future Rockwell Collins FCC Operational Program Software (OPS).

Operating Instructions

When conducting an approach using LNAV to intercept a localizer-based final approach course, monitor localizer raw data and call out deviations. If an overshoot occurs that exceeds or is likely to exceed stabilized approach criteria, go around.

Administrative Information

Insert this bulletin behind the Bulletin Record page in Volume 1 of your Flight Crew Operations Manual (FCOM). Amend the FCOM Bulletin Record Page to show bulletin TBC-115 "In Effect" (IE).

This undesired localizer capture behavior will be corrected with a future Rockwell Collins FCC OPS.

This FCOM Bulletin will be canceled after Boeing is notified that all of the affected airplanes in your fleet have been retrofitted with the appropriate Rockwell Collins FCC OPS when available.

Please send all correspondence regarding Flight Crew Operations Manual Bulletin status, to the 737 Manager, Flight Technical Data, through the Service Requests Application (SR App) on the MyBoeingFleet home page.

Flight Crew Operations Manual Bulletin
for
The Boeing Company

The Boeing Company
Seattle, Washington 98124-2207

737

Number: TBC-116

IssueDate: April 30, 2021

Airplane Effectivity: All 737-600/700/800/900/BBJ (Fail Passive) with Rockwell Collins FCC 11.1 or Newer

Subject: Localizer Overshoot When Using LNAV to Intercept the Localizer for Fail Passive Airplanes with Rockwell Collins FCC 11.1 or Newer

Reason: This bulletin informs flight crews of affected 737-600/700/800/900/BBJ (Fail Passive) airplanes with Rockwell Collins FCC 11.1 or newer of the potential for localizer overshoot by the Autopilot Flight Director System (AFDS) when using LNAV to intercept the localizer.

Information in this bulletin is recommended by The Boeing Company, but may not be FAA approved at the time of writing. In the event of conflict with the FAA approved Airplane Flight Manual (AFM), the AFM shall supersede. The Boeing Company regards the information or procedures described herein as having a direct or indirect bearing on the safe operation of this model airplane.

THE FOLLOWING PROCEDURE AND/OR INFORMATION IS EFFECTIVE UPON RECEIPT

Background Information

Boeing has received reports from operators of the affected 737-600/700/800/900/BBJ (Fail Passive) airplanes with Rockwell Collins FCC 11.1 or newer that the AFDS did not provide proper guidance when capturing a localizer from certain transitions flown in the LNAV roll mode. These incidents have occurred on transitions with large intercept angles (60 degrees or more) and have resulted in flight through the localizer path (overshoot) during capture.

Flight data have confirmed that during these overshoot events, the AFDS initially banks up to 30 degrees but then reduces bank angle during localizer capture and continues through the final approach course, even when VOR/LOC is the engaged roll mode as shown by the Flight Mode Annunciation (FMA). AFDS correction back to the localizer course may not occur within the distance available to establish a stabilized final approach.

Most overshoot events have been reported on ILS approaches with transition segments which intercept the localizer at 90-degree angles. However, some overshoots have also occurred with intercept angles less than 90 degrees. In these events, LNAV is the engaged roll mode prior to engagement of VOR/LOC during localizer capture.

In all reported overshoot events, deviation from the localizer was accurately shown by the localizer pointer and scale on the primary flight display (PFD) and the navigation display (ND), and by the airplane symbol on the ND.

Boeing has been able to reproduce the overshoot behavior in an engineering simulator and has determined the root cause. Boeing plans to correct the undesired localizer capture behavior in future Rockwell Collins FCC Operational Program Software (OPS).

Operating Instructions

When conducting an approach using LNAV to intercept a localizer-based final approach course, monitor localizer raw data and call out deviations. If an overshoot occurs that exceeds or is likely to exceed stabilized approach criteria, go around.

Administrative Information

Insert this bulletin behind the Bulletin Record page in Volume 1 of your Flight Crew Operations Manual (FCOM). Amend the FCOM Bulletin Record Page to show bulletin TBC-116 "In Effect" (IE).

This undesired localizer capture behavior will be corrected with a future Rockwell Collins FCC OPS.

This FCOM Bulletin will be canceled after Boeing is notified that all of the affected airplanes in your fleet have been retrofitted with the appropriate Rockwell Collins FCC OPS when available.

Please send all correspondence regarding Flight Crew Operations Manual Bulletin status, to the 737 Manager, Flight Technical Data, through the Service Requests Application (SR App) on the MyBoeingFleet home page.

Flight Crew Operations Manual Bulletin
for
The Boeing Company

The Boeing Company
Seattle, Washington 98124-2207

737

Number: TBC-117 R3

IssueDate: June 30, 2023

Airplane Effectivity: 737-600 /-700/-700C /-800 /-900/-900ER

Subject: Radio Altimeter Anomalies Due to 5G C-Band Wireless Broadband Interference in the United States

Reason: Radio altimeters can be unreliable due to interference from 5G C-Band wireless broadband.

This bulletin is being revised to reflect the latest information released by the FAA on 5G C-Band interference.

Information in this bulletin is recommended by The Boeing Company, but may not be FAA approved at the time of writing. In the event of conflict with the FAA approved Airplane Flight Manual (AFM), the AFM shall supersede. The Boeing Company regards the information or procedures described herein as having a direct or indirect bearing on the safe operation of this model airplane.

THE FOLLOWING PROCEDURE AND/OR INFORMATION IS EFFECTIVE UPON RECEIPT

Background Information

Frequency spectrum, power levels, tower location, and antenna direction used by new 5G C-Band wireless broadband technology in the United States can interfere with radio altimeters, especially at lower altitudes. Radio altimeters can fail or present erroneous information, which affects systems using radio altimeter data.

In response to this, the FAA has issued Airworthiness Directives (AD 2023-10-02 and AD 2023-12-13) that prohibit certain operations requiring radio altimeter (RA) data when in the presence of 5G C-Band interference.

Background Information (continued)

The FAA considers these ADs to be an interim action. Once the Technical Standard Order (TSO) standard for radio altimeters is established, which will follow the existing international technical consensus on the establishment of the minimum operational performance standards (MOPS), the FAA anticipates that the MOPS will be incorporated into the TSO. Once a new radio altimeter TSO is developed, approved, and available, the FAA might consider additional rulemaking.

In the interim, an airplane that has equipment installed that meets the tolerances specified in the applicable AD is considered a radio altimeter tolerant airplane. Aircraft unable to meet these tolerances are considered non-radio altimeter tolerant airplanes.

AD 2023-12-13 establishes the new concept of 5G C-Band Mitigated Airports (CMAs). CMAs are airports at which 5G providers have voluntarily agreed to limit 5G C-Band interference through limiting power levels and tower locations. They will be identified through an FAA Domestic Notice, and all 5G NOTAMs and current Alternative Methods of Compliance (AMOCs) will be discontinued as of June 30, 2023. The AD 2023-12-13 requires operational restrictions for radio altimeter tolerant airplanes at non-CMAs and for non-radio altimeter tolerant airplanes at all airports in the contiguous U.S. due to the potential presence of 5G C-Band wireless broadband interference.

The FAA AD 2023-10-02 identifies several types of operations that are prohibited when operating a non-radio altimeter tolerant airplane in the contiguous U.S. airspace:

- Instrument Landing System (ILS) Instrument Approach Procedures (IAP) SA CAT I, SA CAT II, CAT II, and CAT III
- Automatic Landing Operations
- Manual Flight Control Guidance System operations to landing/head-up display (HUD) to touchdown operation
- Use of Enhanced Flight Vision System (EFVS) to touchdown under 14 CFR Part 91.176(a).

The reference to the Manual Flight Control Guidance System in the 3rd bullet above, refers to a HUD mode that provides guidance to touchdown.

5G Interference and Potential Effects on Radio Altimeter Indications

When a radio altimeter is subjected to 5G interference, there are three different possible effects for each radio altimeter:

- Fail Warning: Failure of the radio altimeter results in failure alerts of radio altimeter including flags and other system alerts
- No Computed Data (NCD): No data is generated by the radio altimeter. The data shown on the Primary Flight Display (PFD) and HUD (as installed) will be removed from view, however this condition does not generate an alert since it is a normal condition of the radio altimeter
- Erroneous: Interference causes erroneous data to be sent to airplane systems. The erroneous radio altimeter data in this case will be shown on the PFD and HUD (as installed), however, it can be erroneously high or low.

Background Information (continued)

5G Interference and Potential Effects on Airplane Systems

Flight deck effects may be variable on the 737 and multiple systems can be impacted regardless of the approach type or weather. They include, but are not limited to the following:

Autopilot Flight Director System

- NO AUTOLAND autopilot status annunciation may be shown on the PFD and the HUD (as installed - fail operational autopilot and HUD)
- NO AUTOLAND advisory message may be shown on the engine display (as installed - fail operational autopilot)
- Autopilot disengagement may occur during ILS/GLS approaches (as installed - GLS approach capability)
- Autopilot may not engage
- Flare mode (as installed - fail-passive/fail-operational autopilot) and runway alignment (as installed - fail-operational autopilot) may not be available or may activate earlier or later than expected (ILS; as installed - GLS, IAN)
- Flight director on the PFD and HUD may retract from view during ILS/GLS/IAN approach (as installed - HUD and GLS, IAN approach capability)
- Flight director guidance on the PFD and HUD may be erroneous (as installed - HUD)
- LNAV and VNAV may not engage or engage at an erroneous altitude after departure (as installed)
- Takeoff or Go-Around (TO/GA) mode may not be available.

Autothrottle System

- Autothrottle (A/T) may not be available
- A/T may remain in MCP SPD mode and may advance to maintain speed during flare instead of reducing the thrust to RETARD at 27 feet RA, or may reduce thrust to RETARD prematurely.

Flight Controls

- Automatic speedbrake deployment may not occur after touchdown
- SPEEDBRAKES EXTENDED amber light may not illuminate or may illuminate erroneously
- SPEEDBRAKE time critical visual and aural warnings may not be available (as installed)

5G Interference and Potential Effects on Airplane Systems (continued)

Flight Instruments

- The RA indication on the PFD and HUD may not show or may be erroneous (as installed - HUD)
- The RADIO minimums indications (flashing or turning amber) may not be available or may be erroneous on the PFD and HUD (as installed - HUD)
- Rising runway symbol may not show on the PFD (as installed)
- The localizer/FAC deviation alert (amber scale on the PFD and flashing pointer on the PFD and HUD) may not show (the deviation indications are still available) (as installed - HUD and IAN)
- The glideslope/glidepath deviation alert (amber scale on the PFD and flashing pointer on the PFD and HUD) may not show (the deviation indications are still available) (as installed - HUD and IAN).

Traffic Alert and Collision Avoidance System (TCAS)

- TCAS alerts may not be available (TCAS alerts that do occur will be valid)
- TCAS inhibits for resolution advisories may be erroneous.

Ground Proximity Warning System (GPWS)

- GPWS alerts may not be available or may be erroneous. Look-Ahead Terrain Alerting remains available
- In-Air Overrun, On-Ground Overrun and SPEEDBRAKE warnings may not be available or may be erroneous (as installed)
- Radio altitude-based altitude and minimums aural callouts during approach may not be available or erroneous
- Windshear detection systems (predictive and reactive) may be inoperative.

Configuration Warnings

- Erroneous illumination of the red landing gear indicator lights may occur
- Erroneous steady landing gear warning horn may occur
- Radio Altitude Based Alerts may not be available or may be erroneous.

Warning Systems

- Stall warning test may not be available.

Considerations for Dispatch

- No impacts on takeoff distance
- No impacts to dispatch landing performance calculations
- Adjust operational (time of arrival) landing distance for manual speedbrakes

The instrument approach and autoland prohibitions of 5G interference ADs may impact the destination and alternate weather requirements.

Operating Instructions

When operating in the contiguous U.S. airspace, the flight crews should be alert for system anomalies that have been described above.

For non-radio altimeter tolerant airplanes, comply with the following instructions at airports in the contiguous U.S.

For radio altimeter tolerant airplanes, comply with these instructions at non-CMAs in the contiguous U.S., unless covered by an Alternative Method of Compliance (AMOC).

Monitoring and cross checking of barometric and radio altitude indications can provide early indications of 5G interference. If the autopilot flight director system (AFDS) and autothrottle are not performing as expected, pilots should be prepared to disengage both the autopilot and autothrottle, turn off both flight directors, apply manual inputs to ensure proper control of path and performance, and follow the guidance below for the appropriate phase of flight.

Radio altimeter anomalies may not be evident until very low altitudes. After touchdown, the flight crew should be aware of speedbrake deployment. Landing distances can be longer than normal due to the effect of interference on automatic speedbrake deployment.

Prior to Takeoff

Verify normal radio altimeter indications.

Climb Out

- TO/GA mode may not be available
- Monitor pitch mode engagement.
- Monitor roll mode engagement
- Autopilot may not engage.

Descent

Plan on doing a time of arrival (en route) landing distance assessment using normal landing performance adjusted for manual speedbrake deployment.

Operating Instructions (continued)

During ILS, GLS or IAN Approaches

- Monitor radio altimeters for anomalies
- Monitor performance of the AFDS and autothrottle
- If any of the following occurs, disengage the autopilot and autothrottle, and turn off both flight directors:
  - The flight directors automatically retract from view
  - The FLARE pitch mode engages
  - The autothrottle retards to idle
  - Other suspected 5G interference.

Note: If the runway environment is in sight and in a position to make a safe landing, continue manually to a landing.

Note: If the runway environment is not in sight or not in a position to make a safe landing, manually do a go-around and missed approach procedure, and do not engage the autopilot or autothrottle or turn on either flight director until reaching a safe altitude.

At DA(H), MDA(H), or the missed approach point:

- If the runway environment is in sight and in a position to make a safe landing, do the following and continue for a normal manual landing:
  - Disengage the autopilot
  - Disengage the autothrottle
  - Turn off both flight directors.
- If a go-around is needed, do the go-around and the missed approach procedure either in manual or automatic flight:
  - If the AFDS and autothrottle are not performing as expected, pilots should be prepared to disengage both the autopilot and autothrottle, turn off both flight directors, apply manual inputs to ensure proper control of path and performance.

Operating Instructions (continued)

During Landing

- Radio altitude-based altitude aural callouts during approach may be not available or erroneous
- Manual deployment of the speedbrakes may be needed.

During Go-Around and Missed Approach

- TO/GA mode may not be available
- Monitor thrust and verify that thrust increases to go-around thrust
- Monitor pitch mode engagement, as needed
- Monitor roll mode engagement, as needed.

When at a safe altitude:

- Turn on flight directors and verify pitch and roll modes, as needed
- Engage autopilot, as needed
- Engage autothrottle, as needed.

If Radio Altimeter Anomalies are Experienced

Operators and pilots who experience radio altimeter anomalies should notify air traffic control, as soon as practical. Post flight, follow established procedures or policies to document the radio altimeter anomaly so that the radio altimeters can be checked for proper operation. Pilots are encouraged to submit detailed reports of radio altimeter disruptions or interference events, as soon as practical, using the *Radio Altimeter Anomaly Reporting Form* available on the FAA website at https://www.faa.gov/air_traffic/nas/RADALT_reports/.

Additional References

FAA Safety Alert for Operators SAFO 21007

FAA Special Airworthiness Information Bulletin SAIB AIR-21-18R3

Administrative Information

This bulletin replaces bulletin TBC-117 R2 , dated March 23, 2022. Revise the Flight Crew Operations Manual (FCOM) Bulletin Record Page to show bulletin TBC-117 R2 as “CANCELLED” (CANC).

Insert this bulletin behind the Bulletin Record page in Volume 1 of your Flight Crew Operations Manual (FCOM). Amend the FCOM Bulletin Record page to show bulletin TBC-117 R3 "In Effect" (IE).

This bulletin will be revised when more information becomes available.

Please send all correspondence regarding Flight Crew Operations Manual Bulletin status to Flight Technical Data, through the Service Requests Application (SR App) on the MyBoeingFleet home page.

Flight Crew Operations Manual Bulletin
for
The Boeing Company

The Boeing Company
Seattle, Washington 98124-2207

737

Number: TBC-119

IssueDate: November 9, 2022

Airplane Effectivity: B737-600/-700/-700C/-800/-900/-900ER with FMC U14 or U14.1

Subject: DATALINK FULL Datalink Status Message

Reason: To inform flight crews of a process to clear the DATALINK FULL message and reset the ability to send out datalink messages.

Information in this bulletin is recommended by The Boeing Company, but may not be FAA approved at the time of writing. In the event of conflict with the FAA approved Airplane Flight Manual (AFM), the AFM shall supersede. The Boeing Company regards the information or procedures described herein as having a direct or indirect bearing on the safe operation of this model airplane.

THE FOLLOWING PROCEDURE AND/OR INFORMATION IS EFFECTIVE UPON RECEIPT

Background Information

Boeing has been made aware of a datalink fault on airplanes with Flight Management Computer (FMC) U14 or U14.1. If a datalink download is interrupted, any datalink downloads that follow will not be transmitted. This results in a backlog of datalink messages in the download queue which will eventually result in a DATALINK FULL Control Display Unit (CDU) datalink status message.

This anomaly will be corrected with the installation of FMC U14.2 which is scheduled to be released in 4Q2023.

Operating Instructions

If a DATALINK FULL CDU datalink status message occurs, when workload permits do the following:

FMC source select switch ....BOTH ON R

Wait at least 30 seconds

FMC source select switch ....NORMAL

Datalink messages in the download queue will begin to download automatically as well as any new datalink messages. Repeat steps above as needed.

Administrative Information

Insert this bulletin behind the Bulletin Record page in Volume 1 of your Flight Crew Operations Manual (FCOM). Amend the FCOM Bulletin Record page to show bulletin TBC-119 as "In Effect" (IE).

This FCOM Bulletin will be canceled after Boeing is notified that all affected airplanes in your fleet have installed FMC U14.2.

Please send all correspondence regarding Flight Crew Operations Manual Bulletin status, to Flight Technical Data, through the Service Requests Application (SR App) on the MyBoeingFleet home page.

Flight Crew Operations Manual Bulletin
for
The Boeing Company

The Boeing Company
Seattle, Washington 98124-2207

737

Number: TBC-120

IssueDate: November 11, 2022

Airplane Effectivity: B737-600/-700/-700C/-800/-900/-900ER

Subject: Dual FMC Resets During CPDLC On Airplanes Equipped With FMC U14 or U14.1, and FANS 1 or FANS 2

Reason: To inform flight crews of a possible dual FMC reset anomaly.

Information in this bulletin is recommended by The Boeing Company, but may not be FAA approved at the time of writing. In the event of conflict with the FAA approved Airplane Flight Manual (AFM), the AFM shall supersede. The Boeing Company regards the information or procedures described herein as having a direct or indirect bearing on the safe operation of this model airplane.

THE FOLLOWING PROCEDURE AND/OR INFORMATION IS EFFECTIVE UPON RECEIPT

Background Information

Boeing has received several reports from operators regarding dual Flight Management Computer (FMC) resets during Controller Pilot Data Link Communications (CPDLC). The dual FMC resets can occur after the airplane responds to a CPDLC uplink message by either selecting ACCEPT, REJECT or STANDBY. Review of provided datalink audits show situations where ATC sends an error uplink in response to the airplane sending a downlink response. The ATC error uplink contains a Message Reference Number (MRN) that is the same as the airplane’s downlink MRN. The error uplink can reach the airplane before the airplane receives the ATC Logical Acknowledgment, or Network Acknowledgment in FANS airspace. When this occurs, the downlink response message becomes corrupted which results in a dual FMC reset.

These dual FMC resets have occurred on airplanes equipped with FMC U14 and Future Air Navigation System (FANS) 2, but testing has shown that the dual FMC resets can also occur with FMC U14.1 and FANS 1. As a result, any combination of FMC U14 or U14.1 and FANS 1 or FANS 2 is susceptible to this dual FMC reset anomaly.

Operating Instructions

If a dual FMC reset occurs within 1 minute of a response to a CPDLC uplink, wait 1 minute to allow the FMCs to reset. Once the FMCs have reset, an active waypoint may need to be selected and a CPDLC connection may need to be reestablished.

To prevent the FMC reset from reoccurring, do not:

- Select the error uplink in the ATC LOG page
- Select the original uplink that generated the downlink response in the ATC LOG page (message status will show OPEN).

Note: Selection of the ATC function key on the Multi-purpose Control Display Unit (MCDU) can sometimes cause the dual FMC reset to occur.

During a dual FMC reset, the flight crew can do the FMC FAIL Non-Normal Checklist (NNC) if in the flight crew’s judgment that is the best course of action. The steps in the FMC FAIL NNC will not prevent the FMCs from self resetting per the anomaly described in this bulletin.

Administrative Information

Insert this bulletin behind the Bulletin Record page in Volume 1 of your Flight Crew Operations Manual (FCOM). Amend the FCOM Bulletin Record page to show bulletin TBC-120 as "In Effect" (IE).

This anomaly will be corrected with the installation of FMC U14.2 which is scheduled to be released 4Q2023.

This FCOM Bulletin will be canceled after Boeing is notified that all affected airplanes in your fleet have be retrofitted with FMC U14.2 or newer.

Please send all correspondence regarding Flight Crew Operations Manual Bulletin status, to Flight Technical Data, through the Service Requests Application (SR App) on the MyBoeingFleet home page.

Flight Crew Operations Manual Bulletin
for
The Boeing Company

The Boeing Company
Seattle, Washington 98124-2207

737

Number: TBC-121

IssueDate: April 15, 2023

Airplane Effectivity: All Airplanes

Subject: Flap Lever Operation

Reason: This bulletin provides information on flap lever operation.

Information in this bulletin is recommended by The Boeing Company, but may not be FAA approved at the time of writing. In the event of conflict with the FAA approved Airplane Flight Manual (AFM), the AFM shall supersede. The Boeing Company regards the information or procedures described herein as having a direct or indirect bearing on the safe operation of this model airplane.

THE FOLLOWING PROCEDURE AND/OR INFORMATION IS EFFECTIVE UPON RECEIPT

Background Information

Boeing has received reports of unintentional flap movement, including flap and slat extension in cruise, due to the flap lever migrating aft after partial/incomplete seating in the intended detent. Investigation revealed that airplane vibration or unintentional flight crew contact with the flap lever in this partially seated condition may have contributed to the aftward movement of the flap lever.

The flap control system is cable-driven. The flap lever is connected to cables that rotate a cable quadrant to open the associated control valve. The cables are rigged with a tension “preload” that pulls the flap lever in the aft direction when in the UP position. This ensures that the cable control system holds the quadrant firmly in place when the flap handle is stowed in the UP detent to prevent unintended flap actuation. The tension preload can vary between airplanes due to allowable tolerances in the cable rigging process and the normal stretching of the cables over time.

The flap lever mechanism has a detent at each selectable flap position. A pin attached to the flap lever prevents uncommanded flap lever movement while in the selected detent. The lever must be raised out of the detent to select a different position. Due to variation in the tension preload, some airplanes can require additional forward and downward force to place the lever into the detent in the UP position.

Operating Instructions

When moving the flap lever to the commanded position, push down firmly and visually confirm that the flap lever is in the selected detent.

Administrative Information

Insert this bulletin behind the Bulletin Record page in Volume 1 of your Flight Crew Operations Manual (FCOM). Amend the FCOM Bulletin Record page to show bulletin TBC-121 as "In Effect" (IE).

Boeing is updating the flap rigging document and AMM procedures to ensure more uniform flap lever operation. The information in this bulletin will be incorporated in a future revision of the FCOM.

Please send all correspondence regarding Flight Crew Operations Manual Bulletin status, to Flight Technical Data, through the Service Requests Application (SR App) on the MyBoeingFleet home page.

Flight Crew Operations Manual Bulletin
for
The Boeing Company

The Boeing Company
Seattle, Washington 98124-2207

Number: TBC-122

IssueDate: October 17, 2023

Airplane Effectivity: B737-600/-700/-700C/-800/-900/-900ER with FMC U14

Subject: Dual FMC Resets After a Conditional Waypoint (VECTOR)

Reason: To inform flight crews of a possible dual FMC reset anomaly.

Information in this bulletin is recommended by The Boeing Company, but may not be FAA approved at the time of writing. In the event of conflict with the FAA approved Airplane Flight Manual (AFM), the AFM shall supersede. The Boeing Company regards the information or procedures described herein as having a direct or indirect bearing on the safe operation of this model airplane.

THE FOLLOWING PROCEDURE AND/OR INFORMATION IS EFFECTIVE UPON RECEIPT

Background Information

Boeing has received operator reports of dual Flight Management Computer (FMC) resets when flying a route that includes a conditional waypoint leg (VECTOR), followed by a route discontinuity (ROUTE DISCONTINUITY), followed by a waypoint with an RNP value. This route sequence can occur when a procedure such as a STAR or SID terminates in a heading or track during which radar vectors are expected. In such a case, after the conditional waypoint (VECTOR), a route discontinuity appears before subsequent waypoints. If the first waypoint after the discontinuity has an associated RNP value, a software exception can occur when (VECTOR) becomes the active waypoint.

When the described software exception occurs, the MCDUs first show the scratchpad message VNAV INVALID - PERF, then the MCDUs blank. After the FMCs reset, the (VECTOR) leg does not appear. However, the remaining flight plan route is retained and is shown after a ROUTE DISCONTINUITY in RTE LEGS. The crew is prompted to select and execute an active waypoint, and must reenter the cost index (CI) to recover VNAV.

Dual FMC resets for this software exception have occurred in FMC U14-equipped airplanes. Exception handling logic is corrected for this anomaly in FMC U14.1.

Operating Instructions

The software exception described occurs when:

- (VECTOR) is active
- followed by ROUTE DISCONTINUITY
- followed by a waypoint with RNP

Removing one of the above conditions before the conditional waypoint (VECTOR) is active can prevent the exception and dual FMC reset. This can be done by deleting the (VECTOR) leg or by closing the discontinuity after obtaining an ATC radar vector heading or alternate clearance. It can be difficult to determine whether a waypoint is coded with an RNP value as that will depend on the selected procedure, transition, or route of flight; however, when a waypoint with no coded RNP value follows the discontinuity, the software exception will not occur.

When a dual FMC reset occurs as a result of the anomaly described, the FMCs should recover after a short time. Boeing recommends that the flight crew do the FMC FAIL Non-Normal Checklist (NNC) and prepare to resume conventional navigation. The steps in the FMC FAIL NNC will not prevent the FMCs from self-reset.

After the FMCs have reset, it is necessary to select an appropriate waypoint and to enter the Cost Index to restore VNAV.

Administrative Information

Insert this bulletin behind the Bulletin Record page in Volume 1 of your Flight Crew Operations Manual (FCOM). Amend the FCOM Bulletin Record page to show bulletin TBC-122 as "In Effect" (IE).

This anomaly will be corrected with the installation of FMC U14.1, available now, or U14.2 which is scheduled to be released 4Q2024. This FCOM Bulletin will be canceled after Boeing is notified that all affected airplanes in your fleet have been retrofitted with FMC U14.1 or newer.

Please send all correspondence regarding Flight Crew Operations Manual Bulletin status, to Flight Technical Data, through the Service Requests Application (SR App) on the MyBoeingFleet home page.

Flight Crew Operations Manual Bulletin
for
The Boeing Company

The Boeing Company
Seattle, Washington 98124-2207

737

Number: TBC-123 R1

IssueDate: December 20, 2023

Airplane Effectivity: B737-600/-700/-700C/-800/-900/-900ER

Subject: Unexpected Roll Command during RNP approaches with a RNP of 0.3 or below

Reason: This bulletin informs flight crews of an unexpected roll during RNP approaches with a RNP of 0.3 or below.

This bulletin is being revised to update the Background Information, Operating Instructions, and Administrative Information sections.

Information in this bulletin is recommended by The Boeing Company, but may not be FAA approved at the time of writing. In the event of conflict with the FAA approved Airplane Flight Manual (AFM), the AFM shall supersede. The Boeing Company regards the information or procedures described herein as having a direct or indirect bearing on the safe operation of this model airplane.

THE FOLLOWING PROCEDURE AND/OR INFORMATION IS EFFECTIVE UPON RECEIPT

Background Information

Boeing and GE Aviation have received in-service reports of unexpected roll commands and resulting lateral path deviation from the centerline during RNAV/RNP approaches. These events can occur when the FMC enters the approach environment requiring RNP values of RNP 0.3 or below with the Autopilot "B" engaged in Command. The steering gains are increased when transitioning to a RNP environment of RNP 0.3 or below.

Dual FMC system design requirements make the left FMC primary when the FMC source select switch is set to either "Both on Left" or "Normal". Each Autopilot uses the onside FMC, meaning Autopilot "A" uses FMC-L for primary guidance while Autopilot "B" uses FMC-R. In these reported events, Autopilot "B" is selected and the FMC Source Select Switch is in the "Normal" position.

The condition appears to have been introduced with FMC software update U11, where a gain increase was added to the FMC Roll Command control law when the FMC enters the approach environment requiring RNP values of RNP 0.3 or below. When the gain increases, the left FMC may contain a residual crosstrack error that is not present in the right FMC. Due to the increase in command gain, the residual FMC roll command also increases and the left and right FMC command may differ by more than 5.5 degrees, which is the tolerance. When the tolerance is exceeded, it results in a RAM Crossload to resynchronize the two FMCs and triggers the right FMC to increase its roll command output from FMC-R and subsequent FCC "B" commanded roll rate. This generates a temporary roll maneuver that is unexpected.

GE analysis indicates a worst case deviation induced by the left FMC RAM crossload is limited to less than 0.1 NM before the FMC self corrects. The resulting crosstrack error is less than the RNP containment boundary for annunciation of the "UNABLE REQD NAV PERF-RNP" message.

This condition has been reproduced and its root cause has been determined. Boeing currently plans to incorporate the fix for this condition in FMC OPS U14.2.

Operating Instructions

Using Autopilot “A” (CMD A) prevents RAM Crossloads from impacting approach procedures.

Note: Autopilot “B” (CMD B) may be used but flight crews should be aware of the potential for an unexpected roll command if a RAM Crossload occurs.

Administrative Information

This bulletin replaces bulletin TBC-123, dated October 23, 2023. Revise the Flight Crew Operations Manual (FCOM) Bulletin Record Page to show bulletin TBC-123 as “CANCELLED” (CANC).

Insert this bulletin behind the Bulletin Record page in Volume 1 of your Flight Crew Operations Manual (FCOM). Amend the FCOM Bulletin Record page to show bulletin TBC-123 R1 as "In Effect" (IE).

This anomaly will be corrected with the installation of U14.2 which is expected to be released in 2025. This FCOM Bulletin will be canceled after Boeing is notified that all affected airplanes in your fleet have been retrofitted with FMC U14.2 or newer.

Please send all correspondence regarding Flight Crew Operations Manual Bulletin status, to Flight Technical Data, through the Service Requests Application (SR App) on the MyBoeingFleet home page.

Limitations — Chapter L

Table of Contents — Section TOC

General

This chapter contains:

- Airplane Flight Manual (AFM) limitations
- AFM operational information
- Non-AFM operational information.

Limitations and operational information are included if they are:

- operationally significant
- required by FAA Airworthiness Directive
- required by another regulatory requirement.

Limitations and operational information are not included if they are:

- incorporated into FCOM normal, supplementary, or non-normal procedures, with a few exceptions
- shown on a placard, display, or other marking.

Limitations and operational information listed in this chapter that must be memorized (memory items) are marked with a (#) symbol. They meet the following criterion - flight crew access by reference cannot assure timely compliance, e.g., Maximum Takeoff and Landing Tailwind Component. They need only be memorized to the extent that compliance is assured. Knowing the exact wording of the limitation is not required.

Assuming that the remaining items are available to the flight crew by reference, they do not need to be memorized.

[TBC only]

Note: Limitations and operational information referring to airplane options and configuration differences are shown in [brackets]. These items are applicable to the TBC FCOM only, and do not appear in customer FCOMs.

Airplane General

AFM Limitations

Runway slope	+/– 2%
# Maximum Takeoff and Landing Tailwind Component **Note:** The capability of the airplane(s) has been satisfactorily demonstrated for takeoff and manual landing with tailwinds up to 15 knots. **Note:** Airplanes operating under FAA Rules: This finding does not constitute operational approval to conduct takeoffs or landings with tailwind components greater than 10 knots.	[Option - 15 kt tailwind] 15 knots (see note(s)) [Option - 10 kt tailwind] 10 knots
Maximum speeds	Observe gear and flap placards
Maximum Operating Altitude	41,000 feet pressure altitude
Maximum Takeoff and Landing Altitude	[Option - Typical] 8,400 feet pressure altitude [Option - High altitude landing system] 12,000 feet pressure altitude

[Option - Without polar navigation]
Maximum flight operating latitude is dependent on the configuration of the Magnetic Variation tables in the ADIRU as follows: 82° North and 82° South, except for the region between 80° West and 130 ° West longitude, the maximum flight operating latitude is 70° North, and the region between 120° East and 160° East longitude, the maximum flight operating latitude is 60° South.

Installation of handle covers on the overwing exits must be verified prior to departure whenever passengers are carried.
[Option - Flight deck security door]
Verify that an operational check of the flight deck door access system has been accomplished according to approved procedures once each flight day.

AFM Operational Information

Severe Turbulent Air Penetration speed is 280 KIAS / .76M, whichever is lower. Applicable to Climb and Descent only. During Cruise, refer to SP.16, Severe Turbulence Supplementary Procedure.

Non–AFM Operational Information

On revenue flights, the escape slide retention bar (girt bar) must be installed during taxi, takeoff and landing.

Do not operate HF radios during refueling operations.

Altitude Display Limits for RVSM Operations

Standby altimeters do not meet altimeter accuracy requirements of RVSM airspace.

The maximum allowable in-flight difference between Captain and First Officer altitude displays for RVSM operations is 200 feet.

The maximum allowable on-the-ground altitude display differences for RVSM operations are:

Field Elevation	Max Difference Between Captain & F/O	Max Difference Between Captain or F/O & Field Elevation
Sea Level to 5,000 feet	50 feet	75 feet
5,001 to 10,000 feet	60 feet	75 feet

Weight Limitations

AFM Limitations

Note: The maximum weight limitations can be further limited as referenced in the WEIGHT LIMITATIONS section of the CERTIFICATE LIMITATIONS chapter of the AFM.

Note: Possible conflicts between the AFM and the FCOM may occur due to separate publication release dates. In the event of a conflict between the FCOM and the AFM, the AFM shall govern.

Maximum Taxi Weight

[Option - Typical 737-600]

127,500 Pounds / 57,833 Kilograms

[Option - Typical 737-700]

133,500 Pounds / 60,554 Kilograms

[Option - Typical 737-800]

156,000 Pounds / 70,760 Kilograms

[Option - Typical 737-900]

174,700 Pounds / 79,242 Kilograms

Maximum Takeoff Weight

[Option - Typical 737-600]

127,000 Pounds / 57,606 Kilograms

[Option - Typical 737-700]

133,000 Pounds / 60,327 Kilograms

[Option - Typical 737-700 with CFM56-7B26 Thrust]

Note: Minimum Takeoff Weight – 125,000 pounds / 56,699 kilograms. Lower minimum takeoff weights that account for the actual pressure altitude and outside air temperature may be obtained by using the Minimum Takeoff Weight table in the Takeoff section of the Performance Dispatch (PD) chapter.

[Option - Typical 737-800]

155,500 Pounds / 70,533 Kilograms

[Option - Typical 737-900]

174,200 Pounds / 79,015 Kilograms

Maximum Landing Weight

[Option - Typical 737-600]

120,500 Pounds / 54,657 Kilograms

[Option - Typical 737-700]

128,000 Pounds / 58,059 Kilograms

[Option - Typical 737-800]

144,000 Pounds / 65,317 Kilograms

[Option - Typical 737-900]

146,300 Pounds / 66,360 Kilograms

(144,200 Pounds / 65,407 Kilograms)*

* Airplanes operating under FAA Rules: Max Landing Weight (Flaps 15). This maximum weight applies when landing with Flaps 15 under normal conditions. It does not apply when Flaps 15 is required during a Non-Normal Checklist.

Maximum Zero Fuel Weight

[Option - Typical 737-600]

114,000 Pounds / 51,709 Kilograms

[Option - Typical 737-700]

120,500 Pounds / 54,657 Kilograms

[Option - Typical 737-800]

136,000 Pounds / 61,688 Kilograms

[Option - Typical 737-900]

138,300 / 62,731 Kilograms

Air Systems

AFM Limitations

Pressurization

[Option - Normal Cabin Altitude]
The maximum cabin differential pressure (relief valves) is 9.1 psi.
[Option - Reduced Cabin Altitude]
The maximum cabin differential pressure (relief valves) is 9.74 psi.

Non–AFM Operational Information

With either one or both engine bleed air switches ON, do not operate the air conditioning packs in HIGH for takeoff, approach or landing.

Note: The fire protection Non-Normal procedures take precedence over the statement regarding no air conditioning pack in HIGH during takeoff, approach, or landing. The CARGO FIRE and SMOKE/ FUMES REMOVAL checklists require the Operating PACK switch(es) HIGH. Switch(es) need to be placed in HIGH in order to increase ventilation for smoke removal.

Anti–Ice, Rain

[Option - 737-600/-700/-800 without stiffened elevator tabs]
(PRR 38506 or Service Bulletin 737-55A1080)

AFM Limitations

After any ground deicing/anti-icing of the horizontal stabilizer using Type II or Type IV fluids, airspeed must be limited to 270 KIAS until the crew has been informed that applicable maintenance procedures have been accomplished that would allow exceedance of 270 KIAS. Once the applicable maintenance procedures have been accomplished, exceeding 270 KIAS is permissible only until the next application of Type II or Type IV deicing/anti-icing fluids.

Autopilot/Flight Director System

AFM Limitations

Use of aileron trim with the autopilot engaged is prohibited.

Do not engage the autopilot for takeoff below 400 feet AGL.
[Option - FAA rules]
Airplanes operating under FAA Rules:

For single channel operation during approach, the autopilot shall not remain engaged below 50 feet AGL.
[Option - High altitude landing system]
Do not use the autopilot below 100 feet radio altitude at airport pressure altitudes above 8,400 feet.
[Option - Typical, 737-800, EASA rules]
Airplanes operating with EASA Certification: The Minimum Use Height (MUH) for single channel autopilot operation is defined as 158 feet AGL.

[Option - Typical, FAA rules, 15 kt tailwind]

Airplanes operating with FAA Rules: Maximum allowable wind speeds when landing weather minima are predicated on autoland operations:

- Headwind 25 knots
- Crosswind 20 knots
- Crosswind 25 knots.
- Tailwind 15 knots.

[Option - Typical, EASA rules, Cat II or Cat III]

Airplanes operating with EASA Certification – Maximum allowable wind speeds, when conducting a dual channel Cat II or Cat III landing predicated on autoland operations, are:

- Headwind 25 knots
- Crosswind 20 knots

[option - CatIIIb]

- Crosswind 25 knots
- Tailwind 10 knots.
- Tailwind 15 knots.
- Tailwind:

[Option - Typical 737-900, 10 kt tailwind]

Field Elevation	Flaps 30	Flaps 40
2000 feet or less	10 knots	10 knots
2001 to 4000 feet	10 knots	10 knots
4001 to 6000 feet	5 knots	10 knots
Greater than 6000 feet	0 knots	10 knots

[Option - Typical 737-900, 15 kt tailwind]

Field Elevation	Flaps 30	Flaps 40
2000 feet or less	15 knots	15 knots
2001 to 4000 feet	10 knots	15 knots
4001 to 6000 feet	5 knots	15 knots
Greater than 6000 feet	0 knots	15 knots

Maximum and minimum glideslope angles for autoland are 3.25 degrees and 2.5 degrees respectively.

Autoland capability may only be used with flaps 30 or 40 and both engines operative.

[Option - CatIIIb]
Airplanes operating with EASA Certification: Autoland capability may only be used with flaps 30 with one engine operative and only for DH at or above 50 feet.
[Option - CatIIIb]
Airplanes operating under FAA Rules: Autoland capability may only be used with flaps 30 with one engine operative.
[Option - Landing altitudes above 8,400 ft]
Autoland capability may only be used to runways at or below 8,400 ft pressure altitude.
[Option - Integrated Approach Navigation (IAN)]
Do not use Integrated Approach Navigation (IAN) Final Approach Course (FAC) or Glide Path (G/P) guidance under either of the following conditions:

- The flight crew has entered an AT or AT/BELOW altitude constraint for a final approach fix, or for waypoints between a final approach fix and a runway
- Any altitude constraint specified by the approach procedure for a final approach fix, or for waypoints between a final approach fix and a runway, has been modified by the flight crew, after the aircraft has passed the initial approach fix.

Non–AFM Operational Information

Do not use LVL CHG on final approach below 1000 feet AFE.

HUD System
[Option - With HGS and no polar navigation]
Do not use the HUD System at latitudes greater than 85 degrees latitude.
[Option - With HGS 4000 Phase I]
AIII mode approach and landings are not approved for airplanes with Flight Dynamics Model 4000 Phase I HGS installed.

Note: Limitation is not applicable to the Model 4000 HUD system following the incorporation of Phase 4 (or later) software.

Communications

AFM Limitations

[Option - With VHF-3 and ACARS without Voice Mode Protection]
Do not use VHF–3 (if installed for voice communication) for ATC communications with ACARS operational.

Aircraft Communications Addressing and Reporting System

[Option - ACARS]
The ACARS is limited to the transmission and receipt of messages that will not create an unsafe condition if the message is improperly received, such as the following conditions:

- the message or parts of the message are delayed or not received,
- the message is delivered to the wrong recipient, or
- the message content may be frequently corrupted.

However, Pre-Departure Clearance, Digital Automatic Terminal Information Service, Oceanic Clearances, Weight and Balance and Takeoff Data messages can be transmitted and received over ACARS if they are verified per approved operational procedures.

Non–AFM Operational Information

Use the VHF radio connected to the top of fuselage antenna for primary ATC communications on the ground.

Electrical

AFM Limitations

The use of Flight Deck Auxiliary Power outlets in the flight deck requires operational regulatory approval.

Engines and APU

AFM Limitations

Engine Limit Display Markings

Maximum and minimum limits are red.

Caution limits are amber.

Engine Ignition

Engine ignition must be on for:

- takeoff
- landing
- operation in heavy rain
- anti-ice operation.

Thrust

Operation with assumed temperature reduced takeoff thrust is not permitted with anti-skid inoperative.

Reverse Thrust

Intentional selection of reverse thrust in flight is prohibited.

APU

[Option - Typical EASA]
Airplanes operating with EASA Certification: APU bleed + electrical load: max alt 10,000 ft.
[Option - Typical FAA]
Airplanes operating under FAA Rules: Inflight - APU bleed + electrical load: max alt 10,000 ft.
[Option - Typical FAA]
Airplanes operating under FAA Rules: Ground only - APU bleed + electrical load: max alt 15,000 ft.

APU bleed: max alt 17,000 ft.

APU electrical load: max alt 41,000 ft.

Non–AFM Operational Information

APU bleed valve must be closed when:

- ground air connected and isolation valve open
- engine no. 1 bleed valve open
- isolation and engine no. 2 bleed valves open.

APU bleed valve may be open during engine start, but avoid engine power above idle.

After three consecutive aborted start attempts, a fifteen minute cooling period is required.

Run the APU for two full minutes before using it as a bleed air source.

Flight Controls

AFM Limitations

The maximum altitude with flaps extended is 20,000 ft.

Holding in icing conditions with flaps extended is prohibited.
[Option - 737-600/-700/-800 without stiffened elevator tabs]
(PRR 38506 or Service Bulletin 737-55A1080)
Do not operate the airplane at speeds in excess of 300 KIAS with speedbrakes extended.

WARNING: Use of speedbrakes at speeds in excess of 320 KIAS could result in a severe vibration, which, in turn, could cause extreme damage to the horizontal stabilizer.

In flight, do not extend the SPEED BRAKE lever beyond the FLIGHT DETENT.

Avoid rapid and large alternating control inputs, especially in combination with large changes in pitch, roll, or yaw (e.g. large side slip angles) as they may result in structural failure at any speed, including below VA.

[Option - EASA rules]
Airplanes operating with EASA Certification: Flaps 15 normal landings are prohibited. A Flaps 15 landing may be performed when required by a non-normal procedure.

Non–AFM Operational Information

Do not deploy the speedbrakes in flight at radio altitudes less than 1,000 feet.

Alternate flap duty cycle:

- When extending or retracting flaps with the ALTERNATE FLAPS position switch, allow 15 seconds after releasing the ALTERNATE FLAPS position switch before moving the switch again to avoid damage to the alternate flap motor clutch
- After a complete extend/retract cycle, i.e., 0 to 15 and back to 0, allow 5 minutes cooling before attempting another extension.

Flight Management, Navigation

AFM Limitations

Air Data Inertial Reference Unit (ADIRU)

ADIRU alignment must not be attempted at latitudes greater than 78 degrees 15 minutes.

All flight operations based on magnetic heading or magnetic track angle are prohibited in geographic areas where the installed IRS MagVar table errors are greater than 5 degrees.

Refer to AFM Normal Procedures/Inertial Reference System section for procedures to determine the geographic areas and magnitude of MagVar errors for the specific MagVar table installed in the IRS and if any of these limitations apply.

[Option - Cat IIIB]
For Fail-Operational Autopilot, all autopilot/flight director ILS (and GLS, if installed) approach and landing operations that use magnetic north referenced courses or bearings are prohibited in geographic areas where the installed IRS MagVar table errors are greater than 3 degrees.

QFE Selection

[Option - Altimeters with QFE]
The use of VNAV or LNAV with the altimeters referenced to QFE is prohibited.

[Option - Vertical Situation Display]
The use of the Vertical Situation Display (VSD) with the altimeters referenced to QFE is prohibited.

QFE operations are prohibited if the option for QFE altitude reference selection is not installed in the Flight Management System (FMS).

[Option - With PFD/ND]
A QFE altitude reference for the PFDs must be selected in the FMS whenever QFE is used instead of QNH.

[Option - With Look-Ahead terrain alerting and without GPS]
The use of Look-Ahead terrain alerting and terrain display functions with the altimeters referenced to QFE is prohibited.

Look-Ahead Terrain Alerting (GPWS)

[Option - With Enhanced GPWS]
Do not use the terrain display for navigation.

Do not use the look-ahead terrain alerting and terrain display functions:

- within 15 nm of takeoff, approach or landing at an airport or runway not contained in the GPWS terrain database.

Note: Refer to Honeywell Document 060-4267-000 for airports and runways contained in the installed GPWS terrain database.

Overrun Warning System (ORW)

[Option - With Overrun Warning System (ORW)]
The ORW alerting system does not replace the requirement to conduct an en route landing distance performance assessment prior to landing. The lack of an overrun alert does not guarantee the airplane can stop prior to reaching the runway end.

If the In-Air Overrun Warning ("OVERRUN, GO-AROUND") occurs during approach, execute an immediate go-around.

Inhibit the overrun alert when:

- Landing altitude is above 10,000 feet pressure altitude; or
- Landing OAT on the ground is below –40°C or greater than 50°C; or
- Gross Weight is greater than Maximum Landing Weight.

Non-AFM Operational Information

Avoid weather radar operation in a hangar.

Avoid weather radar operation when personnel are within the area normally enclosed by the aircraft nose radome.

Note: The hangar recommendation does not apply to the weather radar test mode.

Runway Awareness and Advisory System (RAAS)

[Option - With Runway Awareness and Advisory System]
Do not use RAAS callouts or alerts for navigation.

Do not use RAAS callouts or alerts as a substitute for NOTAM or ATIS information.

Fuel System

AFM Limitations

Maximum tank fuel temperature is 49°C.

Minimum tank fuel temperature prior to takeoff and inflight is –43°C, or 3°C above the fuel freezing point temperature, whichever is higher.

Note: The use of Fuel System Icing Inhibitor additives does not change the minimum fuel tank temperature limit.

Intentional dry running of a center tank fuel pump (low pressure light illuminated) is prohibited.

Fuel Balance

Lateral imbalance between main tanks 1 and 2 must be scheduled to be zero. Random fuel imbalance must not exceed 1000 lbs / 453 kgs for taxi, takeoff, flight or landing.

Fuel Loading

Main tanks 1 and 2 must be full if center tank contains more than 1000 lbs / 453 kgs.

Landing Gear

AFM Limitations

[Option - EASA rules]
Airplanes operating with EASA Certification: Towing operations without the use of a tow bar is restricted to tow vehicles that are designed and operated to preclude damage to the airplane steering system or which provide a reliable and unmistakable warning when damage to the steering system may have occurred.

Non–AFM Operational Information

Do not apply brakes until after touchdown.

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Normal Procedures — Chapter NP
Table of Contents — Section TOC

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Normal Procedures — Chapter NP
Introduction — Section 11

General

This chapter contains:

- an introduction to the normal procedures philosophy and assumptions
- step by step normal procedures.

Normal Procedures Philosophy and Assumptions

Normal procedures verify for each phase of flight that:

- the airplane condition is satisfactory
- the flight deck configuration is correct.

Normal procedures are done on each flight. Refer to the Supplementary Procedures (SP) chapter for procedures that are done as needed, for example the adverse weather procedures.

Normal procedures are written for a trained flight crew and assume:

- all systems operate normally
- the full use of all automated features (LNAV, VNAV, autoland, autopilot, and autothrottle). This does not preclude the possibility of manual flight for pilot proficiency where allowed

Normal procedures also assume coordination with the ground crew before:

- hydraulic system pressurization, or
- flight control surface movement, or
- airplane movement.

Normal procedures do not include steps for flight deck lighting and crew comfort items.

Normal procedures are done by memory and scan flow. The panel illustration in this section shows the scan flow. The scan flow sequence may be changed as needed.

Configuration Check

It is the crew member's responsibility to verify correct system response. Before engine start, use system lights to verify each system's condition or configuration. After engine start, the master caution system alerts the crew to warnings or cautions away from the normal field of view.

If there is an incorrect configuration or response:

- verify that the system controls are set correctly
- check the respective circuit breaker as needed. Maintenance must first determine that it is safe to reset a tripped circuit breaker on the ground
- test the respective system light as needed

Before engine start, use individual system lights to verify the system status. If an individual system light indicates an improper condition:

- check the Dispatch Deviations Guide (DDG) or the operator equivalent to decide if the condition has a dispatch effect
- decide if maintenance is needed

If, during or after engine start, a red warning or amber caution light illuminates:

- do the respective non-normal checklist (NNC)
- on the ground, check the DDG or the operator equivalent

If, during recall, an amber caution illuminates and then extinguishes after a master caution reset:

- check the DDG or the operator equivalent
- the respective non-normal checklist is not needed

Crew Duties

Preflight and postflight crew duties are divided between the captain and first officer. Phase of flight duties are divided between the Pilot Flying (PF) and the Pilot Monitoring (PM).

Each crewmember is responsible for moving the controls and switches in their area of responsibility:

- the phase of flight areas of responsibility for both normal and non-normal procedures are shown in the Area of Responsibility illustrations in this section. Typical panel locations are shown
- the preflight and postflight areas of responsibility are defined by the “Preflight Procedure - Captain” and “Preflight Procedure - First Officer.”

The captain may direct actions outside of the crewmember’s area of responsibility.

The general PF phase of flight responsibilities are:

- taxiing
- flight path and airspeed control
- airplane configuration
- navigation.

The general PM phase of flight responsibilities are:

- checklist reading
- communications

- tasks asked for by the PF
- monitoring taxiing, flight path, airspeed, airplane configuration and navigation.

PF and PM duties may change during a flight. For example, the captain could be the PF during taxi but be the PM during takeoff through landing.

Normal procedures show who does a step by crew position (C, F/O, PF, or PM):

- in the procedure title, or
- in the far right column, or
- in the column heading of a table

The mode control panel is the PF’s responsibility. When flying manually, the PF directs the PM to make the changes on the mode control panel.

The captain is the final authority for all tasks directed and done.

Control Display Unit (CDU) Procedures

Before taxi, the captain or first officer may make CDU entries. The other pilot must verify the entries.

Make CDU entries before taxi or when stopped, when possible. If CDU entries must be made during taxi, the PM makes the entries. The PF must verify the entries before they are executed.

In flight, the PM usually makes the CDU entries. The PF may also make simple, CDU entries when the workload allows. The pilot making the entries executes the change only after the other pilot verifies the entries.

During high workload times, for example departure or arrival, try to reduce the need for CDU entries. Do this by using the MCP heading, altitude, and speed control modes. The MCP can be easier to use than entering complex route modifications into the CDU.

Autopilot Flight Director System (AFDS) Procedures

The crew must always monitor:

- airplane course
- vertical path
- speed

When selecting a value on the MCP, verify that the respective value changes on the flight instruments, as applicable.

The crew must verify manually selected or automatic AFDS changes. Use the FMA to verify mode changes for the:

- autopilot
- flight director
- autothrottle

During LNAV and VNAV operations, verify all changes to the airplane's:

- course
- vertical path
- thrust
- speed

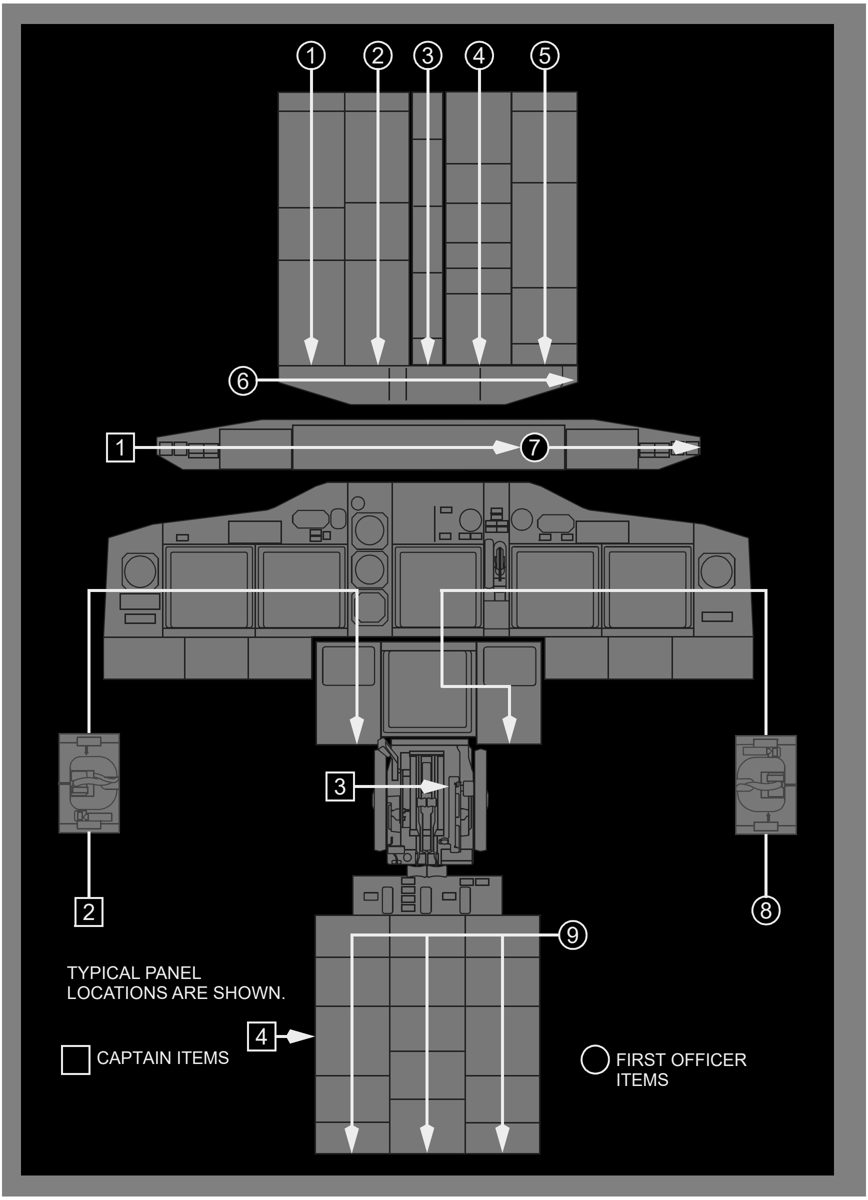
Announcing changes on the FMA and thrust mode display when they occur is a good CRM practice.

Scan Flow and Areas of Responsibility

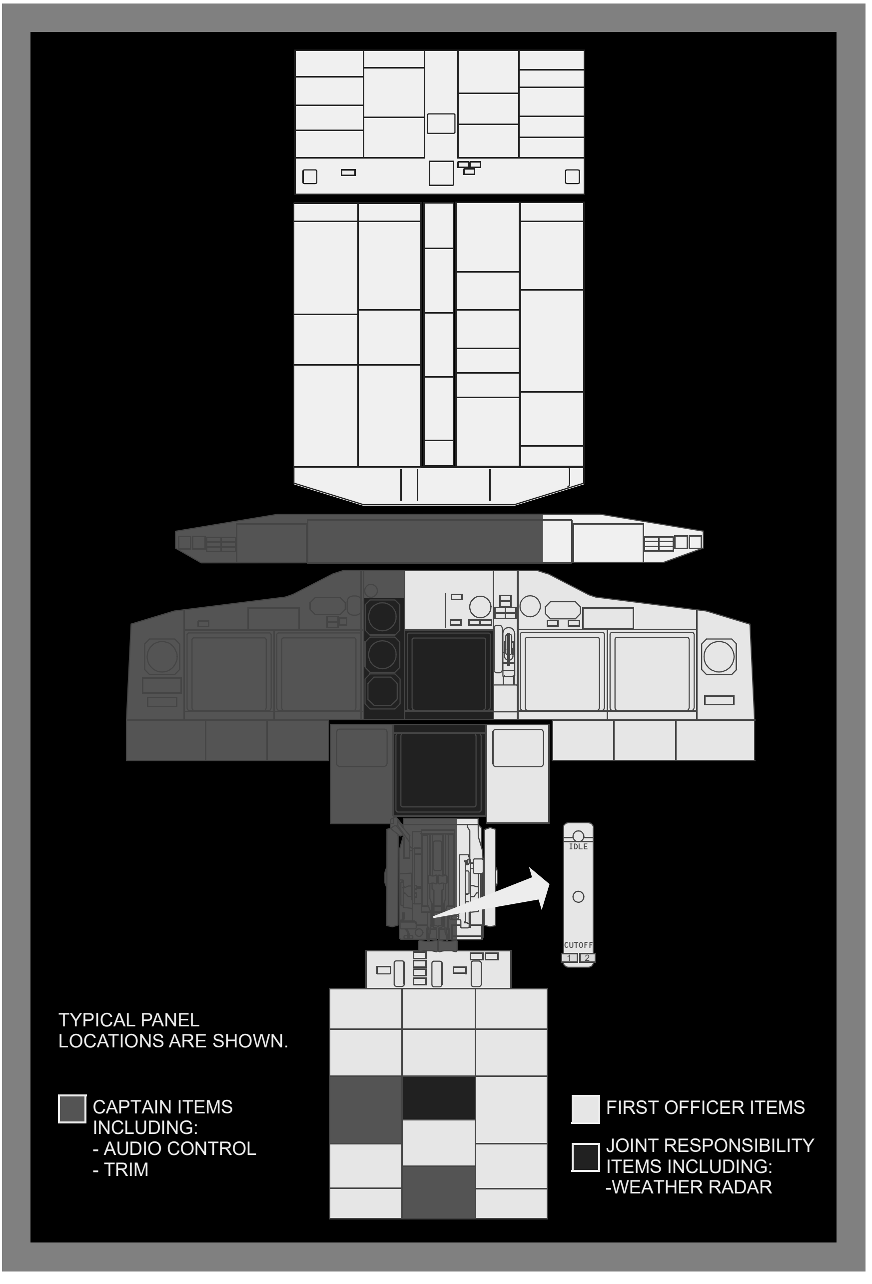
The scan flow and areas of responsibility diagrams shown below are representative and may not match the configuration(s) of your airplanes.

The scan flow diagram provides general guidance on the order each flight crew member should follow when doing the preflight and postflight procedures. Specific guidance on the items to be checked are detailed in the amplified Normal Procedures. For example, preflight procedure details are in the Preflight Procedure - Captain and Preflight Procedure - First Officer.

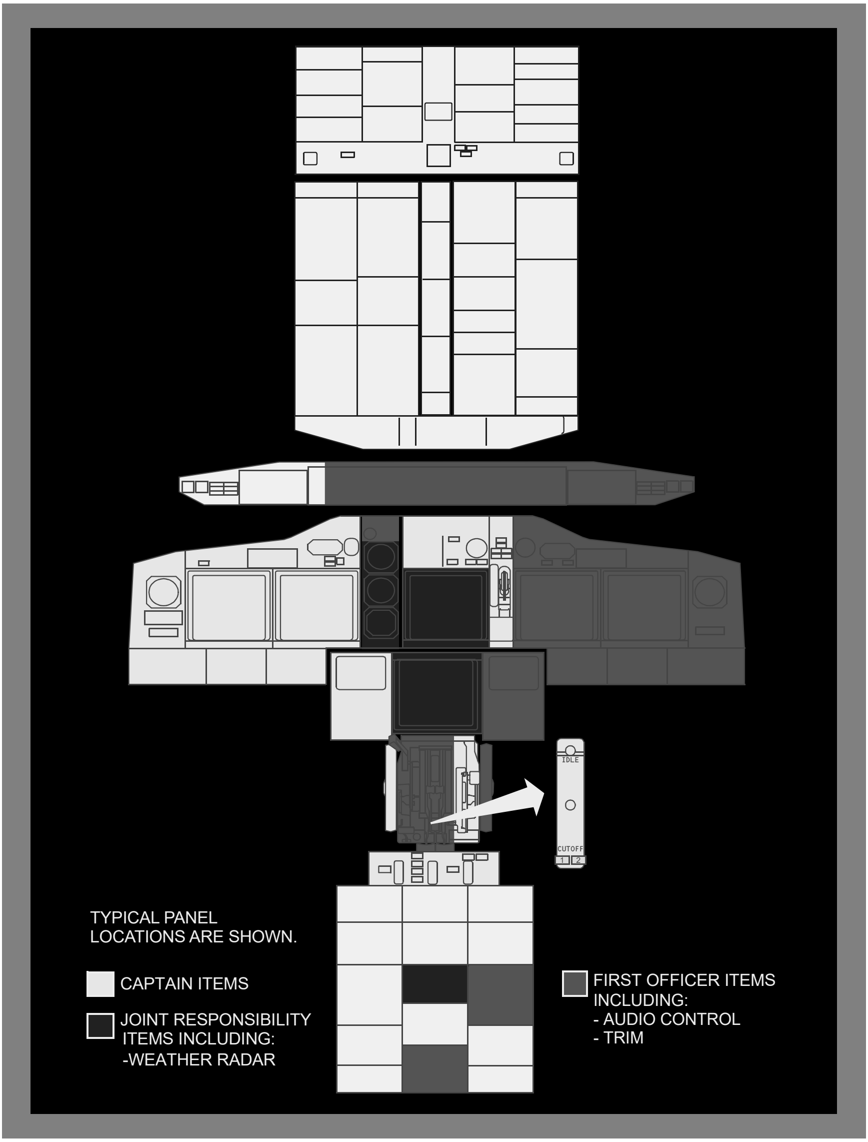
Preflight and Postflight Scan Flow



Areas of Responsibility - Captain as Pilot Flying or Taxiing



Areas of Responsibility - First Officer as Pilot Flying or Taxiing



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Preliminary Preflight Procedure – Captain or First Officer

The Preliminary Preflight Procedure assumes that the Electrical Power Up supplementary procedure is complete.

A full IRS alignment is recommended before each flight. If time does not allow a full alignment, do the Fast Realignment supplementary procedure.

IRS mode selectors .... OFF, then NAV

Verify that the ON DC lights illuminate then extinguish.

Verify that the ALIGN lights are illuminated.

The UNABLE REQD NAV PERF-RNP message may show until IRS alignment is complete.

[Option]
VOICE RECORDER switch ....As needed

Verify that the following are sufficient for flight:

- oxygen pressure
- hydraulic quantity
- engine oil quantity

Do the remaining actions after a crew change or maintenance action.

Note: The following oxygen pressure drop test only needs to be performed at one crewmember or observer station.

[Option - Oronasal Oxygen Mask]
Oxygen pressure drop ....Test

[Chemical passenger oxygen]
Note the crew oxygen pressure.

[Gaseous passenger oxygen]
Note the crew/pass oxygen pressure.

Oxygen mask – Stowed and doors closed

RESET/TEST switch – Push and hold

Verify that the yellow cross shows momentarily in the flow indicator.

EMERGENCY/Test selector – Push and hold

Continue to hold the RESET/TEST switch down and push the EMERGENCY/Test selector for 5 seconds. Verify that the yellow cross shows continuously in the flow indicator.

Verify that the crew oxygen pressure does not decrease more than 100 psig.

If the oxygen cylinder valve is not in the full open position, pressure can:

- decrease rapidly, or
- decrease more than 100 psig, or
- increase slowly back to normal.

Release the RESET/TEST switch and the EMERGENCY/Test selector. Verify that the yellow cross does not show in the flow indicator.

Normal/100% switch – 100%

[Chemical passenger oxygen]
Crew oxygen pressure - Check.

Verify that the pressure is sufficient for dispatch.

[Gaseous passenger oxygen]
Crew/pass oxygen pressure - Check.

Verify that the pressure is sufficient for dispatch.

[Option - EROS Full Face Oxygen Mask]
Oxygen pressure drop ....Test

[Chemical passenger oxygen]
Note the crew oxygen pressure.

[Gaseous passenger oxygen]
Note the crew/pass oxygen pressure.

Oxygen mask – Stowed and doors closed

TEST/RESET switch – Push and hold

Verify that the yellow cross shows momentarily in the flow indicator.

EMERGENCY/Test selector – Push and hold

Continue to hold the TEST/RESET switch down and push the EMERGENCY/Test selector for 5 seconds. Verify that the yellow cross shows continuously in the flow indicator.

Verify that the crew oxygen pressure does not decrease more than 100 psig.

If the oxygen cylinder valve is not in the full open position, pressure can:

- decrease rapidly, or
- decrease more than 100 psig, or
- increase slowly back to normal.

Release the TEST/RESET switch and the EMERGENCY/Test selector. Verify that the yellow cross does not show in the flow indicator.

Normal/100% switch – 100%

[Chemical passenger oxygen]
Crew oxygen pressure - Check.

Verify that the pressure is sufficient for dispatch.

[Gaseous passenger oxygen]
Crew/pass oxygen pressure - Check.

Verify that the pressure is sufficient for dispatch.

Maintenance documents .... Check

[Option]
FLIGHT DECK ACCESS SYSTEM switch ....Guard closed

Emergency equipment .... Check

Fire extinguisher – Checked and stowed

Crash axe – Stowed

Escape ropes – Stowed

Other needed equipment – Checked and stowed

ELT switch ....Guard closed

Verify that the ELT light is extinguished.

PSEU light .... Verify extinguished

SPSEU light .... Verify extinguished

GPS light .... Verify extinguished

[Option - GLS]
ILS light .... Verify extinguished

[Option - GLS]
GLS light .... Verify extinguished

SERVICE INTERPHONE switch .... OFF

ENGINE panel .... Set

Verify that the REVERSER lights are extinguished.

Verify that the ENGINE CONTROL lights are extinguished.

EEC switches – ON

Oxygen panel .... Set

Note: PASSENGER OXYGEN switch activation causes deployment of the passenger oxygen masks.

Note: PASSENGER OXYGEN switch activation causes an audible horn and illuminates the DON OXYGEN sign in the supernumerary cabin.

PASSENGER OXYGEN switch - Guard closed

Verify that the PASS OXY ON light is extinguished.

Landing gear indicator lights .... Verify illuminated

FLIGHT RECORDER switch .... Guard closed

Verify that the OFF light is illuminated.

MACH AIRSPEED WARNING
TEST switches .... Push, one at a time

Verify that the clacker sounds.

STALL WARNING TEST switches. .... Push and hold, one at a time

Verify that each control column vibrates when the respective switch is pushed.

Note: The stall warning test requires that AC transfer busses are powered for up to 4 minutes.

Note: With hydraulic power off, the leading edge flaps can droop enough to cause an asymmetry signal, resulting in a failure of the stall warning system test. Should this occur, obtain a clearance to pressurize the hydraulic system, place the “B” system electric pump ON and retract the flaps. When flaps are retracted repeat the test. At the completion of the test, turn the “B” system electric pump “OFF”.

[Option]
Emergency EVACUATION activation switch .... Guard closed

Verify that the EVAC light is extinguished.

Circuit breakers (P6 panel) .... Check

Manual gear extension access door ....Closed

Circuit breakers (control stand, P18 panel) .... Check

Parking brake ....As needed

Set the parking brake if the brake wear indicators are to be checked during the exterior inspection.

CDU Preflight Procedure - Captain and First Officer

Start the CDU Preflight Procedure any time after the Preliminary Preflight Procedure. The Initial Data and Navigation Data entries must be complete before the flight instrument check during the Preflight Procedure. The Performance Data entries must be complete before the Before Start Checklist.

The captain or first officer may make CDU entries. The other pilot must verify the entries.

Enter data in all the boxed items on the following CDU pages.

Enter data in the dashed items or modify small font items that are listed in this procedure. Enter or modify other items at pilot's discretion.

Failure to enter enroute winds can result in flight plan time and fuel burn errors.

Initial Data ....Set

IDENT page:

Verify that the MODEL is correct.

Verify that the ENG RATING is correct.

Verify that the navigation data base ACTIVE date range is current.

POS INIT page:

Verify that the time is correct.

Enter the present position on the SET IRS POS line. Use the most accurate latitude and longitude.

Navigation Data ....Set

ROUTE page:

Enter the ORIGIN.

Enter the route.

Enter the FLIGHT NUMBER.

Activate and execute the route.

DEPARTURES page:

Select the runway and departure routing.

Execute the runway and departure routing.

LEGS page:

Verify the correct RNP for the departure as needed.

Verify that the route is correct on the RTE pages. Check the LEGS pages as needed to ensure compliance with the flight plan.

Performance Data .... Set

PERF INIT page:

CAUTION: Do not enter the ZFW into the GW boxes. The FMC will calculate performance data with significant errors.

Enter the ZFW.

Verify that the FUEL on the CDU, the dispatch papers, and the fuel quantity indicators agree.

If refueling is not complete, enter the PLAN trip fuel as needed.

Verify that the fuel is sufficient for flight.

Verify that the gross weight and cruise CG (GW/CRZ CG) on the CDU and the dispatch papers agree.

Thrust mode display:

[Option - Aspirated TAT]
Verify that TO shows.

[Option - Non-aspirated TAT]
Verify that dashes are shown.

[Option - FMC U 10.1 and later]
N1 LIMIT page:

[Option - Aspirated TAT]
Confirm the OAT value is correct and reasonable for the ambient conditions.

[Option - Non-aspirated TAT]
Enter or verify OAT. Confirm the OAT value is correct and reasonable for the ambient conditions.

Select an assumed temperature, or a fixed derate takeoff, or both as needed.

Select a full or a derated climb thrust as needed.

[Option - FMC U 10.1 and later]
TAKEOFF REF page:

Make data entries on page 2/2 before page 1/2.

Enter the CG.

Verify that a trim value is shown.

Select or enter the takeoff V speeds.

[Option - FMC U10.8 and later, FCC Collins P4 and later or FCC Honeywell 710 and later, and CDS BP06 and later]
Verify or enter an acceleration height.

[Option - FMC U10.8 and later, FCC Collins P4 and later or FCC Honeywell 710 and later, and CDS BP06 and later]
Verify or enter an engine out acceleration height.

[Option – With automatic thrust reduction after takeoff]
Verify or enter a thrust reduction altitude.

Verify that the preflight is complete.

Exterior Inspection

Before each flight the captain, first officer, or maintenance crew must verify that the airplane is satisfactory for flight.

Items at each location may be checked in any sequence.

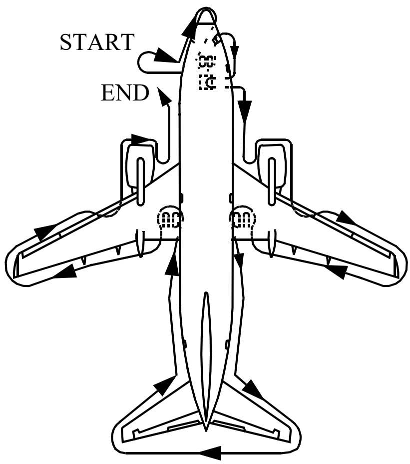
Use the detailed inspection route below to check that:

- the surfaces and structures are clear, not damaged, not missing parts and there are no fluid leaks*
- the tires are not too worn, not damaged, and there is no tread separation
- the gear struts are not fully compressed
- the engine inlets and tailpipes are clear, the access panels are secured, the fan cowls are latched, the exterior, including the bottom of the nacelles, is not damaged, and the reversers are stowed
- the doors and access panels that are not in use are latched
- the probes, vents, and static ports are clear and not damaged
- the skin area adjacent to the pitot probes and static ports is not wrinkled
- the antennas are not damaged
- the light lenses are clean and not damaged

For cold weather operations see the Supplementary Procedures.

Note: * Fluid leaks from the engine drains are allowed provided the leaks are less than a continuous stream. Refer to the Engine Start Procedure for additional guidance.

Inspection Route



Left Forward Fuselage

Probes, sensors, ports, vents, and drains (as applicable) .... Check

Doors and access panels (not in use) .... Latched

Nose

Radome .... Check

Conductor straps - Secure

Forward E and E door .... Secure

Nose Wheel Well

Tires and wheels .... Check

[Without LED Lighting System]
Exterior light .... Check

Gear strut and doors .... Check

Nose wheel steering assembly .... Check

Nose gear steering lockout pin .... As needed

Gear pin .... As needed

Nose wheel spin brake (snubbers) .... In place

Right Forward Fuselage

Probes, sensors, ports, vents, and drains (as applicable) .... Check

Oxygen pressure relief green disc .... In place

Doors and access panels (not in use) .... Latched

Right Wing Root, Pack, and Lower Fuselage

Ram air deflector door .... Extended

Pack and pneumatic access doors .... Secure

Probes, sensors, ports, vents, and drains (as applicable) .... Check

Exterior lights .... Check

Leading edge flaps .... Check

Number 2 Engine

Exterior surfaces
(including the bottom of the nacelles) .... Check for damage

Access panels and fan cowl latches .... Latched

Probes, sensors, ports, vents, and drains (as applicable) .... Check

Fan blades, probes, and spinner .... Check

Thrust reverser .... Stowed

Exhaust area and tailcone .... Check

Right Wing and Leading Edge

Access panels .... Latched

Leading edge flaps and slats .... Check

Fuel measuring sticks .... Flush and secure

Wing Surfaces .... Check

Fuel tank vent .... Check

Right Wing Tip and Trailing Edge

Position and strobe lights .... Check

Static discharge wicks .... Check

Aileron and trailing edge flaps .... Check

Right Main Gear

Tires, brakes and wheels .... Check

Verify that the wheel chocks are in place as needed.

If the parking brake is set, the brake wear indicator pins must extend out of the guides.

Gear strut, actuators, and doors .... Check

Hydraulic lines .... Secure

Gear pin .... As needed

Right Main Wheel Well

APU FIRE CONTROL handle .... Up

[Option]
NGS operability indicator light .... Check

Verify that the light is green.

Wheel well .... Check

Right Aft Fuselage

Doors and access panels (not in use) .... Latched

Negative pressure relief door .... Closed

Outflow valve .... Check

Probes, sensors, ports, vents, and drains (as applicable) .... Check

APU air inlet .... Check

Tail

Vertical stabilizer and rudder .... Check

Elevator feel probes .... Check

[737-800/900]
Tail skid .... Check

Verify that the tail skid is not damaged.

Horizontal stabilizer and elevator .... Check

Static discharge wicks .... Check

Strobe light .... Check

APU cooling air inlet and exhaust outlet .... Check

Left Aft Fuselage

Doors and access panels (not in use) ....Latched

Probes, sensors, ports, vents, and drains (as applicable) .... Check

Left Main Gear

Tires, brakes and wheels .... Check

Verify that the wheel chocks are in place as needed.

If the parking brake is set, the brake wear indicator pins must extend out of the guides.

Gear strut, actuators, and doors .... Check

Hydraulic lines ....Secure

Gear pin ....As needed

Left Main Wheel Well

Wheel well .... Check

Engine fire bottle pressure .... Check

Left Wing Tip and Trailing Edge

Aileron and trailing edge flaps .... Check

Static discharge wicks .... Check

Position and strobe lights .... Check

Left Wing and Leading Edge

Fuel tank vent .... Check

Wing Surfaces .... Check

Fuel measuring sticks .... Flush and secure

Leading edge flaps and slats .... Check

Access panels .... Latched

Number 1 Engine

Exhaust area and tailcone .... Check

Thrust reverser .... Stowed

Fan blades, probes, and spinner .... Check

Probes, sensors, ports, vents, and drains (as applicable) .... Check

Access panels and fan cowl latches .... Latched

Exterior surfaces
(including the bottom of the nacelles) .... Check for damage

Left Wing Root, Pack, and Lower Fuselage

Leading edge flaps .... Check

Probes, sensors, ports, vents, and drains (as applicable) .... Check

Exterior lights .... Check

Pack and pneumatic access doors .... Secure

Ram air deflector door .... Extended

Preflight Procedure – First Officer

The first officer normally does this procedure. The captain may do this procedure as needed.

Flight control panel .... Check

FLIGHT CONTROL switches – Guards closed

Verify that the flight control LOW PRESSURE lights are illuminated.

Flight SPOILER switches – Guards closed

YAW DAMPER switch – ON

Verify that the YAW DAMPER light is extinguished.

Verify that the standby hydraulic LOW QUANTITY light is extinguished.

Verify that the standby hydraulic LOW PRESSURE light is extinguished.

[Option - RSEP airplanes]
Verify that the STBY RUD ON light is extinguished.

ALTERNATE FLAPS master switch – Guard closed

ALTERNATE FLAPS position switch – OFF

Verify that the FEEL DIFF PRESS light is extinguished.

Verify that the SPEED TRIM FAIL light is extinguished.

Verify that the MACH TRIM FAIL light is extinguished.

Verify that the AUTO SLAT FAIL light is extinguished.

NAVIGATION panel ....Set

VHF NAV transfer switch – NORMAL

IRS transfer switch – NORMAL

[Option]
FMC source select switch – NORMAL

DISPLAYS panel ....Set

SOURCE selector – AUTO

CONTROL PANEL select switch – NORMAL

Fuel panel ....Set

Verify that the ENG VALVE CLOSED lights are illuminated dim.

Verify that the SPAR VALVE CLOSED lights are illuminated dim.

Verify that the FILTER BYPASS lights are extinguished.

CROSSFEED selector – Closed

Verify that the VALVE OPEN light is extinguished.

FUEL PUMP switches – OFF

Verify that the center tank fuel pump LOW PRESSURE lights are extinguished.

Verify that the main tank fuel pump LOW PRESSURE lights are illuminated.

Electrical panel ....Set

BATTERY switch – Guard closed

[Option]
CAB/UTIL power switch – ON

[Option]
IFE/PASS SEAT power switch – ON

STANDBY POWER switch – Guard closed

Verify that the STANDBY PWR OFF light is extinguished.

Verify that the BAT DISCHARGE light is extinguished.

Verify that the TR UNIT light is extinguished.

Verify that the ELEC light is extinguished.

Generator drive DISCONNECT switches – Guards closed

Verify that the DRIVE lights are illuminated.

BUS TRANSFER switch – Guard closed

Verify that the TRANSFER BUS OFF lights are extinguished.

Verify that the SOURCE OFF lights are extinguished.

Verify that the GEN OFF BUS lights are illuminated.

Overheat and fire protection panel .... Check

Do this check if the flight crew did not do the Electrical Power Up supplementary procedure. This check is needed once per flight day.

Verify that the engine No. 1, APU, and engine No. 2 fire switches are in.

Alert ground personnel before the following test is accomplished:

OVERHEAT DETECTOR switches – NORMAL

TEST switch – Hold to FAULT/INOP

Verify that the MASTER CAUTION lights are illuminated.

Verify that the OVHT/DET annunciator is illuminated.

Verify that the FAULT light is illuminated.

If the FAULT light fails to illuminate, the fault monitoring system is inoperative.

Verify that the APU DET INOP light is illuminated.

Do not run the APU if the APU DET INOP light does not illuminate.

Note: The fire warning light flashes and the horn sounds on the APU ground control panel when this test is done with the APU running. This can be mistaken by the ground crew as an APU fire.

TEST switch – Hold to OVHT/FIRE

Verify that the fire warning bell sounds.

Verify that the master FIRE WARN lights are illuminated.

Verify that the MASTER CAUTION lights are illuminated.

Verify that the OVHT/DET annunciator is illuminated.

Master FIRE WARN light – Push

Verify that the master FIRE WARN lights are extinguished.

Verify that the fire warning bell cancels.

Verify that the engine No. 1, APU and engine No. 2 fire switches stay illuminated.

[Airplanes with the NEW Engine Start Levers]
Verify that the engine No. 1 and engine No. 2 start lever lights stay illuminated.

Verify that the ENG 1 OVERHEAT and ENG 2 OVERHEAT lights stay illuminated.

Verify that the WHEEL WELL fire warning light stays illuminated.

EXTINGUISHER TEST switch – Check

TEST switch – Position to 1 and hold.

Verify that the three green extinguisher test lights are illuminated.

TEST switch – Release

Verify that the three green extinguisher test lights are extinguished.

Repeat for test position 2.

APU switch (as needed) ....START

Note: If extended APU operation is needed on the ground and the airplane busses are powered by AC electrical power, position an AC powered fuel pump ON. This extends the service life of the APU fuel control unit.

Note: If fuel is loaded in the center tank, position the left center tank fuel pump switch ON to prevent a fuel imbalance before takeoff.

CAUTION: Position the center tank fuel pump switches ON only if the fuel quantity in the center tank exceeds 453kgs/1000 lbs.

CAUTION: Do not operate the center tank fuel pumps with the flight deck unattended.

When the APU GEN OFF BUS light is illuminated:

APU GENERATOR bus switches – ON

Verify that the SOURCE OFF lights are extinguished.

Verify that the TRANSFER BUS OFF lights are extinguished.

Note: Run the APU for two full minutes before using it as a bleed air source.

[Option]
Lavatory SMOKE light ....Verify extinguished

EQUIPMENT COOLING switches .... NORM

Verify that the OFF lights are extinguished.

EMERGENCY EXIT LIGHTS switch ....Guard closed

Verify that the NOT ARMED light is extinguished.

Passenger signs .... Set

NO SMOKING switch – AUTO or ON

[Option]
NO ELECTRONIC DEVICES switch – AUTO or ON

FASTEN BELTS switch – AUTO or ON

Supernumerary signs .... Set

FASTEN BELTS switch – AUTO or ON

When refueling with supernumerary on board, the FASTEN BELTS switch shall remain off.

Windshield WIPER selectors ....PARK

Verify that the windshield wipers are stowed.

WINDOW HEAT switches .... ON

Position switches ON at least 10 minutes before takeoff.

Verify that the OVERHEAT lights are extinguished.

[Option - Green Power ON Indicator Lights]
Verify that the ON lights are illuminated (except at high ambient temperatures.)

[Option - Amber Power OFF Indicator Lights]
Verify that the OFF lights are extinguished (except at high ambient temperatures.)

[With automatic probe heat]
PROBE HEAT switches ....AUTO

Verify that all lights are illuminated.

[Without automatic probe heat]
PROBE HEAT switches .... OFF

Verify that all lights are illuminated.

WING ANTI–ICE switch .... OFF

Verify that the VALVE OPEN lights are extinguished.

[Option]
Verify that the ICE DETECTOR light is extinguished.

ENGINE ANTI–ICE switches .... OFF

Verify that the COWL ANTI–ICE lights are extinguished.

Verify that the COWL VALVE OPEN lights are extinguished.

Hydraulic panel ....Set

ENGINE HYDRAULIC PUMPS switches – ON

Verify that the LOW PRESSURE lights are illuminated.

ELECTRIC HYDRAULIC PUMPS switches – OFF

Verify that the OVERHEAT lights are extinguished.

Verify that the LOW PRESSURE lights are illuminated.

[Option]
High altitude landing switch ....As needed

Verify that the INOP light is extinguished

Air conditioning panel ....Set

AIR TEMPERATURE source selector – As needed

[737-800/900]
TRIM AIR switch – ON

[737-600/700]
Verify that the DUCT OVERHEAT lights are extinguished.

[737-800/900]
Verify that the ZONE TEMP lights are extinguished.

Temperature selectors – As needed

Verify that the RAM DOOR FULL OPEN lights are illuminated.

[737-600/700]
RECIRC FAN switch – AUTO

[737-800/900]
RECIRC FAN switches – AUTO

Air conditioning PACK switches – AUTO or HIGH

ISOLATION VALVE switch – OPEN

Engine BLEED air switches – ON

APU BLEED air switch – ON

Verify that the DUAL BLEED light is illuminated.

[737-600/700]
Verify that the PACK TRIP OFF lights are extinguished.

[737-800/900]
Verify that the PACK lights are extinguished.

Verify that the WING–BODY OVERHEAT lights are extinguished.

Verify that the BLEED TRIP OFF lights are extinguished.

Cabin pressurization panel .... Set

Verify that the AUTO FAIL light is extinguished.

Verify that the OFF SCHED DESCENT light is extinguished.

FLIGHT ALTITUDE indicator – Cruise altitude

LANDING ALTITUDE indicator – Destination field elevation

Pressurization mode selector – AUTO

Verify that the ALTN light is extinguished.

Verify that the MANUAL light is extinguished.

Lighting panel .... Set

[Without LED Lighting System]
LANDING light switches – RETRACT and OFF

[With LED Lighting System]
LANDING light switches - OFF

RUNWAY TURNOFF light switches – OFF

TAXI light switch – OFF

Ignition select switch .... IGN L or R

Alternate the ignition select switch position on subsequent starts.

[Without automatic ignition]
ENGINE START switches .... OFF

[Automatic ignition]
ENGINE START switches ....AUTO

Lighting panel ....Set

[Option - LOGO light switch]
LOGO light switch – As needed

POSITION light switch – As needed

ANTI–COLLISION light switch – OFF

WING illumination switch – As needed

WHEEL WELL light switch – As needed

Mode control panel ....Set

COURSE(S) – Set

FLIGHT DIRECTOR switch – ON

Move the switch for the pilot flying to ON first.

EFIS control panel ....Set

MINIMUMS reference selector – RADIO or BARO

MINIMUMS selector – Set decision height or altitude reference

[Option]
FLIGHT PATH VECTOR switch – As needed

METERS switch – As needed

BAROMETRIC reference selector – IN or HPA

BAROMETRIC selector – Set local altimeter setting

VOR/ADF switches – As needed

Mode selector – MAP

CENTER switch – As needed

Range selector – As needed

TRAFFIC switch – As needed

WEATHER RADAR – Off

Verify that the weather radar indications are not shown on the MAP.

Map switches – As needed

Note: The oxygen test and set is not needed if the oxygen pressure drop test was done at this crewmembers station during the Preliminary Preflight Procedure - Captain or First Officer.

[Option - Oronasal Oxygen Mask]
Oxygen .... Test and set

Oxygen mask – Stowed and doors closed

RESET/TEST switch – Push and hold

Verify that the yellow cross shows momentarily in the flow indicator.

RESET/TEST switch – Release

Normal/100% switch – 100%

EMERGENCY/TEST selector – Normal (non-emergency)

[Option - EROS Full Face Oxygen Mask]
Oxygen .... Test and set

Oxygen mask – Stowed and doors closed

TEST/RESET switch – Push and hold

Verify that the yellow cross shows momentarily in the flow indicator.

TEST/RESET switch - Release

Normal/100% switch – 100%

EMERGENCY/TEST selector – Normal (non-emergency)

[Option - Electronic Flight Bag]
ELECTRONIC FLIGHT BAG .... Set

Clock .... Set

Display select panel .... Set

MAIN PANEL DISPLAY UNITS selector – NORM

LOWER DISPLAY UNIT selector – NORM

TAKEOFF CONFIG light
(if installed and operative) .... Verify extinguished

CABIN ALTITUDE light
(if installed and operative) .... Verify extinguished

Disengage light TEST switch ....Hold to 1

Verify that the A/P light is illuminated steady amber.

Verify that the A/T light is illuminated steady amber.

Verify that the FMC light is illuminated steady amber.

Disengage light TEST switch ....Hold to 2

Verify that the A/P light is illuminated steady red.

Verify that the A/T light is illuminated steady red.

Verify that the FMC light is illuminated steady amber.

Do the Initial Data and Navigation Data steps from the CDU Preflight Procedure and verify that the IRS alignment is complete before checking the flight instruments.

Flight instruments .... Check

Verify that the flight instrument indications are correct.

Verify that only these flags are shown:

- TCAS OFF
- NO VSPD until V–speeds are selected

Verify that the flight mode annunciations are correct:

- autothrottle mode is blank
- roll mode is blank
- pitch mode is blank
- AFDS status is FD.

Select the map mode.

[Option]
BRAKE TEMP light .... Verify extinguished

GROUND PROXIMITY panel .... Check

FLAP INHIBIT switch – Guard closed

GEAR INHIBIT switch – Guard closed

TERRAIN INHIBIT switch – Guard closed

[Option - With Runway Awareness and Advisory System]
RUNWAY INHIBIT switch – Guard closed

Verify that the GROUND PROXIMITY INOP light is extinguished.

[Option - With Runway Awareness and Advisory System]
Verify that the RUNWAY INOP light is extinguished

The RUNWAY INOP light can be illuminated until the GPS accuracy is adequate for the Runway Awareness and Advisory System requirements.

Landing gear panel .... Set

LANDING GEAR lever – DN

Verify that the green landing gear indicator lights are illuminated.

Verify that the red landing gear indicator lights are extinguished.

AUTO BRAKE select switch .... RTO

Verify that the AUTO BRAKE DISARM light is extinguished

ANTISKID INOP light .... Verify extinguished

Engine display control panel .... Set

N1 SET selector – AUTO

SPEED REFERENCE selector – AUTO

FUEL FLOW switch – RATE

Move switch to RESET, then RATE.

Engine instruments .... Check

Verify that the primary and secondary engine indications show existing conditions.

Verify that no exceedance is shown.

[Option]
Verify that the hydraulic quantity indications do not show RF.

[Option - Fail Operational airplanes]
MFD Cancel/Recall switch – Push

Verify that the autoland status advisory messages are not shown.

CARGO FIRE panel .... Check

This check is needed once per flight day.

Flight deck door – Open

[Option - Airplanes w/o Aux Fuel Tanks, or Airplanes with Aux Fuel Tanks and a Modified Cargo Fire System]
DETECTOR SELECT switches – NORM

TEST switch – Push

Verify that the fire warning bell sounds.

Verify that the master FIRE WARN lights are illuminated.

Master FIRE WARN light – Push

Verify that the master FIRE WARN lights are extinguished.

Verify that the fire warning bell cancels.

Verify that the green EXTINGUISHER test lights stay illuminated.

[Option - Passenger Airplanes]
Verify that the FWD and AFT cargo fire warning lights stay illuminated.

Verify that the DETECTOR FAULT light stays extinguished.

Verify that the DISCH light stays illuminated.

[Option]
HUD system .... As needed

[Option]
Radio tuning panel ....Set

WARNING: Do not key the HF radio while the airplane is being fueled. Injury to personnel or fire can occur.

Verify that the OFF light is extinguished.

[Option]
VHF communications radios ....Set

VHF NAVIGATION radios .... Set for departure

Audio control panel ....Set

ADF radios ....Set

WEATHER RADAR control panel ....Set

Transponder panel ....Set

STABILIZER TRIM override switch ....Guard closed

WARNING: Do not put objects between the seat and the aisle stand. Injury can occur when the seat is adjusted.

Seat .... Adjust

Use the handhold above the forward window for assistance when pulling the seat forward. Do not use the glareshield as damage can occur.

Adjust the seat for optimum eye reference.

Whenever the seat is adjusted, verify a positive horizontal (fore and aft) seat lock by pushing against the seat.

Rudder pedals .... Adjust

Adjust the rudder pedals to allow full rudder pedal and brake pedal movement.

CAUTION: Turn the rudder pedal adjust crank no faster than approximately one turn per second to avoid damage. Do not apply force to the pedals during adjustment.

Seat belt and shoulder harness .... Adjust

Do the PREFLIGHT checklist on the captain's command.

Preflight Procedure – Captain

The captain normally does this procedure. The first officer may do this procedure if needed.

Lights ....Test

Master LIGHTS TEST and DIM switch – TEST

The fire warning lights are not checked during this test. Use individual test switches or push to test features to check lights which do not illuminate during the light test. Use scan flow to verify that all other lights are flashing or illuminated. Verify that all system annunciator panel lights are illuminated.

Master LIGHTS TEST and DIM switch – As needed

EFIS control panel ....Set

MINIMUMS reference selector – RADIO or BARO

MINIMUMS selector – Set decision height or altitude reference

[Option]
FLIGHT PATH VECTOR switch – As needed

METERS switch – As needed

BAROMETRIC reference selector – IN or HPA

BAROMETRIC selector – Set local altimeter setting

VOR/ADF switches – As needed

Mode selector – MAP

CENTER switch – As needed

Range selector – As needed

TRAFFIC switch – As needed

WEATHER RADAR – Off

Verify that the weather radar indications are not shown on the MAP.

Map switches – As needed

Mode control panel ....Set

COURSE(S) – Set

FLIGHT DIRECTOR switch – ON

Move the switch for the pilot flying to ON first.

Bank angle selector – As needed

Autopilot DISENGAGE bar – UP

Note: The oxygen test and set is not needed if the oxygen pressure drop test was done at this crewmember station during the Preliminary Preflight Procedure - Captain or First Officer.

[Option - Oronasal Oxygen Mask]
Oxygen ....Test and set

Oxygen mask – Stowed and doors closed

RESET/TEST switch – Push and hold

Verify that the yellow cross shows momentarily in the flow indicator.

RESET/TEST switch – Release

Normal/100% switch – 100%

EMERGENCY/TEST selector – Normal (non-emergency)

[Option - EROS Full Face Oxygen Mask]
Oxygen ....Test and set

Oxygen mask – Stowed and doors closed

TEST/RESET switch – Push and hold

Verify that the yellow cross shows momentarily in the flow indicator.

TEST/RESET switch – Release

Normal/100% switch – 100%

EMERGENCY/TEST selector – Normal (non-emergency)

[Option - Electronic Flight Bag]
ELECTRONIC FLIGHT BAG .... Set

Clock .... Set

NOSE WHEEL STEERING switch .... Guard closed

Display select panel .... Set

MAIN PANEL DISPLAY UNITS selector – NORM

LOWER DISPLAY UNIT selector – NORM

TAKEOFF CONFIG light
(if installed and operative) .... Verify extinguished

CABIN ALTITUDE light
(if installed and operative) .... Verify extinguished

Disengage light TEST switch .... Hold to 1

Verify that the A/P light is illuminated steady amber.

Verify that the A/T light is illuminated steady amber.

Verify that the FMC light is illuminated steady amber.

Disengage light TEST switch .... Hold to 2

Verify that the A/P light is illuminated steady red.

Verify that the A/T light is illuminated steady red.

Verify that the FMC light is illuminated steady amber.

STAB OUT OF TRIM light .... Verify extinguished

Do the Initial Data and Navigation Data steps from the CDU Preflight Procedure and verify that the IRS alignment is complete before checking the flight instruments.

Flight instruments .... Check

Verify that the flight instrument indications are correct.

Verify that only these flags are shown:

- TCAS OFF
- NO VSPD until V–speeds are selected

Verify that the flight mode annunciations are correct:

- autothrottle mode is blank
- roll mode is blank
- pitch mode is blank
- AFDS status is FD

Select the map mode.

[Option - without Integrated Standby Flight Display]
Standby instruments .... Check

Standby attitude indicator – Set

Gyro caging control – Pull, then release

Approach mode selector – OFF

Verify that the flight instrument indications are correct.

Verify that no flags are shown.

Standby altimeter – Set

Verify that the flight instrument indications are correct.

Verify that no flags are shown.

[Option - with Integrated Standby Flight Display]
Integrated standby flight display ....Set

Verify that the approach mode display is blank.

Set the altimeter.

Verify that the flight instrument indications are correct.

Verify that no flags or messages are shown.

[Option]
Standby RMI ....Set

Select either VOR or ADF.

Verify only expected flags are shown.

SPEED BRAKE lever ....DOWN detent

Verify that the SPEED BRAKE ARMED light is extinguished.

Verify that the SPEED BRAKE DO NOT ARM light is extinguished.

Verify that the SPEEDBRAKES EXTENDED light is extinguished.

Reverse thrust levers .... Down

Forward thrust levers ....Closed

FLAP lever .... Set

Set the flap lever to agree with the flap position.

[Option]
Verify that the FLAP LOAD RELIEF light is extinguished.

Parking brake .... Set

Verify that the parking brake warning light is illuminated

Note: Do not assume that the parking brake can prevent airplane movement. Accumulator pressure can be insufficient.

Engine start levers .... CUTOFF

STABILIZER TRIM cutout switches .... NORMAL

[Option]
HUD system .... As needed

[Option]
Radio tuning panel .... Set

WARNING: Do not key the HF radio while the airplane is being fueled. Injury to personnel or fire can occur.

Verify that the OFF light is extinguished.

[Option]
VHF communications radios .... Set

VHF NAVIGATION radios .... Set for departure

Audio control panel .... Set

WARNING: Do not put objects between the seat and the aisle stand. Injury can occur when the seat is adjusted.

Seat .... Adjust

Use the handhold above the forward window for assistance when pulling the seat forward. Do not use the glareshield as damage can occur.

Adjust the seat for optimum eye reference.

Whenever the seat is adjusted, verify a positive horizontal (fore and aft) seat lock by pushing against the seat.

Rudder pedals .... Adjust

Adjust the rudder pedals to allow full rudder pedal and brake pedal movement.

CAUTION: Turn the rudder pedal adjust crank no faster than approximately one turn per second to avoid damage. Do not apply force to the pedals during adjustment.

Seat belt and shoulder harness .... Adjust

Call "PREFLIGHT CHECKLIST."

Before Start Procedure

Start the Before Start Procedure after papers are on board.

Flight deck door ....Closed and locked F/O

Verify that the LOCK FAIL light is extinguished.

Do the CDU Preflight Procedure – Performance Data steps before completing this procedure.

CDU display ....Set C, F/O

Normally the PF selects the TAKEOFF REF page.

Normally the PM selects the LEGS page.

N1 bugs ....Check C, F/O

Verify that the N1 reference bugs are correct.

IAS bugs ....Set C, F/O

[Option - EFIS/MAP]
Verify that the speed bugs are at V1, VR, V2 + 15, and flaps up maneuvering speed.

MCP ....Set C

AUTOTHROTTLE ARM switch – ARM

IAS/MACH selector – Set V2

Arm LNAV as needed

[Option - FMC U10.8 and later, FCC Collins P4 and later or FCC Honeywell 710 and later, and CDS BP06 and later]
Arm VNAV

Initial heading – Set

Initial altitude – Set

Taxi and Takeoff briefings ....Complete C, F/O

The pilot who will do the takeoff does the taxi and takeoff briefings.

As part of the takeoff briefing for the first flight of the day and following a change of either flight crew member, cabin altitude warning indications and memory item procedures must be briefed on airplanes in which the CABIN ALTITUDE and TAKEOFF CONFIG lights are not installed, or are installed but not activated. The briefing must contain the following information:

Whenever the intermittent warning horn sounds in flight at an airplane flight altitude above 10,000 feet MSL:

1. Immediately, don oxygen masks and set regulators to 100%.
2. Establish crew communications.
3. Do the CABIN ALTITUDE WARNING or Rapid Depressurization non-normal checklist.

Both pilots must verify on the overhead Cabin Altitude Panel that the cabin altitude is stabilized at or below 10,000 feet before removing oxygen masks.

Exterior doors .... Verify closed F/O

Flight deck windows ....Closed and locked C, F/O

Start clearance ....Obtain C, F/O

Obtain a clearance to pressurize the hydraulic systems.

Obtain a clearance to start the engines.

If pushback is needed:

Verify that the nose gear steering lockout pin is installed, or, if the nose gear steering lockout pin is not used, depressurize hydraulic system A during the hydraulic panel set step C, F/O

Fuel panel .... Set F/O

If the center tank fuel quantity exceeds 1,000 pounds/453 kilograms:

LEFT and RIGHT CENTER FUEL PUMPS switches – ON

Verify that the LOW PRESSURE lights illuminate momentarily and then extinguish.

If the LOW PRESSURE light stays illuminated turn off the CENTER FUEL PUMPS switch.

AFT and FORWARD FUEL PUMPS switches – ON

Verify that the LOW PRESSURE lights are extinguished.

Hydraulic panel .... Set F/O

If pushback is needed and the nose gear steering lockout pin is not installed:

WARNING: Do not pressurize hydraulic system A. Unwanted tow bar movement can occur.

System A HYDRAULIC PUMP switches – OFF

Verify that the system A pump LOW PRESSURE lights are illuminated.

System B electric HYDRAULIC PUMP switch – ON

Verify that the system B electric pump LOW PRESSURE light is extinguished.

Verify that the brake pressure is 2,800 psi minimum.

Verify that the system B pressure is 2,800 psi minimum.

If pushback is not needed, or if pushback is needed and the nose gear steering lockout pin is installed:

Electric HYDRAULIC PUMP switches – ON

Verify that the electric pump LOW PRESSURE lights are extinguished.

Verify that the brake pressure is 2,800 psi minimum.

Verify that the system A and B pressures are 2,800 psi minimum.

ANTI COLLISION light switch .... ON F/O

Trim .... Set C

Check each trim for freedom of movement.

Stabilizer trim – ___ UNITS

Set the trim for takeoff.

Verify that the trim is in the green band.

Aileron trim – 0 units

Rudder trim – 0 units

Call “BEFORE START CHECKLIST.” C

Do the BEFORE START checklist. F/O

Pushback or Towing Procedure

The Engine Start procedure may be done during pushback or towing.

Establish communications with ground handling personnel. C

CAUTION: Do not hold or turn the nose wheel steering wheel during pushback or towing. This can damage the nose gear or the tow bar.

CAUTION: Do not use airplane brakes to stop the airplane during pushback or towing. This can damage the nose gear or the tow bar.

Transponder ....As needed F/O

Set or release the parking brake as directed by ground handling personnel. C or F/O

When pushback or towing is complete:

Verify that the tow bar is disconnected C

Verify that the nose gear steering lockout pin is removed C

System A HYDRAULIC PUMPS switches – ON F/O

Verify that the system A pump LOW PRESSURE lights are extinguished

Verify that the system A pressure is 2800 psi minimum.

Engine Start Procedure

Normal starter duty cycle:

- Multiple consecutive start attempts are permitted. Each start attempt is limited to 2 minutes of starter usage.
- A minimum of 10 seconds is needed between start attempts.

Extended engine motorings:

- Starter usage is limited to 15 minutes for the first two extended engine motorings. A minimum of 2 minutes is needed between each attempt.
- For the third and subsequent extended engine motorings, starter usage is limited to 5 minutes. A minimum of 10 minutes is needed between each attempt.

Normal engine start considerations:

- do not move an engine start lever to IDLE detent early or a hot start can occur
- keep a hand on the engine start lever while monitoring RPM, EGT and fuel flow until stable
- if fuel is shutoff accidentally (by closing the engine start lever) do not reopen the engine start lever in an attempt to restart the engine

- failure of the ENGINE START switch to stay in GRD until the starter cutout RPM can cause a hot start. Do not re–engage the ENGINE START switch until engine RPM is below 20% N2.
- If a fluid leak (other than a continuous stream) from any of the engine drains is discovered during the Exterior Inspection, the engine can be started. If during engine start, the ground crew reports a fluid leak from an engine drain, the engine start may be continued.
- If the fluid leak continues after the engine is stable at idle, do one of the following:
  - shut down the engine for maintenance action, or
  - run the engine at idle thrust for up to 5 minutes. If the fluid leak stops during this time, no maintenance action is needed, or
  - shut down and restart the engine. Run the engine at idle thrust for up to 5 minutes. If the fluid leak stops during this time, no maintenance action is needed.
- For the first flight of the day, at airport elevations at or above 2,000 feet MSL, if the temperature is below 5°C/41°F, consider placing the Ignition select switch to BOTH before starting the engines. This may increase the likelihood of a successful engine start on the first attempt.

Do the ABORTED ENGINE START checklist for one or more of the following abort start conditions:

- the N1 or N2 does not increase or increases very slowly after the EGT increases
- there is no oil pressure indication by the time that the engine is stable at idle
- the EGT does not increase by 15 seconds after the engine start lever is moved to IDLE detent
- the EGT quickly nears or exceeds the start limit

[Option]
Select the secondary engine indications. F/O

Air conditioning PACK switches ....OFF F/O

Start sequence ....Announce C

Call “START ___ ENGINE” C

ENGINE START switch ....GRD F/O

Verify that the N2 RPM increases. C, F/O

When N1 rotation is seen and N2 is at 25%, or (if 25% N2 is not possible), at maximum motoring and a minimum of 20% N2:

Note: Maximum motoring occurs when N2 acceleration is less than 1% in approximately 5 seconds.

[Option - New Engine Start Levers]

CAUTION: Do not apply rotational force when moving the engine start lever.

Engine start lever .... IDLE detent C

Monitor fuel flow and EGT indications. C, F/O

[Automatic ignition]
At 56% N2, verify that the ENGINE START switch moves to AUTO. If not, move the ENGINE START switch to AUTO. F/O

[Without automatic ignition]
At 56% N2, verify that the ENGINE START switch moves to OFF. If not, move the ENGINE START switch to OFF. F/O

[Automatic ignition]
Verify that the START VALVE OPEN alert extinguishes when the ENGINE START switch moves to AUTO. F/O

[Without automatic ignition]
Verify that the START VALVE OPEN alert extinguishes when the ENGINE START switch moves to OFF. F/O

Call “STARTER CUTOUT.” F/O

Monitor N1, N2, EGT, fuel flow and oil pressure for normal indications while the engine accelerates to a stable idle. C, F/O

After the engine is stable at idle, start the other engine.

Note: The engine is stable at idle when the EGT start limit redline is no longer shown.

Before Taxi Procedure

Start the Before Taxi Procedure after the engines are stable at idle.

GENERATOR 1 and 2 switches .... ON F/O

PROBE HEAT switches ....ON F/O

WING ANTI–ICE switch....................................As needed F/O

ENGINE ANTI–ICE switches ....As needed F/O

PACK switches .... AUTO F/O

ISOLATION VALVE switch .... AUTO F/O

APU BLEED air switch ....OFF F/O

APU switch ....OFF F/O

[Without automatic ignition]
ENGINE START switches .... CONT F/O

Engine start levers ....IDLE detent C

Verify that the ground equipment is clear. C, F/O

Call “FLAPS ___” as needed for takeoff. C

Flap lever ....Set takeoff flaps F/O

Verify that the LE FLAPS EXT green light is illuminated.

Flight controls ....Check C

[Option - Flight Control Surface Position Indicator]
Push the MFD SYS switch to display the flight control surface position indications on the lower display unit, if desired.

Make slow and deliberate inputs, one direction at a time.

Move the control wheel and the control column to full travel in both directions and verify:

- freedom of movement
- that the controls return to center

[Option - Flight Control Surface Position Indicator]
- correct flight control movement if the flight control surface position indications are displayed on the lower display unit.

Hold the nose wheel steering wheel during the rudder check to prevent nose wheel movement.

Move the rudder pedals to full travel in both directions and verify:

- freedom of movement
- that the rudder pedals return to center

[Option - Flight Control Surface Position Indicator]
- correct flight control movement if the flight control surface position indications are displayed on the lower display unit.

[Option]
Blank the lower display unit. F/O

Transponder .... As needed F/O

Recall ....Check C, F/O

Verify that all system annunciator panel lights illuminate and then extinguish.

[Option - Electronic Flight Bag]

CAUTION: Do not use the Airport Map application as a primary navigation reference. The Airport Map application is designed to aid flight crew positional awareness only.

EFB AIRPORT MAP application................................Select C, F/O

Select map as desired.

Update changes to the taxi briefing, as needed. C or PF

Call "BEFORE TAXI CHECKLIST." C

Do the BEFORE TAXI checklist. F/O

Before Takeoff Procedure

Engine warm up requirement:

- verify an increase in engine oil temperature before takeoff.

Engine warm up recommendations:

- run the engines for at least 2 minutes
- use a thrust setting normally used for taxi operations.

Pilot Flying	Pilot Monitoring
	[Passenger Airplanes] Notify the cabin crew to prepare for takeoff. Verify that the cabin is secure. [Freight Only Airplanes] Notify the supernumeraries to prepare for takeoff.
The pilot who will do the takeoff updates changes to the takeoff briefing as needed.	
Set the weather radar display as needed. [Option - with EGPWS] Set the terrain display as needed.	
Call "BEFORE TAKEOFF CHECKLIST."	Do the BEFORE TAKEOFF checklist.

Before Takeoff Procedure [AD 2002-19-52 and AD 2002-24-51]

Engine warm up requirement:

- verify an increase in engine oil temperature before takeoff.

Engine warm up recommendations:

- run the engines for at least 2 minutes
- use a thrust setting normally used for taxi operations.

Pilot Flying	Pilot Monitoring
	Check the center tank fuel quantity. Both center tank fuel pump switches must be OFF for takeoff if center tank fuel is less than 5000 pounds/2300 kilograms. Do not accomplish the CONFIG non-normal checklist with less than 5000 pounds/2300 kilograms in the center tank prior to takeoff.
	[Passenger Airplanes] Notify the cabin crew to prepare for takeoff. Verify that the cabin is secure.
The pilot who will do the takeoff updates changes to the takeoff briefing as needed.	
Set the weather radar display as needed. [Option - with EGPWS] Set the terrain display as needed.	
Call “BEFORE TAKEOFF CHECKLIST.”	Do the BEFORE TAKEOFF checklist.

Before Takeoff Procedure [Alternate Method of Compliance (AMOC) to AD 2002-24-51]

Engine warm up requirement:

- verify an increase in engine oil temperature before takeoff.

Engine warm up recommendations:

- run the engines for at least 2 minutes
- use a thrust setting normally used for taxi operations.

Pilot Flying	Pilot Monitoring
	Check the center tank fuel quantity. Both center tank fuel pump switches must be OFF for takeoff if center tank fuel is less than 5000 pounds/2300 kilograms. Do not accomplish the CONFIG non-normal checklist with less than 5000 pounds/2300 kilograms in the center tank prior to takeoff.
	[Passenger Airplanes] Notify the cabin crew to prepare for takeoff. Verify that the cabin is secure.
The pilot who will do the takeoff updates changes to the takeoff briefing as needed.	
Set the weather radar display as needed. [Option - with EGPWS] Set the terrain display as needed.	
Call “BEFORE TAKEOFF CHECKLIST.”	Do the BEFORE TAKEOFF checklist.

Before Takeoff Procedure [Alternate Method of Compliance (AMOC) to AD 2001-08-24 and AD 2002-24-51 for Airplanes with Master Caution System Logic Change and Automatic Shutoff]

Engine warm up requirement:

- verify an increase in engine oil temperature before takeoff.

Engine warm up recommendations:

- run the engines for at least 2 minutes
- use a thrust setting normally used for taxi operations.

Pilot Flying	Pilot Monitoring
	[Passenger Airplanes] Notify the cabin crew to prepare for takeoff. Verify that the cabin is secure.
The pilot who will do the takeoff updates changes to the takeoff briefing as needed.	
Set the weather radar display as needed. [Option - with EGPWS] Set the terrain display as needed.	
Call “BEFORE TAKEOFF CHECKLIST.”	Do the BEFORE TAKEOFF checklist.

Takeoff Procedure

[Option - With auto T/O thrust reduction and with FMC U10.8 and later, FCC Collins P4 and later or FCC Honeywell 710 and later and CDS BP06 and later]

Pilot Flying	Pilot Monitoring
	[Option - Runway position update with the CDU only] Update the FMC position to the runway threshold on the CDU TAKEOFF REF page.
Before entering the departure runway, verify that the runway and runway entry point are correct.	
	When entering the departure runway, set the STROBE light switch to ON. Use other lights as needed. Set the transponder mode selector to TA/RA.
Verify that the brakes are released. Align the airplane with the runway.	
Verify that the airplane heading agrees with the assigned runway heading.	
	[Without LED Lighting System] When cleared for takeoff, set the FIXED LANDING light switches to ON. [With LED Lighting System] When cleared for takeoff, set the LANDING light switches to ON.
Advance the thrust levers to approximately 40% N1. Allow the engines to stabilize.	
Push the TO/GA switch.	
Verify that the correct takeoff thrust is set.	

Pilot Flying	Pilot Monitoring
	Monitor the engine instruments during the takeoff. Call out any abnormal indications. Adjust takeoff thrust before 60 knots as needed. During strong headwinds, if the thrust levers do not advance to the planned takeoff thrust, manually advance the thrust levers before 60 knots. Call "THRUST SET".
After takeoff thrust is set, the captain’s hand must be on the thrust levers until V1.	
Monitor airspeed. Maintain light forward pressure on the control column.	Monitor airspeed and call out any abnormal indications.
Verify 80 knots and call “CHECK.”	Call “80 KNOTS.”
Verify V1 speed.	Verify the automatic V1 callout or call “V1.”
At VR, rotate toward 15° pitch attitude. After liftoff, follow F/D commands.	At VR, call “ROTATE.” Monitor airspeed and vertical speed.
Establish a positive rate of climb.	
	Verify a positive rate of climb on the altimeter and call “POSITIVE RATE.”
Verify a positive rate of climb on the altimeter and call “GEAR UP.”	
	Set the landing gear lever to UP.
Above 400 feet radio altitude, call for a roll mode as needed.	Select or verify the roll mode. Verify VNAV engaged.
At thrust reduction height, verify that climb thrust is set.	

Pilot Flying	Pilot Monitoring
Verify acceleration at the acceleration height. Call “FLAPS ___” according to the flap retraction schedule.	
	Set the FLAP lever as directed.
Engage the autopilot when above the minimum altitude for autopilot engagement.	
	After flap retraction is complete: • Set or verify engine bleeds and air conditioning packs are operating [Without automatic ignition] • Set the engine start switches as needed • Set the AUTO BRAKE select switch to OFF • Set the landing gear lever to OFF after landing gear retraction is complete.
Call “AFTER TAKEOFF CHECKLIST.”	
	Do the AFTER TAKEOFF checklist.

CAUTION: Do not allow the shoulder harness straps to retract quickly. Buckles can pull or damage circuit breakers.

Takeoff Procedure

[Option - Without auto T/O thrust reduction and with FMC U10.8 and later, FCC Collins P4 and later or FCC Honeywell 710 and later and CDS BP06 and later]

Pilot Flying	Pilot Monitoring
	[Option - Runway position update with the CDU only] Update the FMC position to the runway threshold on the CDU TAKEOFF REF page.
Before entering the departure runway, verify that the runway and runway entry point are correct.	
	When entering the departure runway, set the STROBE light switch to ON. Use other lights as needed. Set the transponder mode selector to TA/RA.
Verify that the brakes are released. Align the airplane with the runway.	
Verify that the airplane heading agrees with the assigned runway heading.	
	[Without LED Lighting System] When cleared for takeoff, set the FIXED LANDING light switches to ON. [With LED Lighting System] When cleared for takeoff, set the LANDING light switches to ON.
Advance the thrust levers to approximately 40% N1. Allow the engines to stabilize.	
Push the TO/GA switch.	
Verify that the correct takeoff thrust is set.	

<table>
<tr><th>Pilot Flying</th><th>Pilot Monitoring</th></tr>
<tr><td></td><td>Monitor the engine instruments during the takeoff. Call out any abnormal indications.
Adjust takeoff thrust before 60 knots as needed.
During strong headwinds, if the thrust levers do not advance to the planned takeoff thrust, manually advance the thrust levers before 60 knots.
Call "THRUST SET".</td></tr>
<tr><td colspan="2">After takeoff thrust is set, the captain’s hand must be on the thrust levers until V1.</td></tr>
<tr><td>Monitor airspeed.
Maintain light forward pressure on the control column.</td><td>Monitor airspeed and call out any abnormal indications.</td></tr>
<tr><td>Verify 80 knots and call “CHECK.”</td><td>Call “80 KNOTS.”</td></tr>
<tr><td>Verify V1 speed.</td><td>Verify the automatic V1 callout or call “V1.”</td></tr>
<tr><td>At VR, rotate toward 15° pitch attitude. After liftoff, follow F/D commands.</td><td>At VR, call “ROTATE.”
Monitor airspeed and vertical speed.</td></tr>
<tr><td>Establish a positive rate of climb.</td><td></td></tr>
<tr><td></td><td>Verify a positive rate of climb on the altimeter and call “POSITIVE RATE.”</td></tr>
<tr><td>Verify a positive rate of climb on the altimeter and call “GEAR UP.”</td><td></td></tr>
<tr><td></td><td>Set the landing gear lever to UP.</td></tr>
<tr><td>Above 400 feet radio altitude, call for a roll mode as needed.</td><td>Select or verify the roll mode.
Verify VNAV engaged.</td></tr>
<tr><td>At 800 feet AGL, verify that takeoff thrust changes to climb thrust.</td><td></td></tr>
</table>

Pilot Flying	Pilot Monitoring
At acceleration height, verify acceleration. Call "FLAPS ___" according to the flap retraction schedule.	
	Set the FLAP lever as directed.
Engage the autopilot when above the minimum altitude for autopilot engagement.	
	After flap retraction is complete: • Set or verify engine bleeds and air conditioning packs are operating [Without automatic ignition] • Set the engine start switches as needed • Set the AUTO BRAKE select switch to OFF • Set the landing gear lever to OFF after landing gear retraction is complete.
Call "AFTER TAKEOFF CHECKLIST."	
	Do the AFTER TAKEOFF checklist.

CAUTION: Do not allow the shoulder harness straps to retract quickly. Buckles can pull or damage circuit breakers.

Takeoff Flap Retraction Speed Schedule

Takeoff Flaps	At Speed (display)	Select Flaps
25	V2 + 15 “15” “5” “1”	15 5 1 UP
15 or 10	V2 + 15 “5” “1”	5 1 UP
5	V2 + 15 “1”	1 UP
1	“1”	UP
Limit bank angle to 15° until reaching V2 + 15		

Climb and Cruise Procedure

Complete the After Takeoff Checklist before starting the Climb and Cruise Procedure.

Pilot Flying	Pilot Monitoring
	During climb and cruise, verify the RNP as needed.
	At or above 10,000 feet MSL, set the LANDING light switches to OFF.
	Set the passenger signs as needed.
When climbing above transition altitude, set and crosscheck the altimeters to standard.	
	During climb, set the affected center tank fuel pump switch to OFF when a center tank fuel pump LOW PRESSURE light illuminates. Set both center tank fuel pump switches to OFF when a center tank fuel pump LOW PRESSURE light illuminates if the center tank is empty.
	When established in a level flight attitude, if the center tank contains usable fuel and a center tank fuel pump switch(es) is OFF, set the center tank fuel pump switch(es) to ON again. Set the affected center tank fuel pump switch to OFF when a center tank fuel pump LOW PRESSURE light illuminates. Set both center tank fuel pump switches to OFF when a center tank fuel pump LOW PRESSURE light illuminates if the center tank is empty.
	During an ETOPS flight, additional steps must be done. See the ETOPS supplementary procedure in SP.1.

Pilot Flying	Pilot Monitoring
	Before the top of descent, modify the active route as needed for the arrival and approach.

Climb and Cruise Procedure [AD 2002-19-52 and AD 2002-24-51]

Complete the After Takeoff Checklist before starting the Climb and Cruise Procedure.

Pilot Flying	Pilot Monitoring
	During climb and cruise, verify the RNP as needed.
	If the center tank fuel pump switches were OFF for takeoff and the center tank contains more than 1000 pounds/500 kilograms, set both center tank fuel pump switches ON above 10,000 feet or after the pitch attitude has been reduced to begin acceleration to a climb speed of 250 knots or greater.
	During climb, set both center tank fuel pump switches OFF when center tank fuel quantity reaches approximately 1000 pounds/500 kilograms.
	At or above 10,000 feet MSL, set the LANDING light switches to OFF.
	Set the passenger signs as needed.
When climbing above transition altitude, set and crosscheck the altimeters to standard.	
	When established in a level attitude at cruise, if the center tank contains more than 1000 pounds/500 kilograms and the center tank fuel pump switches are OFF, set the center tank fuel pump switches ON again. Set both center tank fuel pump switches OFF when center tank fuel quantity reaches approximately 1000 pounds/500 kilograms.

Pilot Flying	Pilot Monitoring
	During an ETOPS flight, additional steps must be done. See the ETOPS supplementary procedure in SP.1.
	Before the top of descent, modify the active route as needed for the arrival and approach.

Climb and Cruise Procedure [Alternate Method of Compliance (AMOC) to AD 2002-24-51]

Complete the After Takeoff Checklist before starting the Climb and Cruise Procedure.

Pilot Flying	Pilot Monitoring
	During climb and cruise, verify the RNP as needed.
	If the center tank fuel pump switches were OFF for takeoff and the center tank contains more than 2000 pounds/950 kilograms, set both center tank fuel pump switches ON above 10,000 feet or after the pitch attitude has been reduced to begin acceleration to a climb speed of 250 knots or greater.
	At or above 10,000 feet MSL, set the LANDING light switches to OFF.
	Set the passenger signs as needed.
When climbing above transition altitude, set and crosscheck the altimeters to standard.	
	During climb or cruise, set one center tank fuel pump switch OFF when center tank fuel quantity reaches approximately 2000 pounds/950 kilograms. Open the crossfeed valve to minimize fuel imbalance. Set the remaining center tank fuel pump switch OFF without delay and close the crossfeed valve when the Master Caution and FUEL system annunciator illuminate.
	During an ETOPS flight, additional steps must be done. See the ETOPS supplementary procedure in SP.1.

Pilot Flying	Pilot Monitoring
	Before the top of descent, modify the active route as needed for the arrival and approach.

Climb and Cruise Procedure [Alternate Method of Compliance (AMOC) to AD 2001-08-24 and AD 2002-24-51 for Airplanes with Master Caution System Logic Change and Automatic Shutoff]

Complete the After Takeoff Checklist before starting the Climb and Cruise Procedure.

<table>
<tr><th>Pilot Flying</th><th>Pilot Monitoring</th></tr>
<tr><td></td><td>During climb and cruise, verify the RNP as needed.</td></tr>
<tr><td></td><td>At or above 10,000 feet MSL, set the LANDING light switches to OFF.</td></tr>
<tr><td></td><td>Set the passenger signs as needed.</td></tr>
<tr><td colspan="2">When climbing above transition altitude, set and crosscheck the altimeters to standard.</td></tr>
<tr><td></td><td>During climb, set the affected center tank fuel pump switch to OFF when a center tank fuel pump LOW PRESSURE light illuminates.

Set both center tank fuel pump switches to OFF when a center tank fuel pump LOW PRESSURE light illuminates if the center tank is empty.</td></tr>
<tr><td></td><td>When established in a level flight attitude, if the center tank contains usable fuel and a center tank fuel pump switch(es) is OFF, set the center tank fuel pump switch(es) to ON again.

Set the affected center tank fuel pump switch to OFF when a center tank fuel pump LOW PRESSURE light illuminates.

Set both center tank fuel pump switches to OFF when a center tank fuel pump LOW PRESSURE light illuminates if the center tank is empty.</td></tr>
</table>

Pilot Flying	Pilot Monitoring
	During an ETOPS flight, additional steps must be done. See the ETOPS supplementary procedure in SP.1.
	Before the top of descent, modify the active route as needed for the arrival and approach.

Descent Procedure

Start the Descent Procedure before the airplane descends below the cruise altitude for arrival at destination.

Complete the Descent Procedure by 10,000 feet MSL.

Pilot Flying	Pilot Monitoring
	During the descent, verify the RNP as needed.
	Set the affected center tank fuel pump switch to OFF when a center tank fuel pump LOW PRESSURE light illuminates. Set both center tank fuel pump switches to OFF when a center tank fuel pump LOW PRESSURE light illuminates if the center tank is empty.

Pilot Flying	Pilot Monitoring
	If established in a level flight attitude, for an extended period of time with usable fuel in the center tank and a center tank fuel pump switch(es) is OFF, set the center tank fuel pump switch(es) to ON again. Set the affected center tank fuel pump switch to OFF when a center tank fuel pump LOW PRESSURE light illuminates. Set both center tank fuel pump switches to OFF when a center tank fuel pump LOW PRESSURE light illuminates if the center tank is empty.
	Verify that pressurization is set to landing altitude.
Review the system annunciator lights.	Recall and review the system annunciator lights.
Check landing performance	
	[Airplanes with Fail Operational Autoland capability] Verify that the autoland advisory messages are not shown.

[Not ORW]

Verify VREF on the APPROACH REF page.	Enter VREF on the APPROACH REF page.

Set the RADIO/BARO minimums as needed for the approach.	
Set or verify the navigation radios and course for the approach.	
	Set the AUTO BRAKE select switch to the needed brake setting.
Do the approach briefing.	
Call “DESCENT CHECKLIST.”	Do the DESCENT checklist.

Descent Procedure [AD 2002-19-52 and AD 2002-24-51]

Start the Descent Procedure before the airplane descends below the cruise altitude for arrival at destination.

Complete the Descent Procedure by 10,000 feet MSL.

Pilot Flying	Pilot Monitoring
	During the descent, verify the RNP as needed.
	Set both center tank fuel pump switches OFF when center tank fuel quantity reaches approximately 3000 pounds/1400 kilograms. Do not accomplish the CONFIG non-normal checklist.
	Verify that pressurization is set to landing altitude.
Review the system annunciator lights.	Recall and review the system annunciator lights.
Check landing performance	

[Not ORW]

Verify VREF on the APPROACH REF page.	Enter VREF on the APPROACH REF page.

[ORW]

Verify VREF on APPROACH REF page 1/2.	Enter VREF on APPROACH REF page 1/2.

[ORW]

Verify runway condition on APPROACH REF page 2/2.	Enter or verify runway condition on APPROACH REF page 2/2.

Set the RADIO/BARO minimums as needed for the approach.
Set or verify the navigation radios and course for the approach.

Pilot Flying	Pilot Monitoring
	Set the AUTO BRAKE select switch to the needed brake setting.
Do the approach briefing.	
Call “DESCENT CHECKLIST.”	Do the DESCENT checklist.

Descent Procedure [Alternate Method of Compliance (AMOC) to AD 2002-24-51]

Start the Descent Procedure before the airplane descends below the cruise altitude for arrival at destination.

Complete the Descent Procedure by 10,000 feet MSL.

Pilot Flying	Pilot Monitoring
	During the descent, verify the RNP as needed.
	Set one center tank fuel pump switch OFF when center tank fuel quantity reaches approximately 3000 pounds/1400 kilograms. Open the crossfeed valve to minimize fuel imbalance. Turn the remaining center tank fuel pump switch OFF without delay and close the crossfeed valve when the Master Caution and FUEL system annunciator illuminate.

Pilot Flying	Pilot Monitoring
	If established in level flight for an extended period of time prior to approach and landing with more than 2000 pounds/950 kilograms in the center tank and the center tank fuel pump switches OFF, one center tank fuel pump switch may be turned ON again. Open the crossfeed valve to minimize fuel imbalance. Turn the remaining center tank fuel pump switch OFF without delay and close the crossfeed valve when the Master Caution and FUEL system annunciator illuminate.
	Verify that pressurization is set to landing altitude.
Review the system annunciator lights.	Recall and review the system annunciator lights.
Check landing performance	

[Not ORW]

Verify VREF on the APPROACH REF page.	Enter VREF on the APPROACH REF page.

[ORW]

Verify VREF on APPROACH REF page 1/2.	Enter VREF on APPROACH REF page 1/2.

[ORW]

Verify runway condition on APPROACH REF page 2/2.	Enter or verify runway condition on APPROACH REF page 2/2.

Set the RADIO/BARO minimums as needed for the approach.	
Set or verify the navigation radios and course for the approach.	

Pilot Flying	Pilot Monitoring
	Set the AUTO BRAKE select switch to the needed brake setting.
Do the approach briefing.	
Call “DESCENT CHECKLIST.”	Do the DESCENT checklist.

Descent Procedure [Alternate Method of Compliance (AMOC) to AD 2001-08-24 and AD 2002-24-51 for Airplanes with Master Caution System Logic Change and Automatic Shutoff]

Start the Descent Procedure before the airplane descends below the cruise altitude for arrival at destination.

Complete the Descent Procedure by 10,000 feet MSL.

Pilot Flying	Pilot Monitoring
	During the descent, verify the RNP as needed.
	Set the affected center tank fuel pump switch to OFF when a center tank fuel pump LOW PRESSURE light illuminates. Set both center tank fuel pump switches to OFF when a center tank fuel pump LOW PRESSURE light illuminates if the center tank is empty.

Pilot Flying	Pilot Monitoring
	If established in a level flight attitude, for an extended period of time with usable fuel in the center tank and a center tank fuel pump switch(es) is OFF, set the center tank fuel pump switch(es) to ON again. Set the affected center tank fuel pump switch to OFF when a center tank fuel pump LOW PRESSURE light illuminates. Set both center tank fuel pump switches to OFF when a center tank fuel pump LOW PRESSURE light illuminates if the center tank is empty.
	Verify that pressurization is set to landing altitude.
Review the system annunciator lights.	Recall and review the system annunciator lights.
Check landing performance	

[Not ORW]

Verify VREF on the APPROACH REF page.	Enter VREF on the APPROACH REF page.

[ORW]

Verify VREF on APPROACH REF page 1/2.	Enter VREF on APPROACH REF page 1/2.

[ORW]

Verify runway condition on APPROACH REF page 2/2.	Enter or verify runway condition on APPROACH REF page 2/2.

Set the RADIO/BARO minimums as needed for the approach.
Set or verify the navigation radios and course for the approach.

Pilot Flying	Pilot Monitoring
	Set the AUTO BRAKE select switch to the needed brake setting.
Do the approach briefing.	
Call "DESCENT CHECKLIST."	Do the DESCENT checklist.

Approach Procedure

The Approach Procedure is normally started at transition level.

Complete the Approach Procedure before:

- the initial approach fix, or
- the start of radar vectors to the final approach course, or
- the start of a visual approach

[Option - IAN]
For an instrument approach using IAN, select the approach procedure on the ARRIVALS page. Select the G/S prompt OFF if flying an ILS approach where the G/S transmitter is inoperative or when the G/S data is unreliable. Do not manually build the approach to add waypoints to the selected FMC procedure.

When using QFE, the use of LNAV/VNAV and IAN are not authorized.

[Option - GLS]
For a GLS approach, select the appropriate GLS channel.

For an ILS, LOC, BCRS, SDF or LDA approach, select the appropriate localizer frequency.

For a BCRS approach, enter the front course in the Mode Control Panel COURSE window. Do not select VOR/LOC.

[Option -IAN]
For all other approaches, select a VOR frequency in both VHF control panels.

[FAA]
If a flaps 15 landing is needed because of performance:

[FAA]

GROUND PROXIMITY FLAP INHIBIT
switch .... FLAP INHIBIT F/O

Note: If any of the following conditions apply, set VREF ICE = VREF 15 + 10 knots:

- Engine anti–ice will be used during landing
- Wing anti–ice has been used any time during the flight
- Icing conditions were encountered during the flight and the landing temperature is below 10°C.

Note: When VREF ICE is needed, the wind additive should not exceed 5 knots.

Pilot Flying	Pilot Monitoring
	During arrival and approach, verify the RNP as needed.
	Set the passenger signs as needed.
	[Without LED Lighting System] At or above 10,000 feet MSL, set the FIXED LANDING light switches to ON. [With LED Lighting System] At or above 10,000 feet MSL, set the LANDING light switches to ON.
When descending below the transition level, set and crosscheck the altimeters.	
Update the arrival and approach, as needed.	
Update the approach briefing as needed.	
Call “APPROACH CHECKLIST.”	Do the APPROACH checklist.

Flap Extension Schedule

Current Flap Position	At Speedtape “Display”	Select Flaps	Command Speed for Selected Flaps
UP	“UP”	1	“1”
1	“1”	5	“5”
5	“5”	15	“15”
15	“15”	30 or 40	(VREF30 or VREF40) + wind additives

Landing Procedure - ILS or GLS

Pilot Flying	Pilot Monitoring

Initially
• If on radar vectors
  • HDG SEL
  • Pitch mode (as needed)
• If enroute to a fix
  • LNAV or other roll mode
  • VNAV or other pitch mode	

	[Passenger Airplanes] Notify the cabin crew to prepare for landing. Verify that the cabin is secure. [Freight Only Airplanes] Notify the supernumeraries to prepare for landing.
Call "FLAPS ___" according to the flap extension schedule.	Set the flap lever as directed. Monitor flaps and slats extension.
When on localizer intercept heading: • verify that the ILS or GLS is tuned and identified • verify that the LOC and G/S pointers are shown.	
Arm the APP mode. If a dual channel approach is desired, engage the second autopilot.	

[Option - Digital Flight Control System does not capture glideslope before localizer is captured]

Note: When using LNAV to intercept the final approach course, LNAV might parallel the localizer without capturing it.

Use LNAV or HDG SEL to intercept the final approach course as needed.	
Verify that the localizer is captured. Verify the final approach course heading.	
	Call "GLIDESLOPE ALIVE."

Pilot Flying	Pilot Monitoring
At glideslope alive, call: • "GEAR DOWN" • "FLAPS 15"	
	Set the landing gear lever to DN. Verify that the green landing gear indicator lights are illuminated. Set the flap lever to 15. [Without automatic ignition] Set the engine start switches to CONT.
Set the speed brake lever to ARM. Verify that the SPEED BRAKE ARMED light is illuminated.	
At glideslope capture, call "FLAPS ___" as needed for landing.	Set the flap lever as directed.
Set the missed approach altitude on the MCP.	
Call "LANDING CHECKLIST."	Do the LANDING checklist.
At the final approach fix (LOM, MKR, DME), verify the crossing altitude.	
Monitor the approach. [Without Fail Operational Autoland capability] If an autoland is planned, verify the AFDS status at 500 feet AGL. [Fail Operational Autoland capability] If an autoland is planned, verify the autoland status at 500 feet AGL.	
For a single channel approach, disengage the autopilot and autothrottle no later than the minimum use height for single autopilot operation. For a dual channel approach, disengage the autopilot after touchdown.	

Landing Procedure - Instrument Approach using IAN

IAN should be used only for approaches that have one of the following features:

- a published GP angle on the LEGS page for the final approach segment
- an RWxx waypoint at the approach end of the runway
- a missed approach waypoint before the approach end of the runway, (for example, MXxx)

Use of IAN is not recommended when an approach has a visual maneuver segment that is not in the FMC database.

This procedure is not authorized using QFE.

Pilot Flying	Pilot Monitoring

Initially
• If on radar vectors
  • HDG SEL
  • Pitch mode (as needed)
• If enroute to a fix
  • LNAV or other roll mode
  • VNAV or other pitch mode	

	[Passenger Airplanes] Notify the cabin crew to prepare for landing. Verify that the cabin is secure.
Call “FLAPS ___” according to the flap extension schedule.	Set the flap lever as directed. Monitor flaps and slats extension.
When on localizer/final approach course intercept heading: • verify that the navigation radios are tuned and identified (as needed) • verify that the deviation pointers are shown.	
Arm the APP mode.	
WARNING: When using LNAV to intercept the localizer, LNAV might parallel the localizer without capturing it. The airplane can then descend on the glide path with the localizer not captured.	
Use LNAV or HDG SEL to intercept the final approach course as needed.	
Verify that the localizer/final approach course is captured. Verify final approach course heading.	

Pilot Flying	Pilot Monitoring
	Approximately 2 NM before the final approach fix, call "APPROACHING GLIDE PATH."
Approximately 2 NM before the final approach fix, call: • "GEAR DOWN" • "FLAPS 15"	
	Set the landing gear lever to DN. Verify that the green landing gear indicator lights are illuminated. Set the flap lever to 15. [Without automatic ignition] Set the engine start switches to CONT.
Set the speed brake lever to ARM. Verify that the SPEED BRAKE ARMED light is illuminated.	
At glide path capture, call "FLAPS ___" as needed for landing.	Set the flap lever as directed.
Set the missed approach altitude on the MCP.	
Call "LANDING CHECKLIST."	Do the LANDING checklist.
At the final approach fix: • verify the crossing altitude • crosscheck the altimeters. Verify they agree within 100 feet.	
Monitor the approach.	
If suitable visual reference is established at MDA(H), DA(H), or the missed approach point, disengage the autopilot in accordance with regulatory requirements, and disengage the autothrottle at the same time. Maintain the glide path to landing.	

Landing Procedure - Instrument Approach using VNAV

[With VNAV ALT enabled]

VNAV should be used only for approaches that have one of the following features:

- a published GP angle on the LEGS page for the final approach segment
- an RWxx waypoint at the approach end of the runway
- a missed approach waypoint before the approach end of the runway, (for example, MXxx).

This procedure is not authorized using QFE.

Pilot Flying	Pilot Monitoring

Initially
• If on radar vectors
  • HDG SEL
  • Pitch mode (as needed)
• If enroute to a fix
  • LNAV or other roll mode
  • VNAV or other pitch mode	

	[Passenger Airplanes] Notify the cabin crew to prepare for landing. Verify that the cabin is secure.
Call “FLAPS ___” according to the flap extension schedule.	Set the flap lever as directed. Monitor flaps and slats extension.
The recommended roll modes for the final approach are: • for an RNAV or GPS approach use LNAV • for a LOC-BC, VOR or NDB approach use LNAV • for a LOC, SDF or LDA approach use LNAV or VOR/LOC.	
When on the final approach course intercept heading for LOC, LOC-BC, SDF or LDA approaches: • verify that the localizer is tuned and identified [With NPS scales] • verify that the anticipation cue or LOC pointer is shown [Without NPS scales] • verify that the LOC pointer is shown.	
Select LNAV or arm the VOR/LOC mode.	

<table>
<tr><th>Pilot Flying</th><th>Pilot Monitoring</th></tr>
<tr><td colspan="2">WARNING: When using LNAV to intercept the localizer, LNAV might parallel the localizer without capturing it. The airplane can then descend on the VNAV path with the localizer not captured.</td></tr>
<tr><td>Use LNAV or HDG SEL to intercept the final approach course as needed.</td><td></td></tr>
<tr><td colspan="2">Verify that LNAV is engaged or that VOR/LOC is captured.</td></tr>
<tr><td>Approximately 2 NM before the final approach fix and after ALT HOLD or VNAV PTH or VNAV ALT is annunciated:
• set DA(H) or MDA(H) on the MCP
• select or verify VNAV
[Option - Speed and altitude intervention]
• select or verify speed intervention, (as needed).</td><td>Approximately 2 NM before the final approach fix, call “APPROACHING GLIDE PATH.”</td></tr>
<tr><td>Call:
• “GEAR DOWN”
• “FLAPS 15.”</td><td></td></tr>
<tr><td></td><td>Set the landing gear lever to DN.
Verify that the green landing gear indicator lights are illuminated.
Set the flap lever to 15.
[Without automatic ignition]
Set the engine start switches to CONT.</td></tr>
<tr><td>Set the speed brake lever to ARM.
Verify that the SPEED BRAKE ARMED light is illuminated.</td><td></td></tr>
<tr><td>Beginning the final approach descent, call “FLAPS ___” as needed for landing.</td><td>Set the flap lever as directed.</td></tr>
<tr><td>Call “LANDING CHECKLIST.”</td><td>Do the LANDING checklist.</td></tr>
</table>

Pilot Flying	Pilot Monitoring
At the final approach fix: • verify the crossing altitude • crosscheck the altimeters. Verify they agree within 100 feet.	
Monitor the approach.	
When at least 300 feet below the missed approach altitude, set the missed approach altitude on the MCP.	
If suitable visual reference is established at DA(H), MDA(H) or the missed approach point, disengage the autopilot in accordance with regulatory requirements, and disengage the autothrottle at the same time. Maintain the glide path to landing.	

Landing Procedure - Instrument Approach using VNAV

[Without VNAV ALT enabled]

VNAV should be used only for approaches that have one of the following features:

- a published GP angle on the LEGS page for the final approach segment
- an RWxx waypoint at the approach end of the runway
- a missed approach waypoint before the approach end of the runway, (for example, MXxx).

This procedure is not authorized using QFE.

Pilot Flying	Pilot Monitoring

Initially
• If on radar vectors
  • HDG SEL
  • Pitch mode (as needed)
• If enroute to a fix
  • LNAV or other roll mode
  • VNAV or other pitch mode	

	[Passenger Airplanes] Notify the cabin crew to prepare for landing. Verify that the cabin is secure. [Freight Only Airplanes] Notify the supernumeraries to prepare for landing.
Call “FLAPS ___” according to the flap extension schedule.	Set the flap lever as directed. Monitor flaps and slats extension.
The recommended roll modes for the final approach are: • for an RNAV or GPS approach use LNAV • for a LOC-BC, VOR or NDB approach use LNAV • for a LOC, SDF or LDA approach use LNAV or VOR/LOC.	

<table>
<tr><th>Pilot Flying</th><th>Pilot Monitoring</th></tr>
<tr><td colspan="2">When on the final approach course intercept heading for LOC, LOC-BC, SDF or LDA approaches:
• verify that the localizer is tuned and identified
[With NPS scales]
• verify that the anticipation cue or LOC pointer is shown
[Without NPS scales]
• verify that the LOC pointer is shown.</td></tr>
<tr><td>Select LNAV or arm the VOR/LOC mode.</td><td></td></tr>
<tr><td colspan="2">WARNING: When using LNAV to intercept the localizer, LNAV might parallel the localizer without capturing it. The airplane can then descend on the VNAV path with the localizer not captured.</td></tr>
<tr><td>Use LNAV or HDG SEL to intercept the final approach course as needed.</td><td></td></tr>
<tr><td colspan="2">Verify that LNAV is engaged or that VOR/LOC is captured.</td></tr>
<tr><td>Approximately 2 NM before the final approach fix and after ALT HOLD or VNAV PTH is annunciated:
• set DA(H) or MDA(H) on the MCP
• select or verify VNAV
[Option - Speed and altitude intervention]
• select or verify speed intervention, (as needed).</td><td>Approximately 2 NM before the final approach fix, call “APPROACHING GLIDE PATH.”</td></tr>
<tr><td>Call:
• “GEAR DOWN”
• “FLAPS 15.”</td><td></td></tr>
<tr><td></td><td>Set the landing gear lever to DN.
Verify that the green landing gear indicator lights are illuminated.
Set the flap lever to 15.
[Without automatic ignition]
Set the engine start switches to CONT.</td></tr>
</table>

Pilot Flying	Pilot Monitoring
Set the speed brake lever to ARM. Verify that the SPEED BRAKE ARMED light is illuminated.	
Beginning the final approach descent, call “FLAPS ___” as needed for landing.	Set the flap lever as directed.
Call “LANDING CHECKLIST.”	Do the LANDING checklist.
At the final approach fix: • verify the crossing altitude • crosscheck the altimeters. Verify they agree within 100 feet.	
Monitor the approach.	
When at least 300 feet below the missed approach altitude, set the missed approach altitude on the MCP.	
If suitable visual reference is established at DA(H), MDA(H) or the missed approach point, disengage the autopilot in accordance with regulatory requirements, and disengage the autothrottle at the same time. Maintain the glide path to landing.	

Go–Around and Missed Approach Procedure

Pilot Flying	Pilot Monitoring
Push the TO/GA switch.	
Verify that the thrust increases.	
Call "FLAPS 15" or "FLAPS ___" as needed.	Set the flap lever as directed and monitor flap retraction.
Verify the rotation to go-around attitude.	
	Verify that the thrust is sufficient for the go-around or adjust as needed.
Verify a positive rate of climb on the altimeter and call “GEAR UP.”	Verify a positive rate of climb on the altimeter and call “POSITIVE RATE.” Set the landing gear lever to UP.
	Verify that the missed approach altitude is set.
If the airspeed is within the amber band, limit bank angle to 15°.	
[Option - Airplanes with TO/GA to LNAV feature] Above 400 feet radio altitude, verify LNAV or select HDG SEL as appropriate. [Option - Airplanes without TO/GA to LNAV feature] Above 400 feet radio altitude, select appropriate roll mode and verify proper mode annunciation.	Observe mode annunciation.
Verify that the missed approach route is tracked.	
At acceleration height, call “FLAPS ___” according to the flap retraction schedule.	Set the FLAP lever as directed. Monitor flaps and slats retraction.

Pilot Flying	Pilot Monitoring

[Option -- FMC U10.7 and later]

After flaps are set to the planned flap setting and at or above the flap maneuvering speed, select LVL CHG or VNAV.	

Verify that climb thrust is set.	
Verify that the missed approach altitude is captured.	
	Set the landing gear lever to OFF after landing gear retraction is complete. [Without automatic ignition] Set the engine start switches as needed.
Call “AFTER TAKEOFF CHECKLIST.”	Do the AFTER TAKEOFF checklist.

Landing Roll Procedure

[Option - Electronic Flight Bag]

Pilot Flying	Pilot Monitoring
If an autoland was accomplished, disengage the autopilot. Control the airplane manually.	
Verify that the thrust levers are closed. Verify that the SPEED BRAKE lever is UP. Without delay, fly the nose wheel smoothly onto the runway.	Verify that the SPEED BRAKE lever is UP. Call “SPEED BRAKES UP.” If the SPEED BRAKE lever is not UP, call “SPEED BRAKES NOT UP.”
Monitor the rollout progress.	
Verify correct autobrake operation.	
WARNING: After the reverse thrust levers are moved, only a full stop landing can be made. If an engine stays in reverse, safe flight is not possible.	
Without delay, move the reverse thrust levers to the interlocks and hold light pressure until the interlocks release. Apply reverse thrust as needed.	Verify that the forward thrust levers are closed. When both REV indications are green, call "REVERSERS NORMAL". If there is no REV indication(s) or the indication(s) stays amber, call "NO REVERSER ENGINE NUMBER 1", or "NO REVERSER ENGINE NUMBER 2", or "NO REVERSERS".
By 60 knots, start movement of the reverse thrust levers to be at the reverse idle detent before taxi speed.	Call “60 KNOTS.”
After the engines are at reverse idle, move the reverse thrust levers full down.	
Before taxi speed, disarm the autobrake. Use manual braking as needed.	

Pilot Flying	Pilot Monitoring
CAUTION: Do not use the Airport Map application as a primary navigation reference. The Airport Map application is designed to aid flight crew positional awareness only.	

Landing Roll Procedure - Airplanes with Fail Operational Autoland Capability

[Option - Electronic Flight Bag]

Pilot Flying	Pilot Monitoring
Verify that the thrust levers are closed. Verify that the SPEED BRAKE lever is UP.	Verify that the SPEED BRAKE lever is UP. Call “SPEED BRAKES UP.” If the SPEED BRAKE lever is not UP, call “SPEED BRAKES NOT UP.”
Monitor the rollout progress.	
Verify correct autobrake operation.	
WARNING: After the reverse thrust levers are moved, only a full stop landing can be made. If an engine stays in reverse, safe flight is not possible.	
Without delay, move the reverse thrust levers to the interlocks and hold light pressure until the interlocks release. Apply reverse thrust as needed.	Verify that the forward thrust levers are closed. When both REV indications are green, call "REVERSERS NORMAL". If there is no REV indication(s) or the indication(s) stays amber, call "NO REVERSER ENGINE NUMBER 1", or "NO REVERSER ENGINE NUMBER 2", or "NO REVERSERS".
By 60 knots, start movement of the reverse thrust levers to be at the reverse idle detent before taxi speed.	Call “60 KNOTS.”
After the engines are at reverse idle, move the reverse thrust levers full down.	

Pilot Flying	Pilot Monitoring
Before taxi speed, disarm the autobrake. Use manual braking as needed.	
If an autoland was accomplished, disengage the autopilot before turning off the runway.	

CAUTION: Do not use the Airport Map application as a primary navigation reference. The Airport Map application is designed to aid flight crew positional awareness only.

After Landing Procedure

[Without automatic ignition]

Start the After Landing Procedure when clear of the active runway.

Engine cooldown recommendations:

- run the engines for at least 3 minutes
- use a thrust setting normally used for taxi operations
- routine cooldown times less than 3 minutes are not recommended.

Pilot Flying	Pilot Monitoring
The captain moves or verifies that the SPEED BRAKE lever is DOWN.	
	Start the APU, as needed.
	[With automatic probe heat] Set the PROBE HEAT switches to AUTO. [Without automatic probe heat] Set the PROBE HEAT switches to OFF.
	Set the exterior lights as needed.
	Set the ENGINE START switches to OFF.
Set the weather radar to OFF.	
	Set the AUTO BRAKE select switch to OFF.
	Set the flap lever to UP.
	Set the transponder as needed.

After Landing Procedure

[With automatic ignition]

Start the After Landing Procedure when clear of the active runway.

Engine cooldown recommendations:

- run the engines for at least 3 minutes
- use a thrust setting normally used for taxi operations
- routine cooldown times less than 3 minutes are not recommended.

Pilot Flying	Pilot Monitoring
The captain moves or verifies that the SPEED BRAKE lever is DOWN.	
	Start the APU, as needed.
	[With automatic probe heat] Set the PROBE HEAT switches to AUTO. [Without automatic probe heat] Set the PROBE HEAT switches to OFF.
	Set the exterior lights as needed.
Set the weather radar to OFF.	
	Set the AUTO BRAKE select switch to OFF.
	Set the flap lever to UP.
	Set the transponder as needed.

Shutdown Procedure

Start the Shutdown Procedure after taxi is complete.

Parking brake .... Set C or F/O

Verify that the parking brake warning light is illuminated.

Electrical power .... Set F/O

If APU power is needed:

Verify that the APU GENERATOR OFF BUS light is illuminated.

APU GENERATOR bus switches – ON

Verify that the SOURCE OFF lights are extinguished.

If external power is needed:

Verify that the GRD POWER AVAILABLE light is illuminated.

GRD POWER switch – ON

Verify that the SOURCE OFF lights are extinguished.

[Option - New Engine Start levers]

CAUTION: Do not apply rotational force when moving the engine start lever.

Engine start levers ....CUTOFF C

Operate the engines at or near idle thrust for a minimum of three minutes before shutdown to thermally stabilize the engines and reduce undercowl soak-back temperatures. Taxi thrust can be considered idle thrust for this purpose.

If idle reverse thrust or no reverse thrust is used during the landing rollout, the three minute period can begin when thrust is reduced to idle for landing.

Routine cooldown times of less than three minutes before engine shutdown can cause engine degradation.

If towing is needed:

Establish communications with ground handling personnel C

WARNING: If the nose gear steering lockout pin is not installed and hydraulic system A is pressurized, any change to electrical or hydraulic power with the tow bar connected can cause unwanted tow bar movement.

Verify that the nose gear steering lockout pin is installed, or, if the nose gear steering lockout pin is not used C

System A HYDRAULIC PUMP switches – OFF

Verify that the system A pump LOW PRESSURE lights are illuminated.

CAUTION: Do not hold or turn the nose wheel steering wheel during pushback or towing. This can damage the nose gear or the tow bar.

CAUTION: Do not use airplane brakes to stop the airplane during pushback or towing. This can damage the nose gear or the tow bar.

Set or release the parking brake as directed by ground handling personnel.		C or F/O
FASTEN BELTS switch	OFF	F/O
ANTI COLLISION light switch	OFF	F/O
FUEL PUMP switches	OFF	F/O
[Option] CAB/UTIL power switch	As needed	F/O
[Option] IFE/PASS SEAT power switch	As needed	F/O
WING ANTI–ICE switch	OFF	F/O
ENGINE ANTI–ICE switches	OFF	F/O
Hydraulic panel	Set	F/O
ENGINE HYDRAULIC PUMPS switches - ON		
ELECTRIC HYDRAULIC PUMPS switches - OFF		
Air conditioning PACK switches	AUTO	F/O
ISOLATION VALVE switch	OPEN	F/O
Engine BLEED air switches	ON	F/O
APU BLEED air switch	ON	F/O
Exterior lights switches	As needed	F/O
FLIGHT DIRECTOR switches	OFF	C, F/O
Transponder mode selector	STBY	F/O
[Option - Electronic Flight Bag] EFB CLOSE FLIGHT	Select	C, F/O
After the wheel chocks are in place:		
Parking brake – Release		C or F/O
APU switch	As needed	F/O

Note: If extended APU operation is needed on the ground and the airplane busses are powered by AC electrical power, position an AC powered fuel pump ON. This extends the service life of the APU fuel control unit.

Note: If fuel is loaded in the center tank, position the left center tank fuel pump switch ON to prevent a fuel imbalance before takeoff.

CAUTION: Position the center tank fuel pump switches ON only if the fuel quantity in the center tank exceeds 453kgs/1000 lbs.

CAUTION: Do not operate the center tank fuel pumps with the flight deck unattended.

Call “SHUTDOWN CHECKLIST.”	C
Do the SHUTDOWN checklist.	F/O

Secure Procedure

IRS mode selectors	OFF	F/O
EMERGENCY EXIT LIGHTS switch	OFF	F/O
WINDOW HEAT switches	OFF	F/O
Air conditioning PACK switches	OFF	F/O
[Option - Electronic Flight Bag] EFB POWER switch	Push	C, F/O
Call “SECURE CHECKLIST.”		C
Do the SECURE checklist.		F/O

Intentionally
Blank

Supplementary Procedures — Chapter SP
Table of Contents — Section TOC

General

This section contains procedures (adverse weather operation, engine crossbleed start, and so on) that are accomplished as required rather than routinely performed on each flight.

Supplementary procedures may be required because of adverse weather, unscheduled maintenance or as a result of a procedure referenced in a Non–Normal Checklist. Additionally, some may be performed if the flight crew must accomplish preflight actions normally performed by maintenance personnel.

At the discretion of the Captain, procedures may be performed by memory, by reviewing the procedure prior to accomplishment, or by reference to the procedure during its accomplishment.

Supplementary procedures are provided by section. Section titles correspond to the respective chapter title for the system being addressed except for the adverse weather section.

Intentionally
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Interior Inspection

Emergency exit lights .... Check

Passenger signs .... Check

Service and entry doors .... Check

Escape slides .... Check pressure

Emergency exits .... Check

Wing upper surfaces .... Check

Lavatory fire extinguishers .... Check

Emergency equipment .... Check

Check availability and condition of emergency equipment, as required.

Flight Deck Door Access System Test

Flight Deck Access System switch ....NORM

Flight deck door .... Open

Flight deck door lock selector...AUTO

Emergency access code .... Enter

ENT key ....Push

Verify alert sounds.

Verify AUTO UNLK light illuminates.

Flight deck door lock selector.. DENY

Verify AUTO UNLK light extinguishes.

Flight deck door lock selector...UNLKD

Flight deck access system switch .... OFF

Verify LOCK FAIL light illuminates.

Flight deck access system switch .... NORM

Guard - Down

Verify LOCK FAIL light extinguishes.

Water System Draining

Lavatory water supply selector valves .... SUPPLY/DRAIN

Galley water supply shutoff valves .... SUPPLY ON

The shutoff valve is found adjacent to each wet galley sink.

Drain line ....Connect to drain ports

There are two drain port locations:

- below the forward entry door
- aft of the water service panel

Water service panel ....Open

Tank drain valve handle ....OPEN

Drains potable water tank and water system aft of the wings.

Forward lavatory drain valve ....OPEN

Drain valve is found below the sink in the forward lavatory only.

Drain valves for coffee maker and
water boiler (if installed) ....OPEN

All galley and lavatory water faucets ....Open

Close faucets when water flow stops.

Accomplish the following items after verifying the potable water system is empty:

Drain valves for coffee maker and
water boiler (if installed) .... CLOSED

Forward lavatory drain valve .... CLOSED

Tank drain valve handle .... CLOSED

Water service panel ....Close

Drain line ....Disconnect from drain ports

If the potable water tank will not be refilled immediately after the system is emptied, open the following circuit breakers and attach DO–NOT–CLOSE tags:

P18–3 circuit breaker panel

- LAVATORY WATER HEATER A
- LAVATORY WATER HEATER D
- LAVATORY WATER HEATER E

Power distribution panel number 1

- POT WATER COMPRESSOR
- WATER QTY IND

Forward Airstair Operation

[Option]

WARNING: Use care not to fall from the airstair platform when operating the forward entry door. The small platform area and bad weather can make the door difficult to operate.

CAUTION: Operation of airstair in winds exceeding 40 knots is not recommended.

CAUTION: Do not move airplane with stair extended.

Interior Control

WARNING: Open entry door to cocked position to allow clear visibility of area outside airplane to prevent injury to personnel. Do not open door beyond cocked position while operating airstair.

To extend:

Forward entry door ....Open to cocked position

When operating the airstair from the interior control panel, the forward entry door must be open to the cocked position. Safety circuits prevent airstair operation if the entry door is closed.

Control switch ....EXTEND

Note: For interior standby operation, the battery switch must be ON.

Hold until extension is complete.

The STAIRS OPER light illuminates during extension until the airstair is fully extended.

Note: The STAIRS OPER light will not illuminate with loss of AC power.

Control switch .... Release

Handrail extensions ....Engage

Release latch and pull inboard and up, extend and engage on the supports at the sides of the forward entry doorway.

To Retract:

Handrail extensions .... Disengage

Disengage from door supports, depress latch at base of forward extension to permit retraction within upper segment of handrail. Slide right and left extensions down along upper rails. Stowing in appropriate stowage points provides circuit continuity for energizing retract relay.

CAUTION: Use of the standby control switch bypasses all safety circuits. Airstair handrail extensions must be stowed or substantial damage could result.

Control switch .... RETRACT

Hold until retraction is complete.

The STAIRS OPER light illuminates during retraction until the airstair door is fully closed.

Note: The STAIRS OPER light will not illuminate with loss of AC power.

Control switch .... Release

Exterior Control

To Extend:

Normal mode:

AIRSTAIRS switch .... EXTEND

Standby mode:

POWER switch .... Hold in STANDBY

AIRSTAIRS switch .... EXTEND

Forward entry door .... Open to cocked position

WARNING: Extend and connect the airstair aft handrail to protect against falling and prevent injuries to personnel.

Aft handrail extension .... Engage

Release latch and pull inboard and up, extend and engage on the support at the side of the forward entry door.

WARNING: Step down the airstair as the forward entry door moves to the open position to prevent injuries to personnel.

Forward entry door ....Fully open

Forward handrail extension ....Engage

Release latch and pull inboard and up, extend and engage on the support at the side of the forward entry door.

To Retract:

WARNING: Do not disengage the airstair aft handrail at this time. Injuries to personnel can occur during forward entry door operations if the aft handrail is disengaged.

Forward handrail extension ....Disengage

Disengage from door support, depress latch at base of forward extension to permit retraction within upper segment of handrail. Slide right and left extensions down along upper rails. Stowing in appropriate stowage points provides circuit continuity for energizing retract relay.

WARNING: Step down the airstair as the forward entry door moves to the cocked position to prevent injuries to personnel.

Forward entry door .... Close to cocked position

Aft handrail extension ....Disengage

Disengage from door support, depress latch at base of forward extension to permit retraction within upper segment of handrail. Slide right and left extensions down along upper rails. Stowing in appropriate stowage points provides circuit continuity for energizing retract relay.

Forward entry door .... Fully close

CAUTION: Use of the standby control switch bypasses all safety circuits. Airstair handrail extension must be stowed or substantial damage could result.

Normal mode:

AIRSTAIRS switch ....RETRACT

Standby mode:

POWER switch .... Hold in STANDBY

AIRSTAIRS switch ....RETRACT

Main Deck Cargo Door Operation

Normal Operation

Normal operation requires electrical power and hydraulic pressure from system A.

CAUTION: Do not operate with winds in excess of 40 knots. Do not keep the door in the open position with winds in excess of 60 knots. Strong winds can cause damage to the structure of the airplane.

CAUTION: Verify all personnel and equipment are clear of door path.

Unlock Main Cargo Door

Verify the following lights are illuminated:

- CLOSED & LATCHED
- LOCKED

Verify the following lights are extinguished:

- OPENED
- IN TRANSIT
- READY TO OPEN
- UNLOCKED

UNLOCK or LOCK switch ....Hold to UNLOCK until the READY TO OPEN light illuminates

The LOCKED light extinguishes and the UNLOCKED light illuminates.

Open to Canopy Position

Simultaneously hold the following switches until the OPENED light illuminates:

ARM switch ....Hold up to ARM

UP TO CANOPY or CLOSE switch .... Hold to UP TO CANOPY

READY TO OPEN and CLOSED & LATCHED lights extinguish and IN TRANSIT light illuminates.

IN TRANSIT light extinguishes when the OPENED light illuminates.

Open to Full Open Position

Simultaneously hold the following switches until the door stops moving, indicating it is in the full open position:

ARM switch .... Hold up to ARM

FULL OPEN or
DOWN to CANOPY switch .... Hold to FULL OPEN

OPENED and UNLOCKED lights stay illuminated.

Lower to Canopy Position

Simultaneously hold the following switches until the door stops moving, indicating it is in the canopy position:

ARM switch .... Hold down to ARM

FULL OPEN or
DOWN to CANOPY switch .... Hold to DOWN TO CANOPY

OPENED and UNLOCKED lights stay illuminated.

Close from Canopy Position

Simultaneously hold the following switches until the CLOSED & LATCHED light illuminates.

ARM switch .... Hold down to ARM

UP TO CANOPY or CLOSE switch .... Hold to CLOSE

OPENED light extinguishes and IN TRANSIT light illuminates.

Door is closed when the IN TRANSIT light extinguishes, and the CLOSED & LATCHED and READY TO OPEN lights illuminate.

Lock Main Cargo Door

UNLOCK or LOCK switch .... Hold to LOCK until the LOCKED light illuminates

The READY TO OPEN and UNLOCKED lights extinguish and the LOCKED light illuminates.

Verify the following lights are illuminated:
- CLOSED & LATCHED
- LOCKED

Verify the following lights are extinguished:
- OPENED
- IN TRANSIT
- READY TO OPEN
- UNLOCKED

Oxygen Mask Microphone Test

[Without Mask/Boom switch]

FLT INT switch .... Push

SPKR switch .... On

TEST/RESET switch .... Push and hold

EMERGENCY/Test selector .... Push and hold

Push-to-Talk switch .... I/C

Simultaneously push the Push-to-Talk switch, the EMERGENCY/Test selector and the TEST/RESET switch.

Verify oxygen flow sound is heard through the flight deck speaker.

Push-to-Talk switch .... Release

EMERGENCY/Test selector .... Release

TEST/RESET switch .... Release

SPKR switch .... As needed

Oxygen Mask Microphone Test

[With Mask/Boom switch]

MASK/BOOM switch .... MASK

FLT INT switch .... Push

SPKR switch .... On

RESET/TEST switch .... Push and hold

EMERGENCY/Test selector .... Push and hold

Push-to-Talk switch .... INT

Simultaneously push the Push-to-Talk switch, the EMERGENCY/Test selector and the RESET/TEST switch.

Verify oxygen flow sound is heard through the flight deck speaker.

Push-to-Talk switch .... Release

EMERGENCY/Test selector .... Release

RESET/TEST switch .... Release

SPKR switch .... As needed

MASK/BOOM switch .... BOOM

ETOPS

Operators conducting ETOPS are required to comply with appropriate regulations. An operator must have an ETOPS configured and approved airplane, and approved flight operations and maintenance programs in place to support ETOPS.

APU Operation

Unless otherwise authorized, start the APU before the ETOPS segment. The APU must be on for the entire ETOPS segment.

Fuel Crossfeed Valve Check

Unless accomplished by maintenance personnel prior to the ETOPS flight, do the following steps on the ground prior to engine start:

Crossfeed selector .... Open

Verify that the VALVE OPEN light illuminates bright, then dim.

Crossfeed selector .... Close

Verify that the VALVE OPEN light illuminates bright, then extinguishes.

During the last hour of cruise, do the following steps:

Crossfeed selector ....Open

Verify that the VALVE OPEN light illuminates bright, then dim.

Crossfeed selector .... Close

Verify that the VALVE OPEN light illuminates bright, then extinguishes.

Intentionally
Blank

Wing–Body Overheat Test

Wing–body OVHT TEST switch .... Push

Hold for a minimum of 5 seconds.

Both WING–BODY OVERHEAT lights – illuminated

MASTER CAUTION – illuminated

AIR COND system annunciator – illuminated

Wing–body OVHT TEST switch .... Release

Both WING–BODY OVERHEAT lights – extinguished

MASTER CAUTION lights – extinguished

AIR COND system annunciator – extinguished

External Air Cart Use

CAUTION: The BAT switch should always be on when using the airplane air conditioning system since the protective circuits are DC. This ensures protection in the event of loss of AC power.

Note: For engine start with a ground air source, see section SP.7.

APU BLEED air switch .... OFF

ISOLATION VALVE switch .... OPEN

[737-600/700]
RECIRC FAN switch .... AUTO

[737-800/900]
RECIRC FAN switches .... AUTO

[737-800/900]
Trim Air Switch .... ON

PACK switches .... AUTO or HIGH

Cabin temperature selectors .... AUTO

Set for desired temperature.

Duct pressure .... 20 psi minimum

If external air cannot hold 20 psi minimum and the APU is operating:

ISOLATION VALVE switch .... AUTO

APU BLEED air switch .... ON

APU supplies left pack and external air source supplies right pack.

Ground Conditioned Air Use

Before connecting ground conditioned air:

PACK switches ....OFF

Packs can be damaged if they are operated while ground conditioned air is connected.

After disconnecting ground conditioned air:

PACK switches .... As needed

Isolated Pack Operation during Engine Start

To improve cabin air quality between starting the first and second engine:

CAUTION: Moving engine BLEED air switches while a starter is engaged can damage the starter.

Engine No. 2 ....Start

After engine No. 2 stabilized:

ISOLATION VALVE switch .... CLOSE

Right PACK switch .... AUTO

Duct pressure .... Stabilized

Engine No. 1 ....Start

After engine No. 1 stabilized:

ISOLATION VALVE switch .... AUTO

Pressurization System Manual Mode Test

PACK switches ....OFF

Pressurization mode selector .... MAN

AUTO FAIL and ALTN lights – extinguished.

MANUAL light – illuminated.

Outflow valve switch .... CLOSE

Verify outflow valve position indicator moves toward CLOSE.

Outflow valve switch .... OPEN

Verify outflow valve position indicator moves toward OPEN.

Pressurization mode selector ....AUTO

Verify outflow valve position indicator moves toward OPEN.

MANUAL light – extinguished.

Manual Mode Operation

CAUTION: Switch actuation to the manual mode causes an immediate response by the outflow valve. Full range of motion of the outflow valve can take up to 20 seconds.

Pressurization mode selector .... MAN

MANUAL light – illuminated

CABIN/FLIGHT ALTITUDE placard.. Check

Determine the desired cabin altitude.

If a higher cabin altitude is desired:

Outflow valve switch (momentarily) ....OPEN

Verify the outflow valve position indicator moves right, cabin altitude climbs at the desired rate, and differential pressure decreases. Repeat as necessary.

If a lower cabin altitude is desired:

Outflow valve switch (momentarily) ....CLOSE

Verify the outflow valve position indicator moves left, cabin altitude descends at the desired rate, and differential pressure increases. Repeat as necessary.

During Descent

Thrust lever changes should be made as slowly as possible to prevent excessive pressure bumps.

Outflow valve switch (momentarily) .... CLOSE

During descent, intermittently position the outflow valve switch toward CLOSE, observing cabin altitude decrease as the airplane descends.

Before entering the landing pattern, slowly position the outflow valve to full open to depressurize the airplane. Verify differential pressure is zero.

Pressurization Control Operation – Landing at Alternate Airport

At top of descent:

LAND ALT Indicator .... Reset

Reset to new destination field elevation.

Automatic Pressurization Control – Departure Airport Elevation Above 8400 Feet

[Option - High Altitude Landing option (maximum Takeoff and Landing Altitude above 8400 feet) with High Altitude Landing switch]

If departure airport elevation is above 10,000 feet:

Oxygen masks and regulators .... ON, Normal

Supplemental oxygen must be used from departure until the cabin altitude is below 10,000 feet.

After electrical power is applied to the airplane:

HIGH ALT LDG switch .... Off

Monitor CABIN ALT and CABIN rate of CLIMB indicators during climbout to ensure cabin altitude is descending below 8500 feet, at which time the cabin altitude warning system is reset to 10,000 feet.

If landing altitude is at or below 6000 feet:

LAND ALT indicator .... Destination field elevation

If landing altitude is above 6000 feet:

Do the Automatic Pressurization Control - Landing Airport Elevation Above 6000 Feet supplementary procedure.

Return to Departure Airport is Needed

HIGH ALT LDG switch .... ON

If landing elevation is above 10,000 feet:

Oxygen masks and regulators .... ON, Normal

Supplemental oxygen must be used anytime the cabin altitude is above 10,000 feet.

Automatic Pressurization Control – Landing Airport Elevation Above 6000 Feet but 8400 Feet and Below

[All Airplanes]

Do the normal Preflight Procedure - First Officer except as modified below.

Prior to takeoff:

LAND ALT indicator .... 6000 feet

At initial descent:

LAND ALT indicator .... Destination field elevation

Automatic Pressurization Control – Landing Airport Elevation Above 8400 Feet

[Option - High Altitude Landing option (maximum Takeoff and Landing Altitude above 8400 feet) with High Altitude Landing switch]

Do the normal Preflight Procedure - First Officer except as modified below.

Prior to takeoff:

LAND ALT indicator .... 6000 feet

[Normal Cabin Altitude]

At initial descent or approximately 20 minutes prior to landing:

If landing elevation is above 8400 feet:

HIGH ALT LDG switch .... ON

If landing elevation is above 10,000 feet:

Oxygen masks and regulators .... ON, Normal

Supplemental oxygen must be used anytime the cabin altitude is above 10,000 feet.

LAND ALT indicator .... Destination field elevation

[Option - Low Cabin Altitude]

At initial descent or approximately 25 minutes prior to landing:

If landing elevation is above 8400 feet:

HIGH ALT LDG switch .... ON

If landing elevation is above 10,000 feet:

Oxygen masks and regulators .... ON, Normal

Supplemental oxygen must be used anytime the cabin altitude is above 10,000 feet.

LAND ALT indicator .... Destination field elevation

Unpressurized Takeoff and Landing

When making a no engine bleed takeoff or landing with the APU inoperative, or operative but not providing bleed air:

Takeoff

PACK switches .... AUTO

ISOLATION VALVE switch .... CLOSE

Engine BLEED air switches .... OFF

APU BLEED air switch .... OFF

After Takeoff

Note: If engine failure occurs, do not position engine BLEED air switches ON until reaching 1500 feet or until obstacle clearance height has been attained.

At not less than 400 feet, and prior to 2000 feet above field elevation:

Engine No. 2 BLEED air switch .... ON

When CABIN rate of CLIMB indicator stabilizes:

Engine No. 1 BLEED air switch ....ON

ISOLATION VALVE switch .... AUTO

Landing

When below 10,000 feet and starting the turn to final approach:

Engine BLEED air switches .... OFF

[Passenger Airplanes]
Avoid high rates of descent for passenger comfort.

[Freight Only Airplanes]
Avoid high rates of descent for supernumerary comfort.

No Engine Bleed Takeoff and Landing

When making a no engine bleed takeoff or landing with the APU operating.

Takeoff

Note: If anti–ice is required for taxi, configure for a “No Engine Bleed Takeoff” just prior to takeoff.

Note: If anti–ice is not required for taxi, configure for a “No Engine Bleed Takeoff” just after engine start.

Right PACK switch ....AUTO

ISOLATION VALVE switch .... CLOSE

Left PACK switch ....AUTO

Engine No. 1 BLEED air switch .... OFF

APU BLEED air switch ....ON

Engine No. 2 BLEED air switch .... OFF

[737-800/-900]
Trim Air Switch ....ON

WING ANTI-ICE switch .... OFF

The WING ANTI-ICE switch must remain OFF until the engine BLEED air switches are repositioned to ON and the ISOLATION VALVE switch is repositioned to AUTO.

After Takeoff

Note: If engine failure occurs, do not position engine BLEED air switches ON until reaching 1500 feet or until obstacle clearance height has been attained.

Engine No. 2 BLEED air switch .... ON

APU BLEED air switch ....OFF

When CABIN rate of CLIMB indicator stabilizes:

Engine No. 1 BLEED air switch .... ON

ISOLATION VALVE switch...AUTO

Landing

If additional go–around thrust is desired, configure for a "No Engine Bleed Landing."

When below 10,000 feet:

WING ANTI-ICE switch ....OFF

Right PACK switch ....AUTO

ISOLATION VALVE switch .... CLOSE

Left PACK switch ....AUTO

Engine No. 1 BLEED air switch ....OFF

APU BLEED air switch .... ON

Engine No. 2 BLEED air switch ....OFF

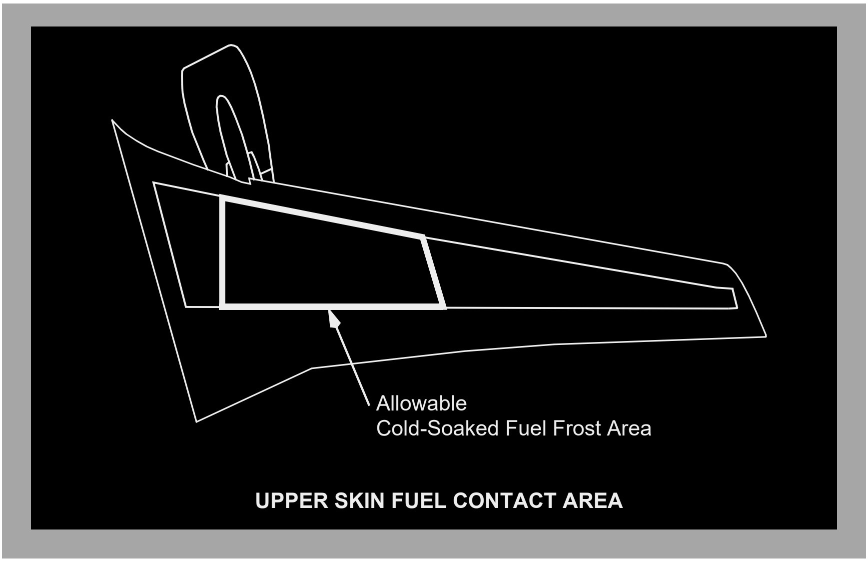
Anti–Ice Operation

Requirements for use of anti–ice and operational procedures for engine and wing anti–ice are contained in Supplementary Procedures, Adverse Weather Section SP.16.

Cold-Soaked Fuel Frost (CSFF)

Frost may form on the lower and upper wing surfaces due to cold-soaked fuel touching the wing surface after long flights with large fuel loads.

Exterior Safety Inspection - Airplanes with Defined Cold-Soaked Fuel Frost Area



Note: The presence of the painted cold soaked fuel frost area on the upper wing and the inclusion of these procedures in the FCOM do not constitute operational approval. Operators may be allowed to use these procedures by referring to the appropriate regulatory authority for approval or exemption, as required, to implement the procedure.

Surfaces .... Check

Visually inspect the lower and upper wing surfaces.

If there is frost or ice on the lower surface outboard of measuring stick 4, there may also be frost or ice on the upper surface. The distance that the frost extends outboard of measuring stick 4 can be used as an indication of the extent of the frost on the upper surface.

Takeoff with CSFF on lower wing surfaces is allowable provided all of the following conditions are met:

- Ambient air temperature is at or above +4°C, +39°F
- There is no precipitation or visible moisture (rain, snow, drizzle, or fog with less than 1 mile visibility)
- Tank fuel temperature is at or above -16°C, +3°F
- All leading edge devices, all control surfaces, tab surfaces, winglet surfaces, and control surface balance panel cavities must be free of snow, ice and frost.
- All leading edge devices, all control surfaces, tab surfaces, and control surface balance panel cavities must be free of snow, ice and frost.

If all of the above conditions are not met, takeoff with light coatings of frost, up to 1/8 inch (3 mm) in thickness, on lower wing surfaces due to cold fuel is allowable; however, all leading edge devices, all control surfaces, tab surfaces, winglet surfaces and control surface balance panel cavities must be free of snow, ice and frost. If the frost on the lower surface is greater than 1/8 inch (3 mm) in thickness, all snow, ice and frost on the wings must be removed using appropriate deicing/anti-icing procedures.

If all of the above conditions are not met, takeoff with light coatings of frost, up to 1/8 inch (3 mm) in thickness, on lower wing surfaces due to cold fuel is allowable; however, all leading edge devices, all control surfaces, tab surfaces and control surface balance panel cavities must be free of snow, ice and frost. If the frost on the lower surface is greater than 1/8 inch (3 mm) in thickness, all snow, ice and frost on the wings must be removed using appropriate deicing/anti-icing procedures.

Takeoff with CSFF on upper wing surfaces is allowed provided all of the following conditions are met:

- The CSFF on the wing tank upper surfaces is only within the lines defining the permissible CSFF area with no snow, ice or frost on the leading edges or control surfaces
- Ambient air temperature is at or above +4°C, +39°F
- There is no precipitation or visible moisture (rain, snow, drizzle, or fog with less than 1 mile visibility)
- Tank fuel temperature is at or above -16°C, +3°F.

If all of the above conditions are not met, all snow, ice and frost on the upper wing surfaces must be removed using appropriate deicing/anti-icing procedures.

Exterior Safety Inspection - Airplanes without Defined Cold-Soaked Fuel Frost Area

Surfaces .... Check

Visually inspect the lower and upper wing surfaces.

If there is frost or ice on the lower surface outboard of measuring stick 4, there may also be frost or ice on the upper surface. The distance that the frost extends outboard of measuring stick 4 can be used as an indication of the extent of the frost on the upper surface.

Takeoff with CSFF on lower wing surfaces is allowable provided all the following condition are met:

- Ambient air temperature is at or above +4°C, +39°F
- There is no precipitation or visible moisture (rain, snow, drizzle, or fog with less than 1 mile visibility)
- Tank fuel temperature is at or above -16°C, or +3°F
- All leading edge devices, all control surfaces, tab surfaces, winglet surfaces, and control surface balance panel cavities must be free of snow, ice and frost.
- All leading edge devices, all control surfaces, tab surfaces, and control surface balance panel cavities must be free of snow, ice and frost.

If all of the above conditions are not met, takeoff with light coatings of frost, up to 1/8 inch (3 mm) in thickness, on lower wing surfaces due to cold fuel is allowable; however, all leading edge devices, all control surfaces, tab surfaces, winglet surfaces and control surface balance panel cavities must be free of snow, ice and frost. If the frost on the lower surface is greater than 1/8 inch (3 mm) in thickness, all snow, ice and frost on the wings must be removed using appropriate deicing/anti-icing procedures.

If all of the above conditions are not met, takeoff with light coatings of frost, up to 1/8 inch (3 mm) in thickness, on lower wing surfaces due to cold fuel is allowable; however, all leading edge devices, all control surfaces, tab surfaces and control surface balance panel cavities must be free of snow, ice and frost. If the frost on the lower surface is greater than 1/8 inch (3 mm) in thickness, all snow, ice and frost on the wings must be removed using appropriate deicing/anti-icing procedures.

Takeoff with frost on upper wing surfaces due to cold fuel (CSFF) is not allowable. If any frost is present on the upper wing surface, all snow, ice and frost on the wings must be removed using appropriate deicing/anti-icing procedures.

Window Heat System Tests

Overheat Test

The overheat test simulates an overheat condition to check the overheat warning function of the window heat system.

WINDOW HEAT switches .... ON

WINDOW HEAT TEST switch ....OVHT

OVERHEAT lights – On

ON lights – Extinguish

Lights extinguish after approximately 1 minute.

OFF lights – Illuminated

Lights illuminate after approximately 1 minute.

MASTER CAUTION – On

ANTI–ICE system annunciator – On

WINDOW HEAT switches ....Reset

Position the WINDOW HEAT switches OFF, then ON.

Power Test

The power test verifies operation of the window heat system. The test may be accomplished when any of the window heat ON lights are extinguished and the associated WINDOW HEAT switch is ON.

WINDOW HEAT switches .... ON

Note: Do not perform the power test when all ON lights are illuminated

WINDOW HEAT TEST switch .... PWR

The controller is forced to full power, bypassing normal temperature control. Overheat protection is still available.

WINDOW HEAT ON lights .... Illuminated

If any ON light remains extinguished, the window heat system is inoperative. Observe the maximum airspeed limit of 250 kts below 10,000 feet.

Power Test

The power test verifies operation of the window heat system. The test may be accomplished when any of the window heat OFF lights are illuminated and the associated WINDOW HEAT switch is ON.

WINDOW HEAT switches .... ON

Note: Do not perform the power test when all OFF lights are extinguished

WINDOW HEAT TEST switch .... PWR

The controller is forced to full power, bypassing normal temperature control. Overheat protection is still available.

WINDOW HEAT OFF lights .... Extinguished

If any OFF light remains illuminated, the window heat system is inoperative. Observe the maximum airspeed limit of 250 kts below 10,000 feet.

Level Change Climb/Descent

ALTITUDE selector .... Set desired altitude

Note: If a new MCP altitude is selected while in ALT ACQ, the AFDS engages in V/S and the existing vertical speed is maintained.

LVL CHG switch .... Push

Verify FMA display:

Thrust mode (climb) – N1

Thrust mode (descent) – RETARD then ARM

Pitch mode – MCP SPD

IAS/MACH Selector .... Set desired speed

Vertical Speed (V/S) Climb/Descent

ALTITUDE selector .... Set desired altitude

Note: If a new MCP altitude is selected while in ALT ACQ, the AFDS engages in V/S and the existing vertical speed is maintained.

V/S thumbwheel .... Set desired vertical speed

Verify FMA display:

Thrust mode (climb or descent) – MCP SPD

Pitch mode – V/S

IAS/MACH Selector .... Set desired speed

To transition to the vertical speed mode from another engaged climb or descent mode:

V/S mode switch .... Push

V/S climb mode engages at existing V/S.

V/S thumbwheel .... Set desired vertical speed

Verify FMA display:

Thrust mode (climb or descent) – MCP SPD

Pitch mode – V/S

IAS/MACH Selector .... Set desired speed

Intervention of FMC Altitude Constraints during VNAV Climb

[Option - Speed and altitude intervention]

MCP altitude selector .... Set new altitude

New altitude must be higher than the FMC altitude constraint(s) to be deleted.

ALT INTV switch .... Push

Each push of the ALT INTV switch will delete an FMC altitude constraint.

Intervention of FMC Cruise Altitude during VNAV Cruise

[Option - Speed and altitude intervention with FMC U10.8A and earlier]

MCP altitude selector .... Set

ALT INTV switch .... Push

If a higher altitude is selected, a CRZ climb will be started.

If a lower altitude is selected, an early descent will be started.

Intervention of FMC Cruise Altitude during VNAV Cruise

[Option - Speed and altitude intervention with FMC U11.0 and later]

MCP altitude selector .... Set

ALT INTV switch .... Push

If a higher altitude is selected, a CRZ climb will be started.

If the airplane is more than 50 nm from T/D, if a lower altitude is selected, a CRZ descent will be started if the selected altitude is at or above any FMC altitude constraint.

If the airplane is more than 50 nm from T/D, if a lower altitude is selected, an early descent will be started if the selected altitude is below any FMC altitude constraint.

If the airplane is 50 nm or less from T/D, if a lower altitude is selected, an early descent will be started.

Intervention of FMC Altitude Constraints during VNAV Descent

[Option - Speed and altitude intervention]

MCP altitude selector .... Set new altitude

New altitude must be lower than the FMC altitude constraint(s) to be deleted.

ALT INTV switch .... Push

Each push of the ALT INTV switch will delete an FMC altitude constraint.

If all FMC altitude constraints are deleted, the descent mode will revert to a VNAV speed descent.

Intervention of FMC Airspeed Constraints during VNAV

[Option - Speed and altitude intervention]

SPD INTV switch .... Push

MCP IAS/MACH display shows current FMC target speed.

IAS/MACH Selector .... Set desired speed

VNAV remains engaged.

To resume former FMC speed:

SPD INTV switch .... Push

MCP IAS/MACH display blanks and FMC commanded VNAV speed is active.

Altitude Hold

Altitude HOLD switch .... Push

Verify FMA display:

Pitch mode – ALT HOLD

Heading Select

Heading selector .... Set desired heading

Heading select switch .... Push

Verify FMA display:

Roll mode – HDG SEL

VOR Navigation

VHF NAV radio(s) .... Tune and Identify

COURSE selector .... Set desired course

When on an intercept heading to the VOR course:

VOR LOC mode switch .... Push

Verify VOR LOC armed mode annunciates.

A/P automatically captures the VOR course.

Verify VOR LOC engaged mode annunciates upon course capture.

Note: If change to a localizer frequency is desired when captured in the VOR mode, disengage VOR LOC mode prior to selection of the localizer. VOR LOC mode can then be reengaged.

Instrument Approach using Vertical Speed (V/S)

Pilot Flying	Pilot Monitoring

Initially
• If on radar vectors
  • HDG SEL
  • Pitch mode (as needed)
• If enroute to a fix
  • LNAV or other roll mode
  • VNAV or other pitch mode	

Call “FLAPS ___” according to the flap extension schedule.	Set the flap lever as directed. Monitor flaps and slats extension.

Note: If required to remain at or above MDA(H) during the missed approach, the missed approach must be initiated at least 50 feet above MDA(H).

Recommended roll modes:

- RNAV, GPS, TACAN, LOC-BC, VOR or NDB approach: LNAV or HDG SEL.
- LOC, SDF or LDA approach: VOR/LOC or LNAV.

Note: When using LNAV to intercept a localizer, LNAV might parallel the localizer without capturing it. Use HDG SEL to intercept the final approach course, if needed.

Ensure appropriate navaids (VOR, LOC or NDB) are tuned and identified before commencing the approach.

Pilot Flying	Pilot Monitoring
Use LNAV or other roll mode to intercept the final approach course as needed.	
Approximately 2 NM before the final approach fix, set the first intermediate altitude constraint or MDA(H). Set the MCP altitude to the nearest 100 foot increment at or above each intermediate altitude constraint or MDA(H). When the current constraint is assured, set the next constraint before ALT HOLD is engaged to achieve a continuous descent path.	Approximately 2 NM before the final approach fix, call “APPROACHING GLIDE PATH.”
Call: • “GEAR DOWN” • “FLAPS 15.”	Set the landing gear lever to DN. Verify that the green landing gear indicator lights are illuminated. Set the flap lever to 15. [Without automatic ignition] Set the engine start switches to CONT.
Set the speed brake lever to ARM. Verify that the SPEED BRAKE ARMED light is illuminated.	

Before descent to MDA(H):

Pilot Flying	Pilot Monitoring
Call "FLAPS ___" as needed for landing.	Set the flap lever as directed.

At descent point:

Desired V/S ....Set

Set desired V/S to descend to MDA(H). Use a V/S that results in no level flight segment at MDA(H).

Verify V/S mode annunciates.

Pilot Flying	Pilot Monitoring
Call "LANDING CHECKLIST."	Do the LANDING checklist.
At the final approach fix, crosscheck the altimeters. Verify they agree within 100 feet.	

Approximately 300 feet above MDA(H):

MCP altitude .... Set missed approach altitude

At MDA(H)/missed approach point:

If suitable visual reference is not established, execute missed approach.

After suitable visual reference is established:

A/P disengage switch ....Push

Disengage the autopilot in accordance with regulatory requirements.

A/T disengage switch ....Push

Disengage the autothrottle when disengaging the autopilot.

Circling Approach

If a missed approach is needed at any time while circling, make an initial climbing turn toward the landing runway and intercept the missed approach course.

Configuration at MDA(H):

- Gear down
- Flaps 15
- Speedbrake armed

MCP altitude selector ....Set

Set the MCP altitude to the nearest 100 foot increment at or above the MDA(H).

Accomplish an instrument approach, establish suitable visual reference and level off at MCP altitude.

[Option - VNAV ALT not enabled]
Verify ALT HLD mode annunciates.

[Option - VNAV ALT enabled]
Verify ALT HLD or VNAV ALT mode annunciates.

[Option - VNAV ALT enabled]
ALT HLD mode .... Verify/select

Verify ALT HLD mode annunciates.

MCP altitude selector .... Set missed approach altitude

HDG SEL switch .... Push

Verify HDG SEL mode annunciates.

Before starting the turn to base:
- Landing flaps (if not previously selected)
- Do the LANDING checklist.

Intercepting the landing profile:

Autopilot disengage switch .... Push

Autothrottle disengage switch .... Push

Instrument Approach - RNAV (RNP) AR

Note: Operators need approval to conduct RNAV (RNP) AR Instrument Approaches.

[Option - Airplanes without IAN]
Note: For RNAV (GPS) and RNAV (GNSS) procedures use the Landing Procedure - Instrument Approach using VNAV in Normal Procedures.

[Option - Airplanes with IAN]
Note: For RNAV (GPS) and RNAV (GNSS) procedures use the Landing Procedure - Instrument Approach using VNAV or Landing Procedure - Instrument Approach using IAN in Normal Procedures.

Note: This procedure is not authorized using QFE.

[Option - Airplanes with IAN]
Note: This procedure is not authorized using IAN.

The procedure below supplements Normal Preflight, Cruise, Descent and Approach Procedures and replaces the Landing Procedure.

[Without TO/GA to LNAV option]
Additional information is given in case of a go-around.

Preflight Procedure

Review RNP availability predictions.

Pre-approach Requirements

Airplane equipment required to begin the approach:

- EGPWS
- 2 FMCs
- 2 CDUs
- 2 GPS Receivers
- 2 Radio Altimeters
- 2 ADIRUs, IRSs in NAV mode
- 2 EFIS/MAP or PFD/ND displays (as installed)
- 1 A/P and 2 F/Ds capable of LNAV and VNAV(for RNP 0.15 or greater)
- 2 A/P and 2 F/Ds capable of LNAV and VNAV(for RNP less than 0.15)

[Option - Airplanes with FMC U10.7 and newer]
Note: Do the Go-Around and Missed Approach Procedure if the UNABLE REQD NAV PERF-RNP, FMC DISAGREE, or any VERIFY POS alerting message is shown unless suitable visual reference is established and maintained.

[Option - FMC U14.0 and newer]

WARNING: If an UNABLE REQD NAV PERF-RNP is shown during the approach, whether the lateral or vertical RNP are exceeded or not, do the Go-Around and Missed Approach Procedure unless suitable visual reference is established and maintained.

Do the following before starting the approach

- verify that the UNABLE REQD NAV PERF-RNP alert is not displayed
- verify that the approach RNP is equal to or greater than:

  [With NPS]
  - 0.10 (A/P or F/D)

[Without NPS]
  - 0.11 (A/P)

[Without NPS]
  - 0.15 (F/D)
- set current local altimeter (remote altimeter settings not allowed)
- verify that the wind is within limits published for the approach (if applicable)

[Option - Without FMC Temperature Compensation]
- verify that the reported airport temperature is within published limits for the approach

[Option - FMC Temperature Compensation]
- verify that the reported airport temperature is within published limits for the approach unless the Automatic Temperature Compensationfor Approach Altitudes Supplementary Procedure is done.
- review the maximum IAS for each segment of the approach as determined by aircraft category and applicable regulatory airspeed requirements.

Cruise Procedure

Pilot Flying	Pilot Monitoring
	When selecting the approach from the navigation database verify ACT RTE X LEGS page matches the charted approach. If there is an “at or above” altitude restriction before the FAF, it may be changed to an “at” altitude restriction using the same altitude. Speed modifications are allowed as long as the maximum published speed is not exceeded.

Descent Procedure

Pilot Flying	Pilot Monitoring
In the approach briefing include speed and altitude restrictions, missed approach, engine failure, and unable RNP procedures.	Select VOR UPDATE - OFF on the NAV OPTIONS page. Inhibit other navaids as needed per NOTAM.

Approach Procedure

Complete the Approach Procedure before the initial approach fix, or the start of radar vectors to the final approach course.

Note: When receiving radar vectors from ATC, intercept course modifications may be used to join the LNAV path at any point on the initial, intermediate or missed approach segments.

Note: Direct To modifications are not permitted when:

- The fix is the beginning of an RF leg
- The fix is the Final Approach Fix (FAF) for the procedure.

Pilot Flying	Pilot Monitoring
	On the RNP PROGRESS page verify RNP for the approach.

[With NPS]

Note: For airplanes with NPS, verify that the vertical RNP is 125 feet. While there are no vertical RNP values published on the approach chart, the use of 125 feet will cause the NPS amber deviation exceedance alert to occur at 75 feet or slightly less deviation, since vertical ANP will be at least 50 feet at all times.

Landing Procedure

[With NPS]

Pilot Flying	Pilot Monitoring

Initially
• If on radar vectors
  • HDG SEL
  • Pitch mode (as needed)
• If enroute to a fix
  • LNAV or other roll mode
  • VNAV or other pitch mode	

	Notify the cabin crew to prepare for landing. Verify that the cabin is secure.
Select TERR on map. Select CDU: ACT RTE X LEGS page.	Select TERR or WX radar on map.
Use LNAV and VNAV or other pitch mode for initial descent. VNAV is required from the FAF inbound. Some approach procedures can require use of VNAV from the IAF inbound. On intercept heading, select or verify LNAV.	

Pilot Flying	Pilot Monitoring
Call "FLAPS ___" according to the flap extension schedule or approach speed constraint.	Set the flap lever as directed. Monitor flaps and slats extension.
Approximately 2 NM before the final approach fix and after ALT HOLD or VNAV PTH or VNAV ALT (as installed) is annunciated: • set DA(H) on the MCP • select or verify VNAV [Option- Speed and altitude intervention] • select or verify speed intervention (as needed)	
Maximum Lateral Deviation (XTK ERROR): NPS amber indication or 1 x RNP Maximum Vertical Deviation - FAF to DA: 75 feet Monitor NPS	
Approaching glide path, call: • "GEAR DOWN" • "FLAPS 15"	Set the landing gear lever to DN. Verify that the green landing gear indicator lights are illuminated. Set the flap lever to 15.
Set the speed brake lever to ARM. Verify that the SPEED BRAKE ARMED light is illuminated.	
Beginning the final approach descent, call "FLAPS ___" as needed for landing.	Set the flap lever as directed.
Call "LANDING CHECKLIST."	Do the LANDING checklist.
At the final approach fix, verify the crossing altitude and crosscheck altimeters within 100 feet between primary altimeters.	
Monitor the approach.	

Pilot Flying	Pilot Monitoring
When at least 300 feet below the missed approach altitude, set the missed approach altitude on the MCP	
If suitable visual reference is established at DA(H), disengage the autopilot in accordance with regulatory requirements, and disengage the autothrottle at the same time. Maintain the glide path to landing.	

[Without TO/GA to LNAV option]

Note: If a go-around/missed approach is needed, track the required course manually using the trend vector and map until LNAV is selected.

Landing Procedure

[Without NPS]

Pilot Flying	Pilot Monitoring

Initially
• If on radar vectors
  • HDG SEL
  • Pitch mode (as needed)
• If enroute to a fix
  • LNAV or other roll mode
  • VNAV or other pitch mode	

	Notify the cabin crew to prepare for landing. Verify that the cabin is secure.
Select TERR on map. Select CDU: ACT RTE X LEGS page.	Select TERR or WX radar on map. Select CDU: RNP PROGRESS page.
One pilot must have the map display in 10 NM range or less to monitor path tracking during the final approach segment.	
Use LNAV and VNAV or other pitch mode for initial descent. VNAV is required from the FAF inbound. Some approach procedures can require use of VNAV from the IAF inbound. On intercept heading, select or verify LNAV.	
Call “FLAPS ___” according to the flap extension schedule or approach speed constraint.	Set the flap lever as directed. Monitor flaps and slats extension.

Pilot Flying	Pilot Monitoring
Approximately 2 NM before the final approach fix and after ALT HOLD or VNAV PTH or VNAV ALT (as installed) is annunciated: • set DA(H) on the MCP • select or verify VNAV [Option- Speed and altitude intervention] • select or verify speed intervention (as needed)	
	Maximum Lateral Deviation (XTK ERROR): 1 x RNP Maximum Vertical Deviation - FAF to DA: 75 feet Monitor RNP PROGRESS page
Approaching glide path, call: • “GEAR DOWN” • “FLAPS 15”	Set the landing gear lever to DN. Verify that the green landing gear indicator lights are illuminated. Set the flap lever to 15. [Without automatic ignition] Set the engine start switches to CONT.
Set the speed brake lever to ARM. Verify that the SPEED BRAKE ARMED light is illuminated.	
Beginning the final approach descent, call “FLAPS ___” as needed for landing.	Set the flap lever as directed.
Call “LANDING CHECKLIST.”	Do the LANDING checklist.
When at least 300 feet below the missed approach altitude, set the missed approach altitude on the MCP.	
At the final approach fix, verify the crossing altitude and crosscheck altimeters within 100 feet between primary altimeters.	

<table>
<tr><th>Pilot Flying</th><th>Pilot Monitoring</th></tr>
<tr><td colspan="2">Monitor the approach.

[The requirement for map display at 10NM is only for aircraft without NPS]
(At least one pilot must have map display set to 10NM range)</td></tr>
<tr><td>If suitable visual reference is established at DA(H), disengage the autopilot in accordance with regulatory requirements, and disengage the autothrottle at the same time.

Maintain the glide path to landing.</td><td></td></tr>
</table>

[Without TO/GA to LNAV option]

Note: If a go-around/missed approach is needed, track the required course manually using the trend vector and map until LNAV is selected.

Aircraft Communication Addressing and Reporting System (ACARS)

The following procedures are applicable to the noted ACARS functions from the company pages.

Pre-Departure Clearance

The flight crew shall manually verify (compare) the filed flight plan versus the digital pre-departure clearance and shall initiate voice contact with Air Traffic Control if any question/confusion exists between the filed flight plan and the digital pre-departure clearance.

Digital-Automatic Information Service

The flight crew shall verify that the D-ATIS altimeter setting numeric value and alpha value are identical. If the D-ATIS altimeter setting numeric value and alpha values are different, the flight crew must not accept the D-ATIS altimeter setting.

Oceanic Clearances

The flight crew shall manually verify (compare) the filed flight plan versus the digital oceanic clearance and initiate voice contact with Air Traffic Control if any questions/confusion exists between the filed flight plan and the digital oceanic clearance.

Weight and Balance

The flight crew shall verify the Weight and Balance numeric and alphabetical values are identical. If the Weight and Balance numeric and alphabetical values are different, the flight crew must not accept the Weight and Balance data.

Takeoff Data

The flight crew shall verify the Takeoff Data numeric and alphabetic values are identical. If the Takeoff Data numeric and alphabetic values are different, the flight crew must not accept the Takeoff Data message.

Cockpit Voice Recorder Test

[Option]

[Option - Voice Recorder switch]

Note: The Cockpit VOICE RECORDER switch must be in the ON position or at least one engine must be operating to perform this test.

Test switch .... Push

After a slight delay, observe that the monitor indicator rises into the green band. A tone may be heard through a headset plugged into the headset jack.

The indicator remains in the green band and the tone continues until the switch is released.

Cockpit Voice Recorder Test

[Option]

[Option - Voice Recorder switch]

Note: The Cockpit VOICE RECORDER switch must be in the ON position or at least one engine must be operating to perform this test.

Test switch .... Push

Hold switch for 5 seconds. Observe that the STATUS light flashes once. A tone may be heard through a headset plugged into the headset jack.

Electrical Power Up

The following procedure is accomplished to permit safe application of electrical power.

BATTERY switch .... Guard closed

[Option]

Note: Do not move the airplane until Integrated Standby Flight Display (ISFD) alignment is complete.

[Option - Airplanes with Flight Deck Auxiliary Power Outlets]

Note: Devices plugged into the flight deck auxiliary power outlets during Electrical Power Up will not be powered until the plugs are removed and reinserted.

STANDBY POWER switch .... Guard closed

ALTERNATE FLAPS master switch .... Guard closed

Windshield WIPER selectors .... PARK

ELECTRIC HYDRAULIC PUMPS switches .... OFF

LANDING GEAR lever .... DN

Verify that the green landing gear indicator lights are illuminated.

Verify that the red landing gear indicator lights are extinguished.

If external power is needed:

Verify that the GRD POWER AVAILABLE light is illuminated.

GRD POWER switch – ON

Verify that the SOURCE OFF lights are extinguished.

Verify that the TRANSFER BUS OFF lights are extinguished.

Verify that the STANDBY PWR OFF light is extinguished.

If APU power is needed:

Verify that the engine No. 1, APU and the engine No. 2 fire switches are in.

Alert ground personnel before the following test is accomplished.

OVERHEAT DETECTOR switches – NORMAL

TEST switch – Hold to FAULT/INOP

Verify that the MASTER CAUTION lights are illuminated.

Verify that the OVHT/DET annunciator is illuminated.

Verify that the FAULT light is illuminated.

If the FAULT light fails to illuminate, the fault monitoring system is inoperative.

Verify that the APU DET INOP light is illuminated.

Do not operate the APU if the APU DET INOP light fails to illuminate.

TEST switch – Hold to OVHT/FIRE

Verify that the fire warning bell sounds.

Verify that the master FIRE WARN lights are illuminated.

Verify that the MASTER CAUTION lights are illuminated.

Verify that the OVHT/DET annunciator is illuminated.

Master FIRE WARN light – Push

Verify that the master FIRE WARN lights are extinguished.

Verify that the fire warning bell cancels.

Verify that the engine No. 1, APU and the engine No. 2 fire switches stay illuminated.

[Airplanes with the NEW Engine Start Levers]
Verify that the engine No. 1 and engine No. 2 start lever lights stay illuminated.

Verify that the ENG 1 OVERHEAT and ENG 2 OVERHEAT lights stay illuminated.

Note: The WHEEL WELL fire warning light on the overheat and fire protection panel may or may not illuminate when testing on DC electrical power only. For accurate testing, do the wheel well fire detection system test after AC electrical power is established.

EXTINGUISHER TEST switch – Check

TEST Switch - Position to 1 and hold

Verify that the three green extinguisher test lights are illuminated.

TEST Switch - Release

Verify that the three green extinguisher test lights are extinguished.

Repeat for test position 2.

APU - Start

Note: If extended APU operation is needed on the ground and the airplane busses are powered by AC electrical power, position an AC powered fuel pump ON. This will extend the service life of the APU fuel control unit.

Note: If fuel is loaded in the center tank, position the left center tank fuel pump switch ON to prevent a fuel imbalance before takeoff.

CAUTION: Center tank fuel pump switches should be positioned ON only if the fuel quantity in the center tank exceeds 1000 lbs/453 kgs.

CAUTION: Do not operate the center tank fuel pumps with the flight deck unattended.

When the APU GEN OFF BUS light is illuminated:

APU GENERATOR bus switches - ON

Verify that the SOURCE OFF lights are extinguished.

Verify that the TRANSFER BUS OFF lights are extinguished.

Verify that the STANDBY PWR OFF light is extinguished.

Verify that the APU MAINT light is extinguished.

Verify that the APU LOW OIL PRESSURE light is extinguished.

Verify that the APU FAULT light is extinguished.

Verify that the APU OVERSPEED light is extinguished.

Wheel well fire detection system ....Test

Test switch – Hold to OVHT/FIRE

Verify fire warning bell sounds, master FIRE WARN lights, MASTER CAUTION lights and OVHT/DET annunciator illuminate.

Fire warning BELL CUTOUT switch – Push

Verify that the master FIRE WARN lights extinguish.

Verify that the fire warning bell cancels.

Verify that the WHEEL WELL fire warning light is illuminated.

Electrical Power Down

This procedure assumes the Secure procedure is complete.

APU switch and/or GRD POWER switch ....OFF

If APU was operating:

Delay approximately 2 minutes after the APU GEN OFF BUS light extinguishes before placing the BATTERY switch OFF.

BATTERY switch ....OFF

Standby Power Test

[Option - Single battery]

Battery switch ....ON

AC and DC meter selectors ....STBY PWR

If APU generator is on–line:

BUS TRANSFER switch ....OFF

APU GEN No. 2 switch or GRD PWR switch ....OFF

Turn OFF appropriate switch depending on power source in use. Removes power from TR 3.

STANDBY POWER switch ....OFF

Check STANDBY PWR OFF light illuminated.

AC–DC voltmeters ....Zero

STANDBY POWER switch ....BAT

Check STANDBY PWR OFF Light extinguished

AC–DC voltmeters ....Check

AC voltmeter 115 +/-5 volts

DC voltmeter 24 +/-4 volts

Frequency meter ....Check

Check frequency meter for normal indication: 400 +/- 5 CPS.

STANDBY POWER switch ....AUTO

BUS TRANS switch ....AUTO

APU GEN No. 2 switch or GRD PWR switch ....ON

Note: It can take up to 3 minutes for CDS displays to recover when power is interrupted for more than 2 seconds on the ground.

Standby Power Test

[Option – Dual battery]

Battery switch ....ON

AC and DC meter selectors ....STBY PWR

If APU generator is on–line:

APU GEN No. 1 switch ....OFF

APU GEN No. 2 switch ....OFF

If ground power is on–line:

GRD PWR switch ....OFF

STANDBY POWER switch ....OFF

Check STANDBY PWR OFF light illuminated.

AC–DC voltmeters ....Zero

STANDBY POWER switch ....BAT

Check STANDBY PWR OFF Light extinguished.

AC–DC voltmeters ....Check

AC voltmeter 115 +/-5 volts

DC voltmeter 24 +/-4 volts

Frequency meter ....Check

Check frequency meter for normal indication: 400 +/- 5 CPS.

DC meter selector ....BAT

Check DC voltmeter for normal indication: 24 +/- 2 volts.

Check DC ammeter for discharge indication: a negative value.

DC meter selector .... AUX BAT

Check DC voltmeter for normal indication: 24 +/- 2 volts.

Check DC ammeter for discharge indication: a negative value.

STANDBY POWER switch .... AUTO

GRD PWR switch or APU GEN No. 1 and No. 2 switches .... ON

Note: It can take up to 3 minutes for CDS displays to recover when power is interrupted for more than 2 seconds on the ground.

Battery Start

(With APU bleed or ground air available)

Maintenance documents .... Check

[Option]
FLIGHT DECK ACCESS SYSTEM
switch .... Guard closed

BATTERY switch .... Guard closed

[Option]

Note: Do not move the airplane until Integrated Standby Flight Display (ISFD) alignment is complete.

ELECTRIC HYDRAULIC PUMPS
switches.. OFF

LANDING GEAR lever ....DN

Verify that the green landing gear indicator lights are illuminated.

Verify that the red landing gear indicator lights are extinguished.

Emergency equipment .... Check

Fire extinguisher - Checked and stowed

Crash axe - Stowed

Escape ropes - Stowed

Other needed equipment - Checked and stowed.

Flight recorder switch .... Guard closed

Circuit breakers (P6 panel) .... Check

Circuit breakers (control stand, P18 panel) .... Check

Accomplish the Interior and Exterior Inspection if required, except for items requiring electrical or hydraulic power.

Verify that the oxygen pressure is sufficient for flight.

Accomplish the following Preflight Procedure - First Officer items:

Overheat and fire protection panel ....Check

OVERHEAT DETECTOR switches - NORMAL

TEST switch - Hold to FAULT/INOP

TEST switch - Hold to OVHT/FIRE

EXTINGUISHER TEST switch - Check

APU switch
(bleed air source, if available) ....START

On the captain's command, the first officer reads and the captain does the following items:

Oxygen .... Test and set

CAB/UTIL power switch .... ON

IFE/PASS seat power switch .... ON

EMERGENCY EXIT LIGHTS switch ....Guard closed

Passenger signs ....Set

HYDRAULIC PUMP switches .... ON

Air conditioning panel ....Set

PACK switches - AUTO or HIGH

Engine BLEED air switches - ON

APU BLEED air switch - ON

SPEED BRAKE lever ....DOWN detent

Reverse thrust levers .... Down

Forward thrust levers ....Closed

Parking brake ....Set

Note: The wheels should be chocked in case the brake pressure has bled down.

Engine start levers ....CUTOFF

Papers ....Aboard

When cleared for Engine Start, do the following:

Air conditioning PACK switches .... OFF

ANTICOLLISION light switch ....ON

Ignition select switch .... IGN-R

Engine Start

Engine No. 1 start .... Accomplish

Only N1, N2, and oil quantity are displayed until the EECs are powered.

Generator 1 switch ....ON

IRS mode selectors .... OFF, then NAV

Verify that the ON DC lights illuminate, then extinguish

Verify that the ALIGN lights are illuminated.

FMC/CDU .... Set IRS position

Verify that the following are sufficient for flight:

- hydraulic quantity
- engine oil quantity

WARNING: If engine No. 1 was started using a ground air source, to minimize the hazard to ground personnel, the external air should be disconnected and engine No. 2 started using the Engine Crossbleed Start procedure.

Engine No. 2 start .... Accomplish

Generator 2 switch ....ON

Cabin pressurization panel .... Set

FLIGHT ALTITUDE indicator - Cruise altitude

LANDING ALTITUDE indicator - Destination field elevation

Pressurization mode selector - AUTO

Verify that the ALTN light is extinguished.

Verify that the MANUAL light is extinguished.

Complete the Preliminary Preflight Procedure - Captain or First Officer by doing the following items:

PSEU light .... Verify extinguished

GPS light .... Verify extinguished

[Option - GLS]
ILS light .... Verify extinguished

[Option - GLS]
GLS light .... Verify extinguished

SERVICE INTERPHONE switch ....OFF

ENGINE panel ....Set

Verify that the REVERSER lights are extinguished

Verify that the ENGINE CONTROL lights are extinguished

EEC switches - ALTN then ON

Oxygen panel ....Set

CREW OXYGEN pressure indicator - Check

Verify that the pressure meets dispatch requirements.

Note: PASSENGER OXYGEN switch activation causes deployment of the passenger oxygen masks.

PASSENGER OXYGEN switch - Guard closed

Verify that the PASS OXY ON light is extinguished.

Landing gear indicator lights ....Verify illuminated

[Option]
Emergency EVACUATION activation switch ....Guard closed

Verify that the EVAC light is extinguished

Manual gear extension access door ....Closed

Accomplish the normal CDU Preflight Procedure - Captain and First Officer, Preflight Procedure - First Officer, Preflight Procedure - Captain, Before Start Procedure and Before Taxi Procedure to ensure that the flight deck preparation is complete.

BEFORE TAXI checklist ....Accomplish

IRS alignment .... Complete

The airplane is ready for taxi. Refer to the normal checklists for subsequent checks.

Starting with Ground Air Source (AC electrical power available)

Engine No. 1 must be started first.

When cleared to start:

APU BLEED air switch .... OFF

Engine No. 1 start .... Accomplish

Use normal start procedures.

WARNING: To minimize the hazard to ground personnel, the external air should be disconnected, and engine No. 2 started using the Engine Crossbleed Start procedure.

Engine Crossbleed Start

Do not accomplish a crossbleed start during pushback.

Before using this procedure, ensure that the area to the rear is clear.

Engine BLEED air switches ....ON

APU BLEED air switch .... OFF

PACK switches .... OFF

ISOLATION VALVE switch ....AUTO

Ensures bleed air supply for engine start.

Engine thrust lever
(operating engine) .... Advance thrust lever

Advance thrust lever until bleed duct pressure indicates 30 PSI.

Non–operating engine .... Start

Use normal start procedures with crossbleed air.

After starter cutout, adjust thrust on both engines, as required.

Setting N1 Bugs with No Operative FMC (Manual N1 Bug Setting)

Reference the Performance – Inflight section to determine N1 setting for desired phase of flight.

N1 SET outer knob .... BOTH

The last FMC computed value is displayed by reference N1 bugs and readouts. If the FMC has not calculated an input since power up, a default value of 104% is displayed.

N1 SET inner knob .... Set N1

Note: If the N1 SET outer knob is returned to the AUTO position, the bugs and readouts will revert to the last FMC computed value or 104% if the FMC has not calculated an input since power up.

High Altitude Airport Engine Start (Above 8400 Feet)

[Option - High Altitude Landing option with or without High Altitude Landing switch]

Engine start .... Accomplish

An indication of N1 rotation plus maximum motoring and a minimum of 20% N2 are required prior to introducing fuel to the engine.

Note: Maximum motoring occurs when N2 acceleration is less than 1% in approximately 5 seconds.

Fire and Overheat System Test with an Inoperative Loop

[Airplanes with the OLD Engine Start Levers]

To determine the specific inoperative loop:

OVHT DET switches .... A

Test switch .... OVHT/FIRE

If the FAULT light stays extinguished and both ENG OVERHEAT lights and engine fire switches illuminate, loop A is good.

If the FAULT light illuminates and the ENG OVERHEAT light and engine fire switch for an engine stay extinguished, there is a fault in loop A of the detection system for that engine.

OVHT DET switches ....B

Test switch .... OVHT/FIRE

If the FAULT light stays extinguished and both ENG OVERHEAT lights and engine fire switches illuminate, loop B is good.

If the FAULT light illuminates and the ENG OVERHEAT light and engine fire switch for an engine extinguished, there is a fault in loop B of the detection system for that engine.

OVHT DET switches ....As required

Select the good loop for each engine (NORMAL if both loops tested good).

Test switch .... OVHT/FIRE

If the test is successful leave the fire panel in this configuration for flight.

Fire and Overheat System Test with an Inoperative Loop

[Airplanes with the NEW Engine Start Levers]

To determine the specific inoperative loop:

OVHT DET switches .... A

Test switch .... OVHT/FIRE

If the FAULT light stays extinguished and both ENG OVERHEAT lights, engine start lever lights, and engine fire switches illuminate, loop A is good.

If the FAULT light illuminates and the ENG OVERHEAT light, engine start lever light, and engine fire switch for an engine stay extinguished, there is a fault in loop A of the detection system for that engine.

OVHT DET switches .... B

Test switch .... OVHT/FIRE

If the FAULT light stays extinguished and both ENG OVERHEAT lights, engine start lever lights, and engine fire switches illuminate, loop B is good.

If the FAULT light illuminates and the ENG OVERHEAT light, engine start lever light, and engine fire switch for an engine stay extinguished, there is a fault in loop B of the detection system for that engine.

OVHT DET switches .... As required

Select the good loop for each engine (NORMAL if both loops tested good).

Test switch .... OVHT/FIRE

If the test is successful leave the fire panel in this configuration for flight.

Altimeter Difference

Note: If flight in RVSM airspace is planned use the RVSM table in the limitations section.

This procedure is accomplished when there is a noticeable difference between the altimeters. Accomplish this procedure in stabilized level flight or on the ground.

Altimeter barometric settings .... Check

Check all altimeters set to proper barometric setting for phase of flight.

Standby altimeter baro set control ....Rotate and reset

Rotate to a different setting, then reset proper barometric setting.

Altimeters .... Crosscheck

Maximum differences between the altimeter readings:

Altitude	CDS/CDS	CDS/Standby
Sea Level	50 feet	60 feet
5,000 feet	50 feet	80 feet
10,000 feet	60 feet	120 feet
15,000 feet	70 feet	(see note)
20,000 feet	80 feet	(see note)
25,000 feet	100 feet	(see note)
30,000 feet	120 feet	(see note)
35,000 feet	140 feet	(see note)
40,000 feet	160 feet	(see note)
41,000 feet	170 feet	(see note)

Note: Above 10,000 feet and 0.4 Mach, position error causes the tolerance to diverge rapidly and direct crosscheck becomes inconclusive. Between 10,000 feet and 29,000 feet, differences greater than 400 feet should be suspect and verified by ground maintenance checks. Between 29,000 feet and the maximum operating altitude, differences greater than 500 feet should be suspect and verified by ground maintenance checks.

If it is not possible to identify which altimeter is indicating the correct altitude:

ATC .... Notify

QFE Operation

[Option - PFD/ND and Altimeter with QFE]

Use this procedure when ATC altitude assignments are referenced to QFE altimeter settings.

Note: Do not use LNAV or VNAV.

[Option - VSD]
Note: Do not use the vertical situation display.

[Option - IAN]
Note: Instrument approaches using IAN are not authorized.

FMC/CDU APPROACH REFERENCE page
or TAKEOFF REFERENCE page 2/2 .... Select

LANDING REF line select key .... Push

Verify QFE selected.

[This sets the landing altitude to zero.]

Altimeters .... Set

Set altimeters to QFE when below transition altitude/level.

Note: If the QFE altimeter setting is beyond the range of the altimeters, QNH procedures must be used with QNH set in the altimeters.

LAND ALT indicator .... Set at zero

QFE Operation

[Option - EFIS MAP]

Use this procedure when ATC altitude assignments are referenced to QFE altimeter settings.

Note: Do not use LNAV or VNAV.

[Option - VSD]
Note: Do not use the vertical situation display.

Altimeters ....Set

Set altimeters to QFE when below transition altitude/level.

Note: If the QFE altimeter setting is beyond the range of the altimeters, QNH procedures must be used with QNH set in the altimeters.

LAND ALT indicator ....Set at zero

Setting Airspeed Bugs with No Operative FMC (Manual Airspeed Bug Setting)

To set reference airspeed bugs for takeoff:

Speed reference selector (outer) V1

Default speed of 80 knots is displayed.

Speed reference selector (inner) ....Set V1 speed

V1 bug is displayed when a speed greater than 80 knots is set. The NO VSPD flag is displayed until both V1 and VR are set.

Speed reference selector (outer) .... VR

Default speed of 80 knots is displayed.

Speed reference selector (inner) .... Set VR speed

VR bug is displayed when a speed greater than 80 knots is set. The NO VSPD flag is removed after both V1 and VR are set.

MCP speed selector ....Set V2

Airspeed cursor and V2+15 bug move to the correct speeds.

Speed reference selector (outer) ....WT

Default weight of 32,000 kgs / 70,000 lbs is displayed.

Speed reference selector (inner) .... Set takeoff gross weight

Flaps up maneuver speed bug is displayed.

Note: If VREF is selected on the ground, INVALID ENTRY is displayed.

To set the spare bug, if desired:

Speed Reference selector (outer) .... Spare bug

Default speed of 60 knots is displayed.

Speed reference selector (inner) .... Set

Set speed as desired.

Speed reference selector (outer) ....SET

Digital readout is removed.

Note: When the flap lever is set to any takeoff flap setting above flaps 1, a bug comes into view for the next smaller flap maneuvering speed, between takeoff flaps and flaps up. For example, if the flap lever is set to 15 for takeoff, a bug for flaps 5 maneuvering speed will appear. For a flaps 1 takeoff, the flaps 1 maneuvering speed will be displayed.

To set reference airspeed bugs for approach:

Speed reference selector (outer) .... WT

Default weight of 32,000 kgs / 70,000 lbs is displayed.

Speed reference selector (inner) ....Set current gross weight

Flaps up maneuver speed bug is displayed.

Speed reference selector (outer) .... VREF

Default speed of 80 knots is displayed.

Speed reference selector (inner) .... Set VREF speed

The green VREF bug and white VREF +15 bug are shown when a speed greater than 80 knots is set.

The green VREF bug and white VREF +20 bug are shown when a speed greater than 80 knots is set.

Note: If V1 or VR is selected in flight, INVALID ENTRY is displayed.

To set the spare bug, if desired:

Speed reference selector (outer) ....Spare bug

Default speed of 60 knots is displayed.

Speed reference selector (inner) ....Set

Set speed as desired.

Speed reference selector (outer) .... SET

Digital readout is removed.

HUD System Procedures

[Option - Rockwell Collins HUD]

HUD system procedures supplement normal procedures and should be accomplished when applicable.

Preflight Procedure

If the HUD will be used for takeoff, or configured for a possible return for landing, accomplish the following during the Preflight Procedure:

HUD System .... Set

Combiner – Lowered, cover removed

Runway Data – Set in control panel

Enter runway length

The runway length entered must be between 7,500 and 13,500 feet (2,287 and 4,114 meters).

Enter TDZE (if available) or field elevation

Enter glideslope angle for possible return for landing.

The glideslope angle must be set between -2.50° and -3.00° for an AIII approach.

Mode – Set

Select IMC or VMC to verify proper alignment

ALIGN HUD light – Extinguished

After checking alignment, select PRI mode

Note: CLR may be selected to blank display during taxi. Push CLR again to restore display. If the HUD will not be used for takeoff, the combiner should be stowed.

For a low visibility takeoff, enter the ILS frequency and set the course to takeoff runway magnetic heading.

Descent

If HUD will be used for approach and landing, accomplish the following steps:

Prior to completing the DESCENT checklist:

HUD System .... Set

Combiner – Lowered, cover removed

Runway Data – Set in control panel

Enter runway length.

The runway length entered must be between 7,500 and 13,500 feet (2,287 and 4,114 meters) for an AIII guided landing rollout.

Enter runway TDZE (if available) or field elevation

Enter glideslope angle

The glideslope angle must be set between -2.50° and -3.00° for an AIII approach.

Mode – Set

Select IMC or VMC to verify proper alignment

ALIGN HUD light – Extinguished

After checking alignment, select PRI mode

Prior to intercepting final on a visual approach:

Select VMC mode

After intercepting final on an instrument approach:

Select IMC mode, if needed

IMC mode is an alternate approach mode primarily intended for AFDS approaches.

Note: During approach, the PM will monitor the HUD ANNUNCIATOR panel.

Landing

If HUD will be used for a CAT II or CAT IIIa approach:

At glideslope capture:

Select/verify AIII mode active

Shutdown

Accomplish the following step during the Shutdown Procedure:

HUD Combiner ....Stowed

If the airplane will be secured, install cover before stowing.

Intentionally
Blank

Tests

Transponder Test

This procedure requires the IRSs to be aligned and in NAV mode.

Transponder .... TEST

Check FAIL light illuminates.

Check all code segments illuminate. Verify no error codes exist.

Verify aural indicates TCAS system test passed.

Note: TCAS TEST is displayed on the navigation display during the test followed by TCAS TEST PASSED or TCAS TEST FAILED. This test remains in view for 8 seconds then blanks. An aural annunciation sounds at the completion of the test.

[Option - Honeywell and L3 TCAS computers]

AURAL ALERTS	DEFINITION
“TCAS TEST” “TCAS TEST FAIL”	Test failed. Maintenance required.
“TCAS TEST” “TCAS TEST OK”	Test complete. System operable.

[Option - Allied Signal TCAS computer]

AURAL ALERTS	DEFINITION
“TCAS SYSTEM TEST FAIL”	Test failed. Maintenance required.
“TCAS SYSTEM TEST OK”	Test complete. System operable.

Weather Radar Test

EFIS mode selector .... MAP, MAP CTR, VOR, or APP

Weather Radar Mode .... TEST

STAB .... ON

WXR (EFIS control panel) .... ON

Verify test pattern consisting of the following colors appears:
- Green
- Amber
- Red
- Magenta.

[Option - With predictive wind shear]
If testing of the PWS system is desired:

Weather Radar Mode ....Deselect TEST

WXR (EFIS control panel) .... ON

Weather Radar Mode .... TEST

Verify the amber WINDSHEAR caution, red WINDSHEAR warning and PWS FAIL annunciations display momentarily and then extinguish.

Note: In the short time the weather radar is on and not in the TEST position, it will radiate.

IRS

Align Light(s) Flashing

Do not move IRS Mode selector to OFF except where called for in procedure.

POS INIT page .... Select

Set IRS position ....Enter present position

Enter present position using the most accurate latitude and longitude available. If the present position is being entered via the CDU and a position is already displayed on the SET IRS POS line, enter new position over displayed position.

If ALIGN light continues to flash:

Set IRS position ....Enter present position

Re-enter same present position.

If ALIGN light continues to flash after re-entry:

IRS .... OFF

Rotate IRS Mode Selector to OFF and verify ALIGN light extinguished.

Note: Light must be extinguished before continuing with procedure (approximately 30 seconds.)

IRS .... NAV

Rotate IRS Mode Selector to NAV and verify ALIGN light illuminated.

Set IRS position .... Enter present position

Enter present position. If ALIGN light flashes, re-enter same present position over displayed position.

Note: Approximately five to seventeen minutes are required for alignment.

If ALIGN light continues to flash, maintenance action is required.

Fast Realignment

Prior to commencing procedure the airplane must be parked and not moved until procedure is complete and ALIGN lights extinguish.

IRS mode selectors .... ALIGN

Observe ALIGN lights illuminate steadily.

CDU ....Set

Enter present position on SET IRS POS line of the POS INIT page.

IRS mode selector..NAV

Observe ALIGN light extinguished within 30 seconds.

Note: If time permits it is preferable to perform a full alignment of the IRS. A more precise alignment will result.

Note: If the mode selector is accidentally switched to OFF or ATT, position mode selector to OFF, wait for ALIGN light(s) to extinguish, then perform full alignment procedure.

Inadvertent Selection of Attitude Mode (while on the ground)

Inadvertent selection of the attitude mode may be due to physically overpowering the switch during turn–on or may be the result of a faulty switch which prevents the flight crew from accurately determining which mode is selected.

If ATT position is selected inadvertently when switching to NAV

IRS mode selectors ....OFF

Observe ALIGN lights extinguish.

After ALIGN lights extinguish, initiate a full alignment.

IRS Entries

Present Position Entry

IRS mode selector ....NAV

ALIGN lights must be illuminated (steady or flashing).

IRS display selector ....PPOS

Latitude ....Enter

Key–in latitude in the data display, beginning with N or S, then press the ENT Key (the Cue Lights extinguish).

Longitude ....Enter

Key–in longitude in the data display, beginning with E or W, then press the ENT key (the cue lights extinguish). Observe that proper latitude and longitude are displayed and that the ALIGN light is not flashing.

Heading – Enter through CDU

FMC/CDU POS INIT page .... Select

Enter the correct heading into the CDU scratch pad then press line select key 5R. Verify entered heading appears on line 5R. Select HDG on the IRS display selector and verify that the entered heading is displayed on the navigation displays.

Heading – Enter through ISDU

IRS display selector .... HDG

Press the H key to initiate a heading entry.

Key–in present magnetic heading. Press the ENT key (the cue lights extinguish). Observe proper heading displayed on the navigation displays.

Lateral Navigation (LNAV)

Proceeding Direct to a Waypoint (overwrite)

RTE LEGS page .... Select

On page 1/XX, line 1L, enter desired waypoint over the presently active waypoint.

Correct any ROUTE DISCONTINUITY if entered waypoint was not in original flight plan.

[Option - With abeam points]
If abeam waypoints are desired:

ABEAM PTS key .... Push

EXEC key .... Push

Observe the MOD RTE LEGS page changes to ACT.

Proceeding Direct to a Waypoint (DIR/INTC)

[Option - CDU]

DIR INTC key .... Push

Observe DIRECT TO box prompts displayed in line 6L.

Enter desired waypoint on the DIRECT TO line. Observe the waypoint automatically transfers to line 1L.

Correct any ROUTE DISCONTINUITY if entered waypoint was not in the original flight plan.

EXEC key .... Push

Observe MOD RTE LEGS page changes to ACT.

Intercepting a Leg (Course) to a Waypoint

RTE LEGS page .... Select

On page 1/XX, line 1L, enter desired waypoint over presently active waypoint.

Observe INTC CRS prompt displayed in line 6R.

Enter the desired intercept course in the INTC CRS line. Observe the desired course is displayed on line 6R. The displayed course on line 1L may vary by several degrees due to magnetic variation.

Correct any ROUTE DISCONTINUITY if the entered waypoint was not in original flight plan.

EXEC key .... Push

Observe MOD RTE LEGS page changes to ACT.

LNAV may disengage after execution of an intercept leg to a waypoint. If LNAV disengages, turn to a heading to satisfy LNAV capture criteria, as described in Chapter 11, and then engage LNAV.

Intercepting a Leg (Course) to a Waypoint (DIR/INTC)

[Option - CDU]

DIR INTC key .... Push

Observe INTC LEG TO box prompts displayed in line 6R.

Enter the desired waypoint on the INTC LEG TO line. Observe the waypoint automatically transfers to line 1L.

Enter the desired intercept course in the INTC CRS line. Observe the desired course is displayed on line 6R. The displayed course on line 1L may vary by several degrees due to magnetic variation.

Correct any ROUTE DISCONTINUITY if the entered waypoint was not in original flight plan.

EXEC key .... Push

Observe MOD RTE LEGS page changes to ACT.

LNAV may disengage after execution of an intercept leg to a waypoint. If LNAV disengages, turn to a heading to satisfy LNAV capture criteria, as described in Chapter 11, and then engage LNAV.

Route Modification

[Option - FMC U10.8A or earlier]

RTE LEGS or RTE page .... Select

Line select existing waypoints in the desired sequence.

Key–in any new waypoints in the scratch pad and line select into the flight plan. Correct any ROUTE DISCONTINUITY.

EXEC key .... Push

Observe MOD RTE or MOD RTE LEGS page changes to ACT.

Active Route Modification

[Option - FMC U11 and later]

ACT RTE x LEGS or ACT RTE x page .... Select

Line select existing waypoints in the desired sequence.

Key–in any new waypoints in the scratch pad and line select into the flight plan. Correct any ROUTE DISCONTINUITY.

EXEC key .... Push

Observe MOD RTE x LEGS or MOD RTE x page changes to ACT.

Inactive Route Modification

[Option - FMC U11 and later]

RTE x LEGS or RTE x page .... Select

Line select existing waypoints in the desired sequence.

Key–in any new waypoints in the scratch pad and line select into the flight plan. Correct any ROUTE DISCONTINUITY.

Note: The flight number should not be changed in the inactive route as it will change the flight number in the active route.

Route Copy

[Option - FMC U11 and later]

ACT RTE x LEGS or ACT RTE x page .... Select

RTE COPY line select key .... Push

Inactive Route Activation

[Option - FMC U11 and later]

RTE x LEGS or RTE x page .... Select

ACTIVATE line select key .... Push

Correct any ROUTE DISCONTINUITY.

EXEC key .... Push

Route Removal

RTE page .... Select

ORIGIN .... Enter

If EXEC key illuminates

EXEC key .... Push

Linking a Route Discontinuity

Correct the ROUTE DISCONTINUITY by entering or deleting waypoints in a sequence that provides a continuous flight–plan path.

EXEC key .... Push

Observe MOD RTE or MOD RTE LEGS page changes to ACT.

Determining ETA and Distance to Cross Radial (Bearing) or Distance from a Fix

FIX INFO page .... Select

Enter the identifier of the reference waypoint (normally an off–route waypoint) onto the FIX line. Enter the desired radial or distance from the FIX on a RAD/DIS line, or line select the ABM prompt if the desired radial from the FIX is perpendicular to the present route/course.

Time and distance to go .... Check

Check ETA and DTG, as desired.

Note: If ETA and DTG are not displayed, the fix radial and/or distance do not intersect the route.

Changing Destination

RTE page .... Select

Enter the new destination over the original DEST. Enter desired routing to the new destination using the RTE, RTE LEGS, and ARRIVALS pages, as appropriate. Correct any ROUTE DISCONTINUITY.

EXEC key .... Push

Observe the MOD RTE or MOD RTE LEGS page changes to ACT.

Note: If destination is changed during climb, performance predictions may be blanked if the new flight plan is incompatible with the entered cruise altitude. Correct by entering a lower CRZ ALT on the CLB page.

Entering Holding Fix Into Route

HOLD key .... Push

(If RTE HOLD page is displayed, observe NEXT HOLD prompt. Line select 6L until (RTE LEGS) HOLD AT page is displayed.)

Observe HOLD AT box prompts and PPOS prompt (if in flight) are displayed. Enter the holding fix in line 6L, or line select PPOS.

If the holding fix is a waypoint in the active route, or PPOS was selected, observe MOD RTE HOLD page displayed. If the holding fix is a waypoint not in the active route, observe message HOLD AT XXXXX displayed in the scratch pad. Enter the holding fix into the route by line selecting in the desired waypoint sequence. Observe the MOD RTE HOLD page displayed. If displayed holding details are incorrect or inadequate, enter correct information on appropriate line(s).

EXEC key .... Push

Observe MOD RTE HOLD page changes to RTE HOLD (ACT RTE HOLD if holding at PPOS).

Exiting Holding Pattern

HOLD key .... Push

Observe EXIT HOLD prompt displayed.

EXIT HOLD line select key .... Push

Observe EXIT HOLD prompt changes to EXIT ARMED.

EXEC key .... Push

Observe EXIT ARMED is highlighted in reverse video and LNAV flight returns to the holding fix and resumes the active route.

Note: The holding pattern may be exited by performing a DIRECT TO modification if desired. In this case, the flight path may not return to the holding fix before proceeding to the selected waypoint.

[Option - FMC update U10.2 and later]

Note: A late sequencing of the hold exit waypoint may occur if multiple route modifications are performed just prior to exiting the hold. LNAV guidance may be temporarily interrupted while sequencing the hold exit waypoint.

Along Track Displacement

RTE LEGS page .... Select

Line select the reference waypoint to the scratch pad. Add a "/" and the + or – distance desired. (EX: SEA/15 for a point 15 miles downtrack from SEA)

Line select the reference waypoint. (The FMC will automatically position the created waypoint to appropriate position.)

EXEC key .... Push

Observe the MOD RTE LEGS page change to ACT.

Entering Created Waypoints on the Route or Route Legs Pages

Note: Created waypoints are stored in the temporary navigation data base for one flight only.

RTE or RTE LEGS page .... Select

Using any of the following methods, key into the scratch pad the parameters which define the new created waypoint (place identifiers must already be stored in one of the FMC data bases):

- Place bearing/distance (for example, SEA250/40);
- Place bearing/place bearing (for example, SEA180/ELN270);
- Along–track displacement (for example, SEA/-10);
- Latitude and longitude (for example, N4731.8W12218.3).

Enter into the route by line selecting to the appropriate waypoint sequence.

Repeat the above steps to define additional created waypoints as desired. Correct any ROUTE DISCONTINUITY.

EXEC key .... Push

Observe the MOD RTE or MOD RTE LEGS page changes to ACT (for an inactive route, activate and execute on the RTE or RTE LEGS page).

Entering Created Waypoints on the Nav Data Pages

Note: Created waypoints entered on the SUPP NAV DATA pages (permitted on the ground only) are stored in the supplemental navigation data base for an indefinite time period; those entered on REF NAV DATA pages are stored in the temporary navigation data base for one flight only.

INIT/REF key .... Push

Observe INDEX prompt displayed.

INIT/REF INDEX page .... Select

Observe the NAV DATA prompt displayed. To access the SUPP NAV DATA page, enter SUPP into the scratch pad.

NAV DATA page .... Select

(If the SUPP NAV DATA page is selected, observe the EFF FRM date line displayed. If an effective date had not been previously entered, box prompts are displayed. The effective date must be entered before proceeding. If required, enter the current or appropriate date on EFF FRM line and execute.)

Data .... Enter

Enter a crew-assigned identifier on either the WPT IDENT, NAVAID IDENT, or AIRPORT IDENT line, as appropriate. Use the navaid category only for stations with DME.

For a WPT IDENT entry, define the waypoint with entries for either latitude and longitude, or with entries for REF IDENT and RADIAL/DIST (REF IDENT identifier must already be stored in one of the FMC data bases).

For a NAVAID IDENT or AIRPORT IDENT entry, enter appropriate data.

EXEC key illuminates when data has been entered into all box prompts.

EXEC key .... Push

Repeat above steps to define additional created waypoints as desired. To enter a new identifier in the same category, simply overwrite the previous identifier.

Note: To enter a created waypoint into the flight plan, key the identifier into the scratch pad and follow the route modification procedure.

Deleting Created Waypoints on the Nav Data Pages

INIT/REF key .... Push

Observe the INDEX prompt displayed.

INIT/REF INDEX page .... Select

Observe the NAV DATA prompt displayed. To access the SUPP NAV DATA page, key SUPP into the scratch pad.

NAV DATA page .... Select

Enter the identifier on either the WPT IDENT, NAVAID IDENT, or AIRPORT IDENT line, as appropriate.

Data ....Delete

Push the DEL key and then line select the identifier. Observe the EXEC key illuminates.

EXEC key .... Push

Data previously entered is deleted. Observe NAV DATA page displayed with prompts.

Entering a Crossing Radial (Bearing) or Distance from a Fix as a Route Waypoint

FIX INFO page .... Select

Enter identifier of the reference waypoint (normally an off–route waypoint) onto the FIX line. Enter the desired radial or distance from the FIX on a RAD/DIS line, or line select the ABM prompt if the desired radial or distance from the FIX is perpendicular to the present route/course.

Line select the desired intersection (lines 2L–5L) into the scratch pad and observe the new created waypoint displayed as FIX/Radial/Distance.

RTE LEGS page .... Select

Line select the new created waypoint, displayed in the scratch pad, to the desired waypoint sequence.

Repeat the above steps to define additional created waypoints as desired. Correct any ROUTE DISCONTINUITY.

EXEC key .... Push

Observe the MOD RTE LEGS page changes to ACT.

Note: These created waypoints are stored in the temporary navigation data base for one flight only.

Entering a Lateral Offset

RTE page .... Select

Observe the OFFSET prompt displayed.

LATERAL OFFSET page .... Select

Observe dash prompts for OFFSET DIST.

OFFSET DIST .... Enter

Enter desired offset distance using format Lxx or Rxx for left or right offset up to 99 nm. Observe dash prompts for START WAYPOINT and END WAYPOINT.

START/END WAYPOINT .... Enter

If no start/end waypoint is entered, offset will begin/end at first/last valid offset leg.

Change SID or Runway

This entire procedure must be accomplished when a SID is used and the runway or SID is changed. This will prevent the possibility of incorrect routing or inadequate obstacle clearance.

DEPARTURES page .... Select

RUNWAY .... Reselect

SID .... Reselect

TRANSITION (if required) .... Reselect

RTE LEGS page .... Select

WAYPOINT SEQUENCE and ALTITUDES ....Check

Modify as necessary to agree with clearance.

EXEC key ....Push

Change STAR, PROF DES, or APP

The associated airport must be entered as route origin or destination.

ARRIVAL page ....Select

STAR or PROFILE DESCENT (if required) ....Select

TRANSITION (if required) ....Select

APPROACH ....Select

APPROACH TRANSITION (if required) ....Select

RTE LEGS page ....Select

WAYPOINT SEQUENCE ....CHECK

Modify as necessary to agree with clearance.

EXEC key ....Push

Delete Procedure Turn

DEP/ARR page ....Select

Approach ....Select

Reselecting same approach or selecting a new approach will remove procedure turn and select a straight in approach on the LEGS page.

EXEC key ....Push

or

RTE LEGS page ....Select

Select last waypoint of procedure turn to scratchpad and overwrite PROC TURN line. Check waypoint sequencing to comply with clearance.

EXEC key ....Push

Other Operations

FMC Navigation Check

[Option - FMC update U11.0 or later]

Do the following as needed to ensure navigation accuracy if any alerting message listed below is shown in the scratch pad or course deviation is suspected:

- GPS-L INVALID and GPS-R INVALID (both)
- IRS-L DRIFT
- IRS-R DRIFT
- UNABLE REQD NAV PERF - RNP
- VERIFY POS: FMC-FMC
- VERIFY POS: FMC-GPS
- VERIFY POS: FMC-RADIO
- VERIFY POS: IRS-FMC
- VERIFY POS: IRS-IRS
- VERIFY POS: IRS-RADIO

[Option - FMC update U10.7 to U10.8A]

Do the following as needed to ensure navigation accuracy if any alerting message listed below is shown in the scratch pad or course deviation is suspected:

- GPS-L INVALID and GPS-R INVALID (both)
- UNABLE REQD NAV PERF - RNP
- VERIFY POS: FMC-FMC
- VERIFY POS: FMC-GPS
- VERIFY POS: FMC-RADIO
- VERIFY POS: IRS-FMC
- VERIFY POS: IRS-IRS
- VERIFY POS: IRS-RADIO

Actual position....................Determine and compare with FMC position

Determine actual airplane position using raw data from VHF navigation or ADF radios.

If radio navaids are unavailable:

FMC position .... Compare with the IRS position

Use the POS SHIFT page of the FMC CDU. If the two IRS positions are in agreement and the FMC position is significantly different, the FMC position is probably unreliable. The POS SHIFT page may be used to shift FMC position to one of the IRS positions. This is accomplished by line selecting the IRS or radio position and then pressing the EXEC Key.

Actual position .... Confirm with ATC radar or visual reference points.

Navigate using most accurate information available (continue to monitor FMC position using VOR/ADF raw data displays on non–flying pilot's navigation display).

CAUTION: Navigating in LNAV mode with an unreliable FMC position may result in significant navigation errors.

Navigate by conventional VOR/ADF procedures, radar vectors from ATC, dead reckoning from last known position, and/or use of visual references.

Inhibiting VOR/DME Use for Position Updating

Note: This procedure inhibits the use of VOR/DME information for FMC position updating. Use DEL key to remove a VOR/DME from inhibit status.

PROG page .... Select

Observe NAV STATUS prompt displayed.

NAV STATUS page .... Select

NAV OPTIONS page .... Select (NEXT/PREV page)

Observe dash prompts for VOR/DME INHIBIT. Enter desired VOR/DME identifier (a previous entry may be overwritten but will no longer be inhibited).

Inhibiting GPS Updating

[Option - With GPS]

Note: Inhibit GPS updates for approach operations that are not based on WGS-84, unless other appropriate procedures are used.

PROG page .... Select

Observe NAV STATUS prompt displayed.

NAV STATUS page .... Select

NAV OPTIONS page .... Select (NEXT/PREV page)

GPS UPDATE .... OFF

Automatic Temperature Compensation for Approach Altitudes

[Option - FMC U14 and newer with Temp Comp]

Note: This procedure is not authorized using QFE.

Note: When using temperature compensation, advise ATC of the corrections. Failure to do so may lead to loss of vertical separation between airplanes.

Note: FMC temperature compensation applies corrections to all FMC waypoint altitudes from the START WAYPOINT including the missed approach waypoints.

Note: Verify all FMC temperature compensated waypoint altitudes comply with ATC clearance.

Note: For hot temperature altitude corrections:

- In the event of a go-around or missed approach, observe charted altitude restrictions. After flaps are set to the planned flap setting and at or above the flap maneuvering speed, select LVL CHG. Do not use VNAV.

A temperature altitude correction is not needed for the following conditions:

- while under ATC radar vectors
- when maintaining an ATC assigned flight level (FL)

Note: Regulatory authorities may have other requirements for temperature altitude corrections.

Select and execute instrument approach to be flown in the DEP/ARR INDEX page.

APPROACH REF page .... Select

Use the INIT REF key to display the APPROACH REF page.

NEXT PAGE key .... Push

Use the NEXT PAGE key to display the TEMP COMP REF page.

Destination airport .... Verify

Destination airport temperature .... Enter and execute

A destination airport temperature can only be entered after an instrument approach has been selected.

START WAYPOINT .... Set or verify

START WAYPOINT defaults to the IAF for the selected approach.

The START WAYPOINT can be manually changed to any other waypoint before the IAF is sequenced.

Note: For hot temperature, apply corrections to the final approach segment by changing the START WAYPOINT to the FAF. Hot temperature compensation can be applied to other segments of the approach with ATC approval.

Note: Once the START WAYPOINT is sequenced, the START WAYPOINT blanks and cannot be reselected until the destination airport temperature is deleted and re-selected.

Temperature Compensated Altitudes .... Verify

On the ACT RTE X LEGS page the START WAYPOINT and all subsequent waypoints are identified as temperature compensated by an asterisk (*) to the right of the altitude.

For cold temperature correction, verify that the temperature compensation altitudes are higher than the published altitudes.

For hot temperature correction, verify that the temperature compensation altitudes are lower than the published altitudes.

To calculate the temperature compensated altitude that is not in the active flight plan, if needed:

ALT .... Enter

Enter a barometric altitude at LSK 4L to determine the temperature compensated altitude. The temperature compensated barometric altitude is shown under TEMP COMP ALT at LSK 4R.

Note: Enter all the digits for the MSL altitude, for example, enter "500" for 500 feet or "5000" for 5000 feet MSL.

Note: Altitude entries are for information only and does not affect the altitudes on the ACT RTE X LEGS page.

For cold temperature correction, set the MDA/DA at the corrected minimum altitudes for the approach. FMC temperature compensation applies corrections to all the missed approach waypoints.

If the corrected indicated altitude to be flown is between 100 foot increments, set the MCP altitude to the closest 100 foot increment above the corrected indicated altitude to be flown.

For additional information on temperature corrections to departure, enroute and approach altitudes, refer to the Cold Temperature Altitude Corrections Supplementary Procedure (SP 16).

Vertical Navigation (VNAV)

Temporary Level Off during Climb or Descent (Not at FMC Cruise Altitude)

MCP altitude selector .... Set desired altitude

[Option - With VNAV ALT]
Verify VNAV ALT is annunciated on the flight mode annunciator when leveling at the selected MCP altitude.

[Option - Without VNAV ALT]
Verify ALT HOLD is annunciated on the flight mode annunciator when leveling at the selected MCP altitude.

MCP N1 light extinguishes if leveling from a climb.

N1 limit changes to CRZ if leveling from a climb.

To continue climb or descent:

MCP altitude selector ....Set desired altitude

[Option - With VNAV ALT]
ALT INTV switch..Push

Climb or descent is initiated. Mode annunciations appear as initial climb or descent.

[Option - Without VNAV ALT]
VNAV switch..Push

Climb or descent is initiated. Mode annunciations appear as initial climb or descent.

Intervention of FMC Altitude Constraints during VNAV Climb

[Option - With speed and altitude intervention]

MCP altitude selector .... Set new altitude

New altitude must be higher than the FMC altitude constraint(s) to be deleted.

ALT INTV switch .... Push

Each push of the ALT INTV switch will delete an FMC altitude constraint.

Intervention of FMC Cruise Altitude during VNAV Cruise

[Option - Speed and altitude intervention with FMC U10.8A and earlier]

MCP altitude selector .... Set

ALT INTV switch .... Push

If a higher altitude is selected, a CRZ climb will be started.

If a lower altitude is selected, an early descent will be started.

Intervention of FMC Cruise Altitude during VNAV Cruise

[Option - Speed and altitude intervention with FMC U11.0 and later]

MCP altitude selector .... Set

ALT INTV switch .... Push

If a higher altitude is selected, a CRZ climb will be started.

If the airplane is more than 50 nm from T/D, if a lower altitude is selected, a CRZ descent will be started if the selected altitude is at or above any FMC altitude constraint.

If the airplane is more than 50 nm from T/D, if a lower altitude is selected, an early descent will be started if the selected altitude is below any FMC altitude constraint.

If the airplane is 50 nm or less from T/D, if a lower altitude is selected, an early descent will be started.

Intervention of FMC Altitude Constraints during VNAV Descent

[Option - With speed and altitude intervention]

MCP altitude selector .... Set new altitude

New altitude must be lower than the FMC altitude constant (s) to be deleted.

ALT INTV switch .... Push

Each push of the ALT INTV switch will delete an FMC altitude constraint.

If all FMC altitude constraints are deleted, the descent mode will revert to a VNAV speed descent.

Intervention of FMC Airspeed Constraints during VNAV

[Option - With speed and altitude intervention]

SPD INTV switch .... Push

MCP IAS/MACH display shows current FMC target speed.

MCP speed selector .... Set desired speed

VNAV remains engaged.

To resume former FMC speed:

SPD INTV switch .... Push

MCP IAS/MACH display blanks and FMC commanded VNAV speed is active.

Entering Waypoint Speed and Altitude Restriction (On Climb or Descent Legs Only)

RTE LEGS page .... Select

Key–in desired speed and altitude, or speed only (followed by /), or altitude only, into scratch pad.

An altitude followed by A or B signifies a requirement to be “at or above” or “at or below” that altitude at the waypoint (for example, key–in 220A or 240B).

Line select to desired waypoint line.

EXEC key .... Push

Observe MOD RTE LEGS page changes to ACT.

Note: This changes any prior speed and altitude restriction at this waypoint.

Deleting Waypoint Speed and Altitude Restriction

RTE LEGS page .... Select

Push DEL key to enter DELETE in scratch pad. Line select to appropriate waypoint line.

EXEC key .... Push

Observe MOD RTE LEGS page changes to ACT and restriction is deleted and replaced with an FMC predicted value (small size characters).

Changing Speed and/or Altitude Restriction during Climb or Descent

CLB/DES page .... Select

Push DEL key to enter DELETE in the scratch pad, or key–in the desired speed and altitude in the scratch pad. Line select to the SPD REST line.

EXEC key .... Push

Observe the MOD CLB or the MOD DES page changes to ACT and the restriction is changed or deleted.

Changing Climb/Cruise/Descent Speed Schedule

CLB/CRZ/DES page .... Select

Select the prompt for the desired climb/cruise/descent schedule, or key–in the desired speed in the scratch pad and line select to the TGT SPD line.

EXEC key .... Push

Observe the MOD CLB, MOD CRZ, or MOD DES page changes to ACT and new speed schedule is specified.

Early Descent

MCP altitude selector .... Set

Set next level–off altitude.

DES page .... Select

Line select DES NOW prompt.

EXEC key .... Push

Observe MOD DES page changes to ACT. Observe descent is initiated (if VNAV engaged).

Note: For a PATH DES, this will result in a 1000 FPM rate of descent until the planned path is intercepted. For a SPD DES, this will result in an idle thrust normal rate of descent.

Step Climb or Descent from Cruise

MCP altitude selector .... Set

Set new level–off altitude.

FLT ALT indicator .... Set

Set new level–off altitude.

CRZ page .... Select

Enter new altitude on the CRZ ALT line. The display changes to MOD CRZ CLB or MOD CRZ DES.

If the desired climb/descent speed is different from the displayed cruise speed, manually enter the desired TGT SPD, or use access prompts to select desired CLB/DES page.

EXEC key .... Push

Observe the MOD CRZ CLB/MOD CRZ DES page (or other selected MOD CLB/MOD DES page) changes to ACT. Observe climb/descent is initiated at the TGT SPD (if VNAV engaged).

Performance and Progress Functions

Determining ETA and Fuel Remaining for New Destination

RTE page .... Select

Enter the new destination over the original DEST. Enter correct routing to the new destination using RTE, RTE LEGS, and ARRIVALS pages, as appropriate. Correct any ROUTE DISCONTINUITY.

PROGRESS page .... Select

Observe new destination with a MOD title. Check ETA and FUEL remaining.

RTE page .... Select

EXEC or ERASE the new destination/routing, as desired. Observe MOD RTE page changes to ACT.

Estimated Wind Entries for Cruise Waypoints

RTE LEGS page .... Select

Observe the DATA prompt displayed.

RTE DATA page .... Select

Enter the estimated true wind direction/speed on the appropriate line(s).

Step Climb Evaluation

CRZ page .... Select

Enter the desired step climb altitude on the STEP line. If known, enter the estimated average true wind direction/speed for the desired step climb altitude on the ACTUAL WIND line.

Step climb savings .... Determine

Observe the fuel SAVINGS/PENALTY and FUEL AT ______ (destination) lines to determine if a higher cruise altitude is advantageous.

If step climb fuel savings are significant, use the appropriate climb procedure to initiate climb to the higher altitude when NOW is displayed on STEP POINT line.

Note: Step climb evaluations do not consider buffet margin limits. If the altitude entered for the step climb evaluation is higher than the maximum altitude for flight with an adequate buffet margin, the message “MAX ALT FLXXX” will be displayed in the scratch pad. Ensure the new cruise altitude entered for the climb is at or below the MAX ALT displayed in the message in order to maintain a safe buffet margin.

Entering Descent Forecasts

DES page .... Select

Observe FORECAST prompt displayed.

DES FORECASTS page .... Select

Verify the TRANS LVL and revise if required. Enter average ISA DEV forecast for descent and destination QNH. Enter forecast descent WINDs (for up to three different altitudes).

EXEC key .... Push

Observe MOD DES FORECASTS page changes to ACT.

Engine Out

Engine out climb and cruise pages provide advisory information for engine out operation. Refer to section 11.41 and 11.42 for a complete description of ENG OUT CLB and ENG OUT CRZ pages.

Required Time of Arrival (RTA)

Note: An active FMC flight plan complete with all performance data must exist before the required time of arrival (RTA) mode can be used.

Entering an RTA Waypoint and Time

RTA PROGRESS page .... Select

On PROGRESS page 3, line 1L, enter the flight plan waypoint where required time of arrival is applicable. Observe the MOD RTA PROGRESS page displayed with the computed ETA, for the entered waypoint, displayed in line 1R.

RTA ....Enter

Enter required time of arrival into line 1R. Time should be entered in hours, minutes, and seconds (Examples: 174530, 1745, 1745.5). Observe MOD RTA PROGRESS page displayed with pertinent data for complying with entered RTA. Observe EXEC key illuminated.

EXEC key .... Push

Observe ACT RTA PROGRESS page displayed.

Entering Speed Restrictions for RTA Navigation

PERF LIMITS page .... Select

Enter minimum or maximum speed restriction for RTA navigation in lines 2, 3, or 4 depending on phase of flight. Observe RTA parameters change to reflect new limits (RTA PROGRESS page) and EXEC key illuminated.

EXEC key .... Push

Observe MOD PERF LIMITS page change to ACT PERF LIMITS page.

Note: Entered restrictions on line 2, 3, and 4 also restrict other navigation modes such as ECON.

Entering New Time Error Tolerances for RTA Navigation

PERF LIMITS page .... Select

Enter desired time error tolerance (5 to 30 seconds) for the RTA waypoint on line 1L (Example: 25). Observe MOD PERF LIMITS page displayed and EXEC key illuminated.

EXEC key .... Push

Observe ACT PERF LIMITS page displayed.

Additional CDU Functions

Navigation Display Plan Mode (Center Step Operation)

EFIS Control Panel Mode Selector ....PLAN

RTE LEGS page .... Select

EFIS Control Panel Range Selector .... As required

MAP CTR STEP key .... Push

Each push moves the CTR label to the next geographically fixed waypoint in the route. Selecting PREV PAGE or NEXT PAGE moves the CTR label to the first geographically fixed waypoint on the new page.

EFIS Control Panel Mode Selector .... As required

Enter Position Shift on Runway

TAKEOFF REF page .... Select

[Option - Runway position update with TO/GA activation]
TO SHIFT distance .... Enter

Enter distance desired from runway threshold. When TO/GA is pushed, FMC will update position to runway threshold plus entered distance.

[Option - Runway remaining update with TO/GA activation]
RWY REMAIN distance .... Enter

Enter runway remaining distance. When TO/GA is pushed, FMC will update to the runway remaining distance.

If position shift must be removed

RTE page .... Select

RWY .... Enter

Reenter runway on RTE page. Check and reenter other performance data as required.

Intentionally
Blank

Fuel Balancing

If an engine fuel leak is suspected:

Accomplish the Fuel Leak Engine checklist.

If the fuel IMBAL alert shows:

Accomplish the IMBAL checklist.

Maintain main tank No. 1 and No. 2 fuel balance within limitations.

Note: Fuel pump pressure should be supplied to the engines at all times. At high altitude, without fuel pump pressure, thrust deterioration or engine flameout may occur.

If the center tank contains fuel:

Center tank fuel pump switches .... OFF

[Fuel CONFIG indication may be displayed with fuel in the center tank.]

Crossfeed selector .... Open

Fuel pump switches (low tank) .... OFF

When quantities are balanced:

Fuel pump switches (main tank) .... ON

Center tank fuel pump switches .... ON

Crossfeed selector .... Close

If the center tank contains no fuel:

Crossfeed selector .... Open

Fuel pump switches (low tank) .... OFF

When quantities are balanced:

Fuel pump switches .... ON

Crossfeed selector .... Close

Refueling

Fuel Load Distribution

Main tanks No. 1 and No. 2 should normally be serviced equally until full. Additional fuel is loaded into the center tank until the desired fuel load is reached.

Note: Main tanks No. 1 and No. 2 must be scheduled to be full if the center tank contains more than 453 kgs / 1,000 lbs of fuel. With less than 453 kgs / 1,000 lbs of center tank fuel, partial main tank fuel may be loaded provided the effects of balance have been considered.

Fuel Pressure

Apply from a truck or fuel pit. A nozzle pressure of 50 psi provides approximately 1136 liters / 300 U.S. gallons per minute.

Normal Refueling

[Option - Fuel Quantity selector]
When a full fuel load is required, the fuel shutoff system closes the fueling valves automatically when the tanks are full. When a partial fuel load is required, the fuel shutoff system closes the fueling valves automatically when the quantity preselected on the fuel quantity selector (located on the test gauges and fueling panel) is reached.

[Option - Without Fuel Quantity selector]
When a full fuel load is required, the fuel shutoff system closes the fueling valves automatically when the tanks are full. When a partial fuel load is required, the fuel quantity indicators are monitored and the fueling valves are closed by manually positioning the fueling valve switches to CLOSED when the desired fuel quantity is aboard the airplane.

Refueling with Battery Only

When the APU is inoperative and external power is not available, refueling can be accomplished as follows:

Battery switch .... ON

Note: The refueling system will operate normally. Operation is limited only by battery life.

Refueling with No AC or DC Power Source Available

When it becomes necessary to refuel with the APU inoperative, the aircraft battery depleted, and no external power source available, refueling can still be accomplished:

Fueling hose nozzle .... Attached to the refueling receptacle

Fueling valves ....Open for the tanks to be refueled

Note: Main tanks No. 1 and No. 2, and the center tank refueling valves each have a red override button that must be pressed and held while fuel is being pumped into the tank. Releasing the override button allows the spring in the valve to close the valve.

Caution must be observed not to overfill a tank, since there is no automatic fuel shutoff during manual operation. When the desired amount of fuel has been pumped into the tanks, the refueling valves for the respective tanks can be released.

Ground Transfer of Fuel

[Pure Fleet Auto Shutoff]

Fuel can be transferred from one tank to another tank using the fuel pumps, fueling valve, defueling valve, and crossfeed valve. AC power must be available.

Note: Before transferring fuel, ensure that the associated FUEL PUMP LOW PRESSURE lights are operating.

[Passenger Airplanes]

CAUTION: Transferring fuel with passengers onboard is prohibited, unless the fuel quantity in the tank from which fuel is being taken is maintained at or above 2000 pounds/900 kilograms.

[Freighter Airplanes]

CAUTION: Transferring fuel with supernumeraries onboard is prohibited, unless the fuel quantity in the tank from which fuel is being taken is maintained at or above 2000 pounds/900 kilograms.

To transfer fuel from the main tanks to the center tank:

Main tank fuel pump switches ....ON

Crossfeed selector .... Open

Manual defueling valve .... Open

Center tank fueling valve switch .... OPEN

Fuel transfer ....Monitor

The center tank fuel quantity indicator shows an increase in fuel. The main tank indicators show a decrease in fuel.

When a FUEL PUMP LOW PRESSURE light illuminates, turn OFF the associated fuel pump.

When the required amount of fuel has been transferred:

Center tank fueling valve switch .... CLOSED

Manual defueling valve .... Close

Crossfeed selector .... Close

Main tank fuel pump switches ....OFF

Main Tanks .... Refill

Refueling panel and defuel panel access doors .... Close

Ground Transfer of Fuel

[Mixed Fleet Auto Shutoff]

Fuel can be transferred from one tank to another tank using the fuel pumps, fueling valve, defueling valve, and crossfeed valve. AC power must be available.

Note: Before transferring fuel, ensure that the associated FUEL PUMP LOW PRESSURE lights are operating.

[AD 2002-19-52 and AD 2002-24-51]

[Passenger Airplanes]

CAUTION: Transferring fuel with passengers onboard is prohibited.

[Alternate Method of Compliance (AMOC) to AD 2002-24-51]

[Passenger Airplanes]

CAUTION: Transferring fuel with passengers onboard is prohibited, unless the fuel quantity in the tank from which fuel is being taken is maintained at or above 2000 pounds/900 kilograms.

[Alternate Method of Compliance (AMOC) to AD 2001-08-24 and AD 2002-24-51 for Airplanes with Master Caution System Logic Change and Automatic Shutoff]

[Passenger Airplanes]

CAUTION: Transferring fuel with passengers onboard is prohibited, unless the fuel quantity in the tank from which fuel is being taken is maintained at or above 2000 pounds/900 kilograms.

To transfer fuel from the main tanks to the center tank:

Main tank fuel pump switches ....ON

Crossfeed selector ....Open

Manual defueling valve ....Open

Center tank fueling valve switch ....OPEN

Fuel transfer .... Monitor

The center tank fuel quantity indicator shows an increase in fuel. The main tank indicators show a decrease in fuel.

When a FUEL PUMP LOW PRESSURE light illuminates, turn OFF the associated fuel pump.

When the required amount of fuel has been transferred:

Center tank fueling valve switch ....CLOSED

Manual defueling valve ....Close

Crossfeed selector ....Close

Main tank fuel pump switches .... OFF

Main Tanks ....Refill

Refueling panel and defuel panel access doors ....Close

Fuel Crossfeed Valve Check

Crossfeed selector ....Open

Verify crossfeed VALVE OPEN light illuminates bright and then dim.

Crossfeed selector ....Close

Verify crossfeed VALVE OPEN light illuminates bright and then extinguishes.

Ground Proximity Warning System (GPWS) and Runway Awareness and Advisory System (RAAS) Test

[Option - With Runway Awareness and Advisory System]

Verify IRS alignment is complete.

Verify that the guards are closed for all GROUND PROXIMITY INHIBIT switches.

Ground proximity SYS TEST switch .... Push momentarily

Verify the following:

- BELOW G/S and GPWS INOP lights illuminate
- TERR FAIL and TERR TEST annunciations show on navigation displays
- PULL UP and WINDSHEAR alerts illuminate
- “GLIDESLOPE”, “PULL UP” and “WINDSHEAR” aurals sound
- “TERRAIN TERRAIN PULLUP" aural sounds
- terrain display test pattern shows on navigation displays
- TERRAIN caution message shows on navigation displays

[Option - Peaks and Obstacles]
- "OBSTACLE OBSTACLE PULLUP" aural sounds

During the test the RUNWAY INOP light illuminates and one of the following aurals announces the status of the RAAS System:

- "RUNWAY AWARENESS OK - FEET/METERS" (as installed)
- "RUNWAY AWARENESS NOT AVAILABLE"
- "RUNWAY AWARENESS INOP"

[Option - Airspeed Low]
Verify the following:

- "AIRSPEED LOW" aural sounds

Note: If the test switch is held until the aurals begin, additional GPWS aural warnings are tested.

Ground Proximity Warning System (GPWS), Overrun Warning (ORW) System, and Runway Awareness and Advisory System (RAAS) Test

[Option - GPWS, RAAS, and ORW]

Verify IRS alignment is complete.

Verify that the guards are closed for all GROUND PROXIMITY INHIBIT switches.

Ground proximity SYS TEST switch .... Push momentarily

Verify the following:

- BELOW G/S and GPWS INOP lights illuminate
- TERR FAIL and TERR TEST annunciations show on navigation displays
- PULL UP and WINDSHEAR alerts illuminate
- “GLIDESLOPE”, “PULL UP” and “WINDSHEAR” aurals sound
- “TERRAIN TERRAIN PULLUP" aural sounds
- terrain display test pattern shows on navigation displays
- TERRAIN caution message shows on navigation displays

  [Option - Peaks and Obstacles]
- "OBSTACLE OBSTACLE PULLUP" aural sounds

During the test the RUNWAY INOP light illuminates and one of the following aurals announces the status of the ORW and RAAS System:

- "RUNWAY AWARENESS OK - FEET/METERS" (as installed)
- "RUNWAY AWARENESS NOT AVAILABLE"
- "RUNWAY AWARENESS INOP"

[Option - Airspeed Low]
Verify the following:

- "AIRSPEED LOW" aural sounds

Note: If the test switch is held until the aurals begin, additional GPWS aural warnings are tested.

Runway Awareness and Advisory System (RAAS) Inhibit Operation

[Option - With Runway Awareness and Advisory System]

If one or more of the following exist:

- The airport or runway is not in the GPWS database
- A NOTAM applies to the intended runway
- Airline policy prohibits the use of RAAS for an airport or runway.

RUNWAY INHIBIT switch .... INHIBIT

Note: If the RUNWAY INHIBIT switch is in the INHIBIT position and the airspeed is 250 knots or greater for 60 seconds or more, the RUNWAY INOP light illuminates. The RUNWAY INOP light extinguishes when airspeed is below 250 knots.

After takeoff, if RAAS use is allowed at the destination:

RUNWAY INHIBIT switch .... NORM

Overrun Warning (ORW) System, and Runway Awareness and Advisory System (RAAS) Inhibit Operation

[Option - ORW and RAAS]

Before departure if one or more of the following exist:

- The airport or runway is not in the GPWS database
- A NOTAM applies to the intended runway
- Airline policy prohibits the use of RAAS for an airport or runway.

RUNWAY INHIBIT switch .... INHIBIT

Note: If the RUNWAY INHIBIT switch is in the INHIBIT position, and the airspeed is 250 knots or greater for 60 seconds or more, the RUNWAY INOP light illuminates. The RUNWAY INOP light extinguishes when airspeed is below 250 knots.

After takeoff:

RUNWAY INHIBIT switch .... NORM

Before approach if one or more of the following exist or are planned:

- The airport is not in the GPWS database
- A NOTAM applies to the intended runway
- Airline policy prohibits the use of ORW for an airport or runway
- Conducting Land and Hold Short Operations (LAHSO)
- Conducting Touch and Go landings
- Landing altitude is above 10,000 feet pressure altitude
- Landing OAT on the ground is below -40°C or greater than +50°C
- Gross weight is greater than maximum landing weight
- (TALPA) On a dry runway, when the calculated landing distance is based on MAX MANUAL performance data, and the calculated landing distance is within 1,000 feet/305 meters of the landing distance available
- (Non-TALPA) For any runway, when the calculated landing distance is based on MAX MANUAL performance data, and the calculated landing distance is within 2,000 feet/610 meters of the landing distance available.

RUNWAY INHIBIT switch .... INHIBIT

Note: If the RUNWAY INHIBIT switch is in the INHIBIT position, and the airspeed is 250 knots or greater for 60 seconds or more, the RUNWAY INOP light illuminates. The RUNWAY INOP light extinguishes when airspeed is below 250 knots.

Introduction

Airplane operation in adverse weather conditions may require additional considerations due to the effects of extreme temperatures, precipitation, turbulence and windshear. Procedures in this section supplement normal procedures and should be observed when applicable.

Takeoff - Wet or Contaminated Runway Conditions

The following information applies to takeoffs on wet or contaminated runways:

- For wet runways, reduced thrust (fixed derate, assumed temperature method, or both) is allowed provided suitable takeoff performance accountability is made for the increased stopping distance on a wet surface
- For runways contaminated by slush, snow, standing water, or ice, reduced thrust (fixed derate) is allowed provided takeoff performance accounts for the runway surface condition. Reduced thrust using assumed temperature method, whether alone or in combination with a fixed derate, is not allowed
- V1 may be reduced to minimum V1 to provide increased stopping margin provided the field length required for a continued takeoff from the minimum V1 and obstacle clearance meet the regulatory requirements. The determination of such minimum V1 may require a real-time performance calculation tool or other performance information supplied by dispatch
- Takeoffs are not recommended when slush, wet snow, or standing water depth is more than 1/2 inch (13 mm) or dry snow depth is more than 4 inches (102 mm).

Cold Weather Operations

Considerations associated with cold weather operation are primarily concerned with low temperatures and with ice, snow, slush and standing water on the airplane, ramps, taxiways, and runways.

Icing conditions exist when OAT (on the ground) or TAT (in flight) is 10°C or below and any of the following exist:

- visible moisture (clouds, fog with visibility of one statute mile (1600m) or less, rain, snow, sleet, ice crystals, and so on) is present, or
- ice, snow, slush or standing water is present on the ramps, taxiways, or runways.

CAUTION: Do not use engine or wing anti–ice when OAT (on the ground) or TAT (in flight) is above 10°C.

Exterior Inspection

Although removal of surface snow, ice and frost is normally a maintenance function, during preflight procedures, the captain or first officer should carefully inspect areas where surface snow, ice or frost could change or affect normal system operations.

Do the normal Exterior Inspection with the following additional steps:

Surfaces .... Check

[Option - With Blended Winglets]

Takeoff with light coatings of frost, up to 1/8 inch (3 mm) in thickness, on lower wing surfaces due to cold fuel is allowable; however, all leading edge devices, all control surfaces, tab surfaces, upper wing surfaces, winglet surfaces and control surface balance panel cavities must be free of snow, ice and frost.

[Option - Without Blended Winglets]

Takeoff with light coatings of frost, up to 1/8 inch (3 mm) in thickness, on lower wing surfaces due to cold fuel is allowable; however, all leading edge devices, all control surfaces, tab surfaces, upper wing surfaces and control surface balance panel cavities must be free of snow, ice and frost.

Thin hoarfrost is acceptable on the upper surface of the fuselage provided all vents and ports are clear. Thin hoarfrost is a uniform white deposit of fine crystalline texture, which usually occurs on exposed surfaces on a cold and cloudless night, and which is thin enough to distinguish surface features underneath, such as paint lines, markings or lettering.

Control surface balance panel cavities .... Check

Check drainage after snow removal. Puddled water may freeze in flight.

Pitot probes and static ports .... Check

Verify that all pitot probes and static ports free of snow and ice. Water rundown after snow removal may freeze immediately forward of static ports and cause an ice buildup which disturbs airflow over the static ports resulting in erroneous static readings even when static ports are clear.

Air conditioning inlets and exits .... Check

Verify that the air inlets and exits, including the outflow valve, are free of snow and ice.

If the APU is operating, verify that the outflow valve is fully open.

Engine inlets .... Check

Verify that the inlet cowling is free of snow and ice.

Verify that the fan is free to rotate.

Snow or ice that accumulates on the fan spinner or fan blades during extended shutdown periods must be removed by maintenance or other means before engine start.

Snow or ice that accumulates on the fan spinner or fan blades as a result of operation in icing conditions, such as during approach or taxi in, is allowed if the fan is free to rotate and the snow or ice is removed using the ice shedding procedure during taxi out and before setting takeoff thrust.

Fuel tank vents .... Check

Verify all traces of ice and frost are removed.

Landing gear doors .... Check

Landing gear doors should be free of snow and ice.

APU air inlets .... Check

The APU inlet door and cooling air inlet must be free of snow and ice before APU start.

Preflight Procedure - First Officer

Do the following step after completing the normal Preflight Procedure - First Officer:

PROBE HEAT switches .... ON

Verify that all probe heat lights are extinguished.

Engine Start Procedure

Do the normal Engine Start Procedure with the following modifications:

- If the engine has been cold soaked for one or more hours at ambient temperatures below -40°C, do not start or motor the engine. Maintenance personnel should do appropriate procedures for adverse weather heating of the Hydro-Mechanical Unit.
- If the engine has been cold soaked for three or more hours at ambient temperatures below -40°C, do not start or motor the engine. Maintenance personnel should do appropriate procedures for adverse weather starter servicing.
- If ambient temperature is below -35°C, idle the engine for two minutes before changing thrust lever position.
- Several minutes may be needed for oil pressure to reach the normal operating pressure. During this period, oil pressure may go above the normal range and the OIL FILTER BYPASS light may illuminate. Operate the engine at idle thrust until oil pressure returns to the normal range.
- If the oil pressure remains above the normal range after the oil temperature has stabilized within limits, shut down the engine.
- Display units may require additional warm-up time before displayed engine indications accurately show changing values. Display units may appear less bright than normal.

Engine Anti-ice Operation - On the Ground

Engine anti-ice must be selected ON immediately after both engines are started and remain on during all ground operations when icing conditions exist or are anticipated.

WARNING: Do not rely on airframe visual icing cues before activating engine anti-ice. Use the temperature and visible moisture criteria because late activation of engine anti-ice may allow excessive ingestion of ice and result in engine damage or failure.

CAUTION: Do not use engine anti-ice when OAT is above 10°C.

When engine anti-ice is needed:

[Without automatic ignition]
ENGINE START switches .... CONT F/O

ENGINE ANTI-ICE switches .... ON F/O

Verify that the COWL VALVE OPEN lights illuminate bright, then dim.

Verify that the COWL ANTI-ICE lights are extinguished.

Note: If the COWL VALVE OPEN lights remain illuminated bright with engines at IDLE, do the following:

- verify APU BLEED air switch is in the OFF position,
- verify ISOLATION VALVE switch is in the AUTO position,
- check that the area around the airplane is clear, and
- increase thrust slightly (up to a maximum of 30% N1).

When engine anti-ice is no longer needed:

ENGINE ANTI-ICE switches .... OFF F/O

Verify that the COWL VALVE OPEN lights illuminate bright, then extinguish.

Wing Anti-ice Operation - On the Ground

Use wing anti-ice during all ground operations between engine start and takeoff when icing conditions exist or are anticipated, unless the airplane is, or will be protected by the application of Type II or Type IV fluid in compliance with an approved ground de-icing program.

WARNING: Do not use wing anti-ice as an alternative for ground de-icing/anti-icing. Close inspection is still needed to ensure that no frost, snow or ice is adhering to the wing, leading edge devices, stabilizer, control surfaces or other critical airplane components at takeoff.

CAUTION: Do not use wing anti-ice when OAT is above 10°C.

When wing anti-ice is needed:

WING ANTI-ICE switch .... ON F/O

Verify that the L and R VALVE OPEN lights illuminate bright, then dim.

Note: The wing anti-ice VALVE OPEN lights may cycle bright/dim due to the control valves cycling closed/open in response to thrust setting and duct temperature logic.

When wing anti-ice is no longer needed:

WING ANTI-ICE switch .... OFF F/O

Verify that the L and R VALVE OPEN lights illuminate bright, then extinguish.

Before Taxi Procedure

Do the normal Before Taxi Procedure with the following modifications:

GENERATOR 1 and 2 switches .... ON F/O

Normally the IDG's stabilize within one minute, although due to cold oil, up to five minutes can be needed to produce steady power.

If there is snow or ice accumulation on the wing, consider delaying the flight control check until after de-icing/anti-icing is accomplished.

Flight controls .... Check C

An increase in control forces can be expected at low temperatures.

CAUTION: The flap position indicator and the leading edge devices annunciator panel should be closely observed for positive movement. If the flaps should stop, the flap lever should be placed immediately in the same position as indicated.

Flaps .... Check F/O

Move the flaps from Flaps up to Flaps 40 back to Flaps up (i.e., full travel) to ensure freedom of movement.

If taxi route is through ice, snow, slush or standing water in low temperatures or if precipitation is falling with temperatures below freezing, taxi out with the flaps up. Taxiing with the flaps extended subjects the flaps and flap drives to contamination. Leading edge devices are also susceptible to slush accumulations.

Call "FLAPS ___" as needed. C

Flap lever... Set flaps, as needed F/O

Taxi–Out

CAUTION: Taxi at a reduced speed. Use smaller nose wheel steering wheel and rudder inputs and apply minimum thrust smoothly. Differential thrust may be used to help maintain airplane momentum during turns. At all other times, apply thrust evenly. Taxiing on slippery taxiways or runways at excessive speed or with high crosswinds may start a skid.

CAUTION: When operating the engines over significant amounts of standing de-icing or anti-icing fluid, limit thrust to the minimum required. Excessive ingestion of de-icing or anti-icing fluid can cause the fluid to build up on the engine compressor blades resulting in compressor stalls and engine surges.

When engine anti-ice is required and the OAT is 3°C or below, an engine run up is recommended to minimize ice build-up. Use the following procedure:

Check that the area behind the airplane is clear.	PF
Run-up to a minimum of 70% N1 for approximately 30 seconds duration at intervals no greater than 30 minutes.	PF

Note: Fan blade ice build-up is cumulative. If the fan spinner and fan blades were not deiced prior to taxi out, the time the engines were operating during the taxi in should be included in the 30 minute interval.

If airport surface conditions and the concentration of aircraft do not allow the engine thrust level to be increased to 70% N1, then set a thrust level as high as practical and time at that thrust level.	PF

Note: When operating in conditions of freezing rain, freezing drizzle, freezing fog or heavy snow, run-ups to a minimum of 70% N1 for approximately 1 second duration at intervals no greater than 10 minutes enhance ice shedding.

De-icing/Anti-icing

Testing of undiluted de-icing/anti-icing fluids has shown that some of the fluid remains on the wing during takeoff rotation and initial climb. The residual fluid causes a temporary decrease in lift and increase in drag, however, the effects are temporary. Use the normal takeoff rotation rate.

CAUTION: Operate the APU during de-icing only if necessary. If the APU is running, ingestion of de-icing fluid causes objectionable fumes and odors to enter the airplane. Ingestion of snow, slush, ice, or de-icing/anti-icing fluid can also cause damage to the APU.

If de-icing/anti-icing is needed:

APU .... As needed F/O

The APU should be shut down unless APU operation is necessary.

Call "FLAPS UP". C

Flaps .... UP F/O

Prevents ice and slush from accumulating in flap cavities during de-icing.

Thrust levers .... Idle C

Reduces the possibility of injury to personnel at inlet or exhaust areas.

WARNING: Ensure that the stabilizer trim wheel handles are stowed before using electric trim to avoid personal injury.

Stabilizer trim .... ___ UNITS C

Set the trim for takeoff.

Verify that the trim is in the green band.

Engine BLEED air switches .... OFF F/O

Reduces the possibility of fumes entering the air conditioning system.

APU BLEED air switch .... OFF F/O

Reduces the possibility of fumes entering the air conditioning system.

After de-icing/anti-icing is completed:

APU .... As needed F/O

CAUTION: After de-icing, the use of APU bleed air during takeoff can cause smoke in the airplane.

APU BLEED air switch .... As needed F/O

Wait approximately one minute after de-icing is completed to turn engine BLEED air switches on to ensure all de-icing fluid has been cleared from the engines:

Engine BLEED air switches .... ON F/O

Flight controls ....Check, as needed C

An increase in control forces can be expected at low temperatures.

[Without PRR 38506 or Service Bulletin 737-55A-1080]
Control column ....Move full forward/full aft C

Slowly cycle the control column full forward to full aft a minimum of 3 times to drain residual fluid from the elevator balance bay.

Before Takeoff Procedure

Do the normal Before Takeoff Procedure with the following modifications:

Call “FLAPS ___” as needed for takeoff. PF

Flap lever .... Set takeoff flaps, as needed PM

Extend the flaps to the takeoff setting at this time if they have been held because of slush, or standing water, or icing conditions, or because of exterior de-icing/anti-icing.

Verify that the LE FLAPS EXT green light is illuminated.

Takeoff Procedure

Do the normal Takeoff Procedure with the following modification:

When engine anti-ice is required and the OAT is 3°C or below, the takeoff must be preceded by a static engine run-up. Use the following procedure:

Run-up to a minimum of 70% N1 and confirm stable engine operation before the start of the takeoff roll. A 30-second run-up is highly recommended whenever possible.

Engine Anti-Ice Operation - In Flight

Engine anti–ice must be ON during all flight operations when icing conditions exist or are anticipated, except during climb and cruise when the temperature is below -40°C SAT. Engine anti–ice must be ON before, and during descent in all icing conditions, including temperatures below -40°C SAT.

When operating in areas of possible icing, activate engine anti–ice before entering icing conditions.

[Option - Without Icing Advisory Light]

WARNING: Do not rely on airframe visual icing cues before activating engine anti–ice. Use the temperature and visible moisture criteria because late activation of engine anti-ice may allow excessive ingestion of ice and result in engine damage or failure.

[Option - With Icing Advisory Light]

WARNING: Do not rely on airframe visual icing cues or illumination of the ICING light before activating engine anti–ice. Use the temperature and visible moisture criteria because late activation of engine anti-ice may allow excessive ingestion of ice and result in engine damage or failure.

CAUTION: Do not use engine anti-ice when TAT is above 10°C

When engine anti-ice is needed:

[Without automatic ignition]
ENGINE START switches .... CONT PM

ENGINE ANTI-ICE switches .... ON PM

Verify that the COWL VALVE OPEN lights illuminate bright, then dim.

Verify that the COWL ANTI-ICE lights are extinguished.

Note: If the COWL VALVE OPEN lights remain illuminated bright with engines at IDLE, do the following:.

- verify APU BLEED air switch is in the OFF position,
- verify ISOLATION VALVE switch is in the AUTO position, and
- increase thrust slightly (up to a minimum of 30% N1).

When engine anti-ice is no longer needed:

ENGINE ANTI-ICE switches ....OFF PM

Verify that the COWL VALVE OPEN lights illuminate bright, then extinguish.

[Without automatic ignition]
ENGINE START switches ....OFF PM

Fan Ice Removal

CAUTION: Avoid prolonged operation in moderate to severe icing conditions.

Prolonged operation in moderate to severe icing conditions can lead to fan blade/spinner icing and engine vibration. Severe icing can usually be avoided by a change in altitude and/or airspeed. If flight in moderate to severe icing conditions cannot be avoided, do the following on both engines, one engine at a time:

Note: Engine vibration can reduce to a low level before 80% N1 is reached, however, thrust increase must continue to a minimum of 80% N1 to remove ice from the fan blades.

Note: Engine vibration can indicate full scale before shedding ice, however, this has no adverse effect on the engine.

ENGINE START switches (both) .... FLT PM

Autothrottle (if engaged) ....Disengage PF

Thrust .... Increase PF

Increase thrust to a minimum of 80% N1 for approximately 1 second to ensure the fan blades and spinner are clear of ice.

Thrust .... Reduce as needed for flight conditions PF

Wait 15 seconds. This allows engine vibration level to stabilize.

If engine vibration is less than 4.0 units after thrust is reduced, repeat the above steps at approximately 15 minute intervals or sooner as needed.

Autothrottle (if needed) ....Engage PF

If engine vibration is 4.0 units or greater after thrust is reduced, do the Engine High Vibration non-normal checklist.

Wing Anti-ice Operation - In Flight

Ice accumulation on the flight deck window frames, windshield center post, or on the windshield wiper arm may be used as an indication of structural icing conditions and the need to turn on wing anti-ice.

In flight, the wing anti-ice system may be used as a de-icer or as an anti-icer. The primary method is to use it as a de-icer by allowing ice to accumulate before turning wing anti-ice on. This procedure provides the cleanest airfoil surface, the least possible runback ice formation, and the least thrust and fuel penalty. Normally it is not necessary to shed ice periodically unless extended flight through icing conditions is necessary (holding).

The secondary method is to use wing anti-ice before ice accumulation. Operate the wing anti-ice system as an anti-icer only during extended operations in moderate or severe icing conditions, such as holding.

CAUTION: Do not use wing anti-ice when TAT is above 10°C.

CAUTION: Use of wing anti-ice above approximately FL350 may cause bleed trip off and possible loss of cabin pressure.

Note: Prolonged operation in icing conditions with the leading edge and trailing edge flaps extended is not recommended. Holding in icing conditions with flaps extended is prohibited.

When wing anti-ice is needed:

WING ANTI-ICE switch .... ON PM

Verify that the L and R VALVE OPEN lights illuminate bright, then dim.

When wing anti-ice is no longer needed:

WING ANTI-ICE switch ....OFF PM

Verify that the L and R VALVE OPEN lights illuminate bright, then extinguish.

Cold Temperature Altitude Corrections

Extremely low temperatures create significant altimeter errors and greater potential for reduced terrain clearance. When the temperature is colder than ISA, true altitude will be lower than indicated altitude. Altimeter errors become significantly larger when the surface temperature approaches -30°C or colder, and also become larger with increasing height above the altimeter reference source.

[Option - Temperature Compensation Available with U14 and newer]
For additional information on temperature corrections to approach altitudes refer to Temperature Compensation for Approach Altitudes in Supplementary Procedure (SP 11).

Apply the altitude correction table when needed:

- apply corrections to all published minimum departure, en route and approach altitudes, including missed approach altitudes, according to the table below. Advise ATC of the corrections
- MDA/DA settings should be set at the corrected minimum altitudes for the approach
- corrections apply to QNH and QFE operations.

To determine the correction from the Altitude Correction Table:

- subtract the elevation of the altimeter barometric reference setting source (normally the departure or destination airport elevation) from the published minimum altitude to be flown to determine “height above altimeter reference source”
- enter the table with Airport Temperature and with “height above altimeter reference source”. Read the correction where these two entries intersect. Add the correction to the published minimum altitude to be flown to determine the corrected indicated altitude to be flown. To correct an altitude above the altitude in the last column, use linear extrapolation (e.g., to correct 6000 feet or 1800 meters, use twice the correction for 3000 feet or 900 meters, respectively.) The corrected altitude must always be greater than the published minimum altitude
- if the corrected indicated altitude to be flown is between 100 foot increments, set the MCP altitude to the closest 100 foot increment above the corrected indicated altitude to be flown.
- do not correct altimeter barometric reference settings.

An altitude correction due to cold temperature is not needed for the following conditions:

- While under ATC radar vectors
- When maintaining an ATC assigned flight level (FL)
- When the reported airport temperature is above 0°C or if the airport temperature is at or above the minimum published temperature for the procedure being flown.

Note: Regulatory authorities may have other requirements for cold temperature altitude corrections.

Altitude Correction Table (Heights and Altitudes in Feet)

Airport Temp °C	Height Above Altimeter Reference Source											
	200 feet	300 feet	400 feet	500 feet	600 feet	700 feet	800 feet	900 feet	1000 feet	1500 feet	2000 feet	3000 feet
0°	20	20	30	30	40	40	50	50	60	90	120	170
-10°	20	30	40	50	60	70	80	90	100	150	200	290
-20°	30	50	60	70	90	100	120	130	140	210	280	420
-30°	40	60	80	100	120	140	150	170	190	280	380	570
-40°	50	80	100	120	150	170	190	220	240	360	480	720
-50°	60	90	120	150	180	210	240	270	300	450	590	890

Altitude Correction Table (Heights and Altitudes in Meters)

Airport Temp °C	Height Above Altimeter Reference Source											
	60 m	90 m	120 m	150 m	180 m	210 m	240 m	270 m	300 m	450 m	600 m	900 m
0°	5	5	10	10	10	15	15	15	20	25	35	50
-10°	10	10	15	15	20	20	25	30	30	45	60	90
-20°	10	15	20	25	25	30	35	40	45	65	85	130
-30°	15	20	25	30	35	40	45	55	60	85	115	170
-40°	15	25	30	40	45	50	60	65	75	110	145	220
-50°	20	30	40	45	55	65	75	80	90	135	180	270

Approach and Landing

Use normal procedures and reference speeds.

After Landing Procedure

CAUTION: Taxi at a reduced speed. Use smaller nose wheel steering wheel and rudder inputs and apply minimum thrust smoothly. Differential thrust may be used to help maintain airplane momentum during turns. At all other times, apply thrust evenly. Taxiing on slippery taxiways or runways at excessive speed or with high crosswinds may start a skid.

CAUTION: When operating the engines over significant amounts of standing de-icing or anti-icing fluid, limit thrust to the minimum required. Excessive ingestion of de-icing or anti-icing fluid can cause the fluid to build up on the engine compressor blades resulting in compressor stalls and engine surges.

Do the normal After Landing Procedure with the following modifications:

After prolonged operation in icing conditions with the flaps extended, or when an accumulation of airframe ice is observed, or when operating on a runway or taxiway contaminated with ice, snow, slush or standing water:

Do not retract the flaps to less than flaps 15 until the flap areas have been checked to be free of contaminants.

Engine anti-ice must be selected ON and remain on during all ground operations when icing conditions exist or are anticipated.

WARNING: Do not rely on airframe visual icing cues before activating engine anti-ice. Use the temperature and visible moisture criteria because late activation of engine anti-ice may allow excessive ingestion of ice and result in engine damage or failure.

CAUTION: Do not use engine anti-ice when OAT is above 10°C.

When engine anti-ice is needed:

[Without automatic ignition]
ENGINE START switches .... CONT PM

ENGINE ANTI-ICE switches .... ON PM

Verify that the COWL VALVE OPEN lights illuminate bright, then dim.

Verify that the COWL ANTI-ICE lights are extinguished.

Note: If the COWL VALVE OPEN lights remain illuminated bright with engines at IDLE, do the following:

- verify APU BLEED air switch is in the OFF position,
- verify ISOLATION VALVE switch is in the AUTO position, and
- increase thrust slightly (up to a maximum of 30% N1).

When engine anti-ice is no longer needed:

ENGINE ANTI-ICE switches .... OFF PM

Verify that the COWL VALVE OPEN lights illuminate bright, then extinguish.

[Without automatic ignition]
ENGINE START switches .... OFF PM

When engine anti-ice is required and the OAT is 3°C or below, an engine run up is recommended to minimize ice build-up. Use the following procedure: PF

Check that the area behind the airplane is clear.

Run-up to a minimum of 70% N1 for approximately 30 seconds duration at intervals no greater than 30 minutes.

If airport surface conditions and the concentration of aircraft do not allow the engine thrust level to be increased to 70% N1, then set a thrust level as high as practical and time at that thrust level.

Note: When operating in conditions of freezing rain, freezing drizzle, freezing fog or heavy snow, run-ups to a minimum of 70% N1 for approximately 1 second duration at intervals no greater than 10 minutes should be considered.

Shutdown Procedure

Do the following step before starting the normal Shutdown Procedure:

After landing in icing conditions:

WARNING: Ensure that the stabilizer trim wheel handles are stowed before using electric trim to avoid personal injury.

Stabilizer trim .... Set 5 units C

Prevents melting snow and ice from running into the tailcone. Excessive water in the tailcone can freeze and lock controls.

Secure Procedure

Do the normal Secure Procedure with the following modifications:

If the airplane will be attended and warm air circulation throughout the cargo E/E compartments is desired:

CAUTION: Do not leave the interior unattended with a pack operating and all doors closed. With the airplane in this configuration, accidental closure of the main outflow valve can cause unscheduled pressurization of the airplane.

APU	Start	F/O
APU GENERATOR bus switches	ON	F/O
PACK switches	AUTO	F/O
ISOLATION VALVE switch	OPEN	F/O
Pressurization mode selector	MAN	F/O
Outflow valve switch	OPEN	F/O

Prevents aircraft pressurization.

Note: The airplane must be parked into the wind when the outflow valve is full open.

APU BLEED air switch	ON	F/O

If the airplane will not be attended, or if staying overnight at off-line stations or at airports where normal support is not available, the flight crew must arrange for or verify that the following steps are done:

Pressurization mode selector	MAN	F/O
Outflow valve	CLOSE	F/O

Position the outflow valve fully closed to inhibit the intake of snow or ice.

Wheel chocks	Verify in place	C or F/O
Parking brake	Released	C

Reduces the possibility of frozen brakes.

Cold weather maintenance procedures for securing the airplane may be required. These procedures are normally done by maintenance personnel, and include, but are not limited to:

- protective covers and plugs installed
- water storage containers drained
- toilets drained
- doors and sliding windows closed

[Option - Single battery]

- battery removed. If the battery will be exposed to temperatures below -18°C, the battery should be removed and stored in an area warmer than -18°C, but below 40°C. Subsequent installation of the warm battery ensures the starting capability of the APU.

[Option - Dual battery]

- batteries removed. If the batteries will be exposed to temperatures below -18°C, the batteries should be removed and stored in an area warmer than -18°C, but below 40°C. Subsequent installation of the warm batteries ensures the starting capability of the APU.

Hot Weather Operation

During ground operation the following considerations will help keep the airplane as cool as possible:

- While the airplane is electrically powered, packs should be run or cooling air supplied to the airplane when the OAT exceeds 40° C (103° F) to protect the reliability of electrical and electronic equipment in the airplane.
- If cooling air is available from an outside source, the supply should be plugged in immediately after engine shutdown and should not be removed until just prior to engine start.
- Keep all doors and windows, including cargo doors, closed as much as possible.
- Electronic components which contribute to a high temperature level in the flight deck should be turned off while not needed.

[Passenger Airplanes]

- Open all passenger cabin gasper outlets and close all window shades on the sun–exposed side of the passenger cabin.

Note: If only cooling air from a ground air conditioning cart is supplied (no pressurized air from the APU or ground external air), then the TAT probes are not aspirated. Because of high TAT probe temperatures, the FMC’s may not accept an assumed temperature derate. Delay selecting an assumed temperature derate until after bleed air is available.

If these actions do not reduce cabin temperatures sufficiently:

PASSENGER CABIN temperature selector .... AUTO COOL

PACK switches .... HIGH

[737-600/700]
If the cabin temperature remains high:

PASSENGER CABIN temperature selector ....MAN COOL

After engine start with the engines at ground idle, the pneumatic pressure available to the bleed air system may not be sufficient to provide adequate cooling during extended ground operations. Use of APU bleed air instead of engine bleed air to supply the packs while on the ground can significantly increase cabin cooling. If additional cooling is needed during extended ground operations:

Engine BLEED 1 air switch .... OFF

Engine BLEED 2 air switch .... OFF

ISOLATION VALVE switch .... OPEN

APU BLEED air switch ....ON

PACK switches .... HIGH

Temperature selectors ....AUTO COOL

Prior to takeoff:

PACK switches .... AUTO

Engine BLEED 2 air switch ....ON

APU BLEED air switch .... OFF

Engine BLEED 1 air switch ....ON

ISOLATION VALVE switch .... AUTO

Temperature selectors ....As needed

Brake temperature levels may be reached which can cause the wheel fuse plugs to melt and deflate the tires. Consider the following actions:

- Be aware of brake temperature buildup when operating a series of short flight sectors. The energy absorbed by the brakes from each landing is accumulative
- Extending the landing gear early during the approach provides additional cooling for tires and brakes.
- In–flight cooling time can be determined from the “Brake Cooling Schedule” in the Performance–Inflight section of the QRH.

During flight planning consider the following:

- High temperatures inflict performance penalties which must be taken into account on the ground before takeoff
- Alternate takeoff procedures (No Engine Bleed Takeoff, Improved Climb Performance, etc.)

Moderate to Heavy Rain, Hail or Sleet

Flights should be conducted to avoid thunderstorm or hail activity. If visible moisture is present at high altitude, avoid flight over the storm cell. (Storm cells that do not produce visible moisture at high altitude can be overflown safely.) To the maximum extent possible, moderate to heavy rain, hail or sleet should also be avoided.

If moderate to heavy rain, hail or sleet is encountered or anticipated:

ENGINE START switches .... CONT

Autothrottle .... Disengage

Thrust Levers .... Adjust Slowly

If thrust changes are necessary, move the thrust levers slowly. Avoid changing thrust lever direction until engines have stabilized at a selected setting. Maintain an increased minimum thrust setting.

IAS/MACH .... Use a slower speed

Using a slower speed improves engine tolerance to heavy precipitation intake.

Consider starting the APU (if available).

Operation in a Sandy or Dusty Environment

The main hazards of a sandy or dusty environment are erosion (especially of engine fan blades), accumulation of sand or dust on critical surfaces and blockage. The effects of sand ingestion occur predominantly during takeoff, landing and taxi operations. The adverse effects, however, can occur if the airplane’s flight path was through a cloud of visible sand or dust or the airplane was parked during a sand or dust storm. Premature engine deterioration can result from sand or dust ingestion, causing increased fuel burn and reduced EGT margins.

CAUTION: After a sandstorm, if all taxiways and runways are not carefully inspected and swept for debris before flight ops are conducted, the risk of engine damage and wear is increased.

Exterior Inspection

Although removal of sand and dust contaminants is primarily a maintenance function, during the exterior inspection the captain or first officer should carefully inspect areas where accumulation of sand or dust could change or affect normal system operations.

Do the normal Exterior Inspection with the following additional steps:

Windshield .... Check

Verify that the windshield has been cleaned.

Note: Do not use windshield wipers for sand or dust removal. Wash deposits off with water and wipe residue off with a soft cloth.

Surfaces .... Check

Verify that the upper surfaces of the wings and other control surfaces are free of sand.

CAUTION: Particular care should be taken to ensure that the fuselage and all surfaces are clean after a sand storm that occurs with a rain storm.

Probes, sensors, ports, ram turbine doors,
vents, and drains (as applicable) .... Check

Verify that the left and right ram air inlets are free of sand and dust. Verify that the cabin pressure outflow valve and both positive pressure relief valves are free of sand and dust.

Leading edge flaps .... Check

Verify that all leading edges are undamaged.

Engine inlets .... Check

Verify that the inlet cowling is free of sand and dust.

Verify that the fan is free to rotate and fan blades are undamaged.

Fuel tank vents .... Check

Verify that all vents are free of sand and dust.

Landing gear .... Check

Verify that gear struts and doors are free of sand and dust build-up.

Vertical and horizontal stabilizers .... Check

Verify that all leading edges are undamaged.

APU air inlets .... Check

Ensure that the APU inlet door and cooling air inlet are free of sand and dust before APU start.

Preflight Procedure - First Officer

Do the normal Preflight Procedure - First Officer with the following modifications:

Note: Minimize the use of air conditioning, other than from a ground air conditioner, as much as possible. If the APU must be used for air conditioning, maintain a temperature as high as possible while still providing a tolerable flight deck and cabin environment.

APU BLEED air switch .... OFF F/O

If APU bleed air will be used and the APU is not operating:

APU switch .... START F/O

Note: Run the APU for two full minutes before using it as a bleed air source.

Engine BLEED air switches .... OFF F/O

APU BLEED air switch .... ON F/O

Engine Start Procedure

Do the normal Engine Start Procedure with the following modifications:

Note: Use a filtered ground cart for pneumatic air for engine start, if available.

ENGINE START switch .... GRD F/O

Verify that the N2 RPM increases. C, F/O

Motor the engine for 2 minutes to help remove contaminants.

[Option - Fuel Control Switches]

CAUTION: Do not apply rotational force when moving the engine start lever.

Engine start lever .... IDLE detent C

Before Taxi Procedure

Do the normal Before Taxi Procedure with special emphasis on the following steps:

If bleed air is needed to maintain tolerable flight deck and cabin temperatures, use APU bleed air rather than engine bleed air during the taxi out. Limit APU bleed air use as much as possible to reduce sand and dust ingestion.

If APU bleed air will be used and the APU is not operating:

APU switch ....START F/O

Note: Run the APU for two full minutes before using it as a bleed air source.

Engine BLEED air switches .... OFF F/O

APU BLEED air switch .... ON F/O

Flight controls ....Check C

Verify that there is no increase in control forces due to sand or dust contaminants.

Taxi–Out

Do the following, conditions permitting, to minimize sand and dust ingestion by the engines and to improve visibility during taxi:

- Use all engines during taxi and taxi at low speed. Limit ground speed to 10 knots and maintain thrust below 40% N1 whenever possible to avoid creating engine vortices during ground operations.
- Maintain a greater than normal separation from other aircraft while taxiing and avoid the ingestion of another engine's wake.
- Avoid engine overhang of unprepared surfaces.
- In the event of a crosswind during 180° turns, turn away from the wind if possible to minimize sand and dust ingestion.

- Whenever possible, avoid situations that would require the airplane to be brought to a complete stop.
- Avoid excessive braking. The presence of sand or dust will increase brake wear.

Takeoff

Do the following to minimize sand and dust ingestion by the engines during takeoff:

- Use the maximum fixed derate and/or assumed temperature thrust reduction that meets performance requirements.

[Option]
- Avoid the use of "bump thrust".
- Make an No Engine Bleed Takeoff if operations permit. If cabin and flight deck temperatures can be maintained at a tolerable temperature, consider an Unpressurized Takeoff.
- Before takeoff, allow sand and dust to settle if conditions allow.
- Do not take off into a sand or dust cloud.
- Use a rolling takeoff. Whenever possible, avoid setting high thrust at low speed.
- When visible sand and dust exist, consider delaying flap retraction until above the dust cloud, if operations permit.

Approach

Do the following, conditions permitting, to minimize sand and dust ingestion:

- Make an No Engine Bleed Landing if operations permit. If cabin and flight deck temperatures can be maintained at a tolerable temperature, consider an Unpressurized Landing.

Landing

Do the following to minimize sand and dust ingestion by the engines during landing:

- Use autobrakes on landing to help minimize the need for reverse thrust.
- Performance permitting, minimize the use of reverse thrust to prevent ingestion of dust and sand and to prevent reduction of visibility. Reverse thrust is most effective at high speed.

After Landing Procedure

Do the normal After Landing Procedure with the following modifications:

If bleed air is needed to maintain tolerable flight deck and cabin temperatures, use APU bleed air rather than engine bleed air during the taxi in. Limit APU bleed air use as much as possible to reduce sand and dust ingestion.

If APU bleed air will be used and the APU is not operating:

APU switch ....START PM

Note: Run the APU for two full minutes before using it as a bleed air source.

Engine BLEED air switches .... OFF PM

APU BLEED air switch .... ON PM

Taxi-In

Do the following, conditions permitting, to minimize sand and dust ingestion by the engines and to improve visibility during the taxi-in:

- Use all engines and taxi at low speed. Limit ground speed to 10 knots and maintain thrust below 40% N1 whenever possible.
- Maintain a greater than normal separation from other aircraft while taxiing and avoid the ingestion of another engine's wake.
- Avoid engine overhang of unprepared surfaces.
- In the event of a crosswind during 180° turns, turn away from the wind if possible to minimize sand and dust ingestion.
- Whenever possible, avoid situations that would require the airplane to be brought to a complete stop.
- Avoid excessive braking. The presence of sand or dust will increase brake wear.

Secure Procedure

Do the normal Secure Procedure with the following modifications:

CAUTION: Do not leave the interior unattended with a pack operating and all doors closed. With the main outflow valve closed, an unscheduled pressurization of the airplane may occur.

PACK switches ....Verify OFF F/O

Pressurization mode selector ....MAN F/O

Outflow VALVE switch .... CLOSE F/O

Position the outflow valve fully closed to inhibit the intake of sand or dust.

Additional procedures for securing the airplane during sandy or dusty conditions may be needed. These procedures are normally done by maintenance personnel, and include, but are not limited to:

- engine covers installed, if applicable.
- protective covers and plugs installed (streamers should be used to remind personnel to remove before flight).
- doors and sliding windows closed.
- all compartments closed.

Turbulence

During flight in light to moderate turbulence, the autopilot and/or autothrottle may remain engaged unless performance is objectionable. Increased thrust lever activity can be expected when encountering wind, temperature changes and large pressure changes. Brief airspeed excursions of 10 to 15 knots can be expected.

Passenger signs .... ON

[Passenger Airplanes]

Advise passengers to fasten seat belts prior to entering areas of reported or anticipated turbulence. Instruct the cabin crew to check that all passengers' seat belts are fastened.

[Freighter Airplanes]

Advise supernumeraries to fasten seat belts prior to entering areas of reported or anticipated turbulence.

Severe Turbulence

Yaw Damper .... ON

Autothrottle .... Disengage

AUTOPILOT .... CWS

A/P status annunciators display CWS for pitch and roll.

Note: If sustained trimming occurs, disengage the autopilot.

ENGINE START switches .... FLT

Thrust .... Set

Set thrust as needed for the phase of flight. Change thrust setting only if needed to modify an unacceptable speed trend.

PHASE OF FLIGHT	AIRSPEED
CLIMB	280 knots or .76 Mach whichever is lower.
CRUISE	Use FMC recommended thrust settings. If the FMC is inoperative, refer to the Unreliable Airspeed page in the Performance–Inflight section of the QRH for approximate N1 settings that maintain near optimum penetration airspeed.
DESCENT	.76 Mach/280/250 knots whichever is lower. If severe turbulence is encountered at altitudes below 15,000 feet and the airplane gross weight is less than the maximum landing weight, the airplane may be slowed to 250 knots in the clean configuration.

Note: If an approach must be made into an area of severe turbulence, delay flap extension as long as possible. The airplane can withstand higher gust loads in the clean configuration.

Windshear

Windshear is a change of wind speed and/or direction over a short distance along the flight path. Indications of windshear are listed in the Windshear non-normal maneuver in this manual.

Avoidance

The flight crew should search for any clues to the presence of windshear along the intended flight path. Presence of windshear may be indicated by:

- Thunderstorm activity
- Virga (rain that evaporates before reaching the ground)
- Pilot reports
- Low level windshear alerting system (LLWAS) warnings.

Stay clear of thunderstorm cells and heavy precipitation and areas of known windshear. If the presence of windshear is confirmed, delay takeoff or do not continue an approach.

Precautions

If windshear is suspected, be especially alert to any of the danger signals and be prepared for the possibility of an inadvertent encounter. The following precautionary actions are recommended if windshear is suspected:

Takeoff

- Takeoff with full rated takeoff thrust is recommended, unless the use of a fixed derate is required to meet a dispatch performance requirement
- For optimum takeoff performance, use flaps 5, 10 or 15 unless limited by obstacle clearance and/or climb gradient
- Use the longest suitable runway provided it is clear of areas of known windshear
- Consider increasing Vr speed to the performance limited gross weight rotation speed, not to exceed actual gross weight Vr + 20 knots. Set V speeds for the actual gross weight. Rotate at the adjusted (higher) rotation speed. This increased rotation speed results in an increased stall margin and meets takeoff performance requirements. If windshear is encountered at or beyond the actual gross weight Vr, do not attempt to accelerate to the increased Vr but rotate without hesitation
- Be alert for any airspeed fluctuations during takeoff and initial climb. Such fluctuations may be the first indication of windshear
- Know the all–engine initial climb pitch attitude. Rotate at the normal rate to this attitude for all non–engine failure takeoffs. Minimize reductions from the initial climb pitch attitude until terrain and obstruction clearance is assured, unless stick shaker activates
- Crew coordination and awareness are very important. Develop an awareness of normal values of airspeed, attitude, vertical speed, and airspeed buildup. Closely monitor vertical flight path instruments such as vertical speed and altimeters. The pilot monitoring should be especially aware of vertical flight path instruments and call out any deviations from normal
- Should airspeed fall below the trim airspeed, unusual control column forces may be required to maintain the desired pitch attitude. If stick shaker is encountered, reduce pitch attitude. Do not exceed the Pitch Limit Indication.

Approach and Landing

- Use flaps 30 for landing
- Establish a stabilized approach no lower than 1000 feet above the airport to improve windshear recognition capability
- Use the most suitable runway that avoids the areas of suspected windshear and is compatible with crosswind or tailwind limitations. Use electronic or visual glide path indications to detect flight path deviations and help with timely detection of windshear
- If the autothrottle is disengaged, or is planned to be disengaged prior to landing, add an appropriate airspeed correction (correction applied in the same manner as gust), up to a maximum of 15 knots

- Avoid large thrust reductions or trim changes in response to sudden airspeed increases as these may be followed by airspeed decreases
- Crosscheck flight director commands using vertical flight path instruments
- Crew coordination and awareness are very important, particularly at night or in marginal weather conditions. Closely monitor the vertical flight path instruments such as vertical speed, altimeters, and glideslope displacement. The pilot monitoring should call out any deviations from normal. Use of the autopilot and autothrottle for the approach may provide more monitoring and recognition time.

Recovery

Accomplish the Windshear Escape Maneuver found in the Non–Normal Maneuvers section of the QRH.

Ice Crystal Icing (ICI)

At temperatures below freezing near convective weather, the airplane can encounter visible moisture made up of high concentrations of small ice crystals. Ice crystals can accumulate aft of the engine fan in the engine core. Ice shedding can cause engine vibration, engine power loss and engine damage. CFM56-7 engines have experienced several power loss events resulting from ice accumulation in the engine.

Ice crystals can also accumulate in the fan hub. This can cause vibration indications above 4 units. Fan ice removal procedures have no effect on fan hub icing. When clear of clouds, fan hub ice sublimates and engine vibration decreases over time. Fan hub ice can remain into descent.

Ice crystal icing is difficult to detect because ice crystals do not cause significant weather radar returns. They are often found in high concentrations above and near regions of heavy precipitation. Ice crystals do not stick to cold airplane surfaces.

Avoid ICI conditions. Flight in clouds containing high concentrations of ice crystals has been associated with engine vibration, engine power loss and engine damage.

Because these conditions can be difficult to recognize, careful preflight planning is a key component of in–flight situational awareness. When ICI is encountered or suspected, do the QRH Ice Crystal Icing NNC to mitigate the effect on the flight.

Recognizing Ice Crystal Icing

Ice crystals are most frequently found in areas of visible moisture and above altitudes normally associated with icing conditions. Their presence can be indicated by one or more of the following:

- appearance of rain on the windshield at temperatures too cold for liquid water to exist. This is due to ice crystals melting on the heated windows (sounds different than rain)
- Areas of light to moderate turbulence
- In IMC with:
  - No significant airframe icing and
  - no significant radar returns at airplane altitude and
  - heavy precipitation below the airplane, identified by amber and red radar returns on the weather radar.
- cloud tops above typical cruise levels (above the tropopause).
- Smell of ozone or sulfur
- Humidity increase
- Static discharge around the windshield (St. Elmo’s fire)

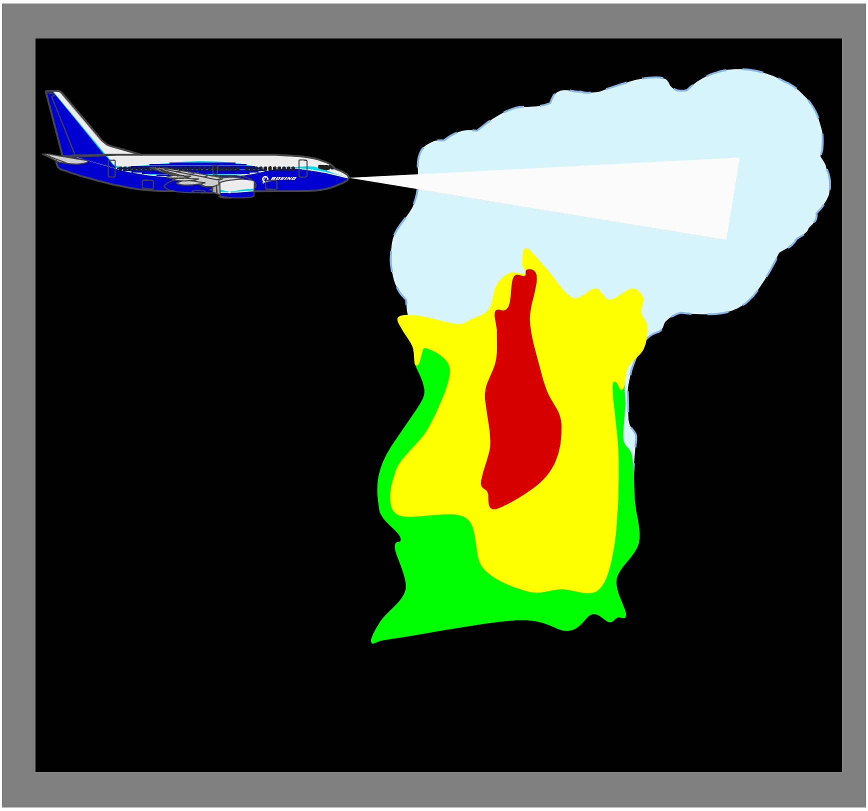
[Airplanes with ice detection]

Note: The ice detection system does not detect ice crystal icing. It is designed to detect supercooled water only.

Avoiding Ice Crystal Icing

During flight in IMC, avoid flying directly over significant amber or red radar returns, even if there are no returns at airplane altitude.

Use the weather radar controls to assess weather radar reflectivity below the airplane flight path. Refer to weather radar operating instructions for additional information.



Areas with a higher risk of High Ice Water Content (HIWC) are identified by some aviation weather vendors. In these areas, ICI should be suspected while operating in IMC. Use of this type of HIWC information is recommended for strategic preflight planning and in–flight adjustments in order to avoid potential ICI conditions.

Ice Crystal Icing Suspected

If conditions allow, exit the ice crystal icing conditions laterally. Climbing or descending to exit ice crystal icing conditions is not recommended. Request a route change to minimize the time above red and amber radar returns.

Do the Ice Crystal Icing non-normal checklist.

Performance Dispatch — Chapter PD

Table of Contents — Section 0

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Performance Dispatch — Chapter PD
Table of Contents — Section 10

737-600 CFM56-7B22 KG FAA CATD

General

The table below shows the airplanes that have been identified with the following performance package. Note, some airplanes may be identified with more than one performance package. This configuration table information reflects the Boeing delivered configuration updated for service bulletin incorporations in conformance with the policy stated in the introduction section of the FCOM. The performance data is prepared for the owner/operator named on the title page. The intent of this information is to assist flight crews and airlines in knowing which performance package is applicable to a given airplane. The performance package model identification information is based on Boeing's knowledge of the airline's fleet at a point in time approximately three months prior to the page date. Notice of Errata (NOE) will not be provided to airlines to identify airplanes that are moved between performance packages within this manual or airplanes added to the airline's fleet whose performance packages are already represented in this manual. These types of changes will be updated in the next block revision. Owners/operators are responsible for ensuring the operational documentation they are using is complete and matches the current configuration of their airplanes, and the accuracy and validity of all information furnished by the owner/operator or any other party. Owners/operators receiving active revision service are responsible to ensure that any modifications to the listed airplanes are properly reflected in this manual.

Serial and tabulation number are supplied by Boeing.

Registry Number	Serial Number	Tabulation Number
YX600	YX600	YX600

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Performance Dispatch — Chapter PD
Takeoff — Section 10

Takeoff Field Corrections - Dry Runway
Slope Corrections

FIELD LENGTH AVAILABLE (M)	SLOPE CORRECTED FIELD LENGTH (M)								
	RUNWAY SLOPE (%)								
	-2.0	-1.5	-1.0	-0.5	0.0	0.5	1.0	1.5	2.0
1200	1230	1230	1220	1210	1200	1180	1150	1130	1100
1400	1460	1440	1430	1410	1400	1360	1320	1280	1250
1600	1680	1660	1640	1620	1600	1550	1500	1440	1390
1800	1910	1880	1850	1830	1800	1730	1670	1600	1540
2000	2130	2100	2070	2030	2000	1920	1840	1760	1680
2200	2360	2320	2280	2240	2200	2110	2010	1920	1830
2400	2580	2540	2490	2450	2400	2290	2190	2080	1970
2600	2810	2750	2700	2650	2600	2480	2360	2240	2120
2800	3030	2970	2910	2860	2800	2670	2530	2400	2260
3000	3250	3190	3130	3060	3000	2850	2700	2560	2410
3200	3480	3410	3340	3270	3200	3040	2880	2720	2550
3400	3700	3630	3550	3480	3400	3230	3050	2880	2700
3600	3930	3850	3760	3680	3600	3410	3220	3030	2850
3800	4150	4060	3980	3890	3800	3600	3400	3190	2990
4000	4380	4280	4190	4090	4000	3780	3570	3350	3140
4200	4600	4500	4400	4300	4200	3970	3740	3510	3280
4400	4830	4720	4610	4510	4400	4160	3910	3670	3430
4600	5050	4940	4820	4710	4600	4340	4090	3830	3570
4800	5270	5160	5040	4920	4800	4530	4260	3990	3720
5000	5500	5370	5250	5120	5000	4720	4430	4150	3860

Wind Corrections

SLOPE CORR'D FIELD LENGTH (M)	SLOPE & WIND CORRECTED FIELD LENGTH (M)							
	WIND COMPONENT (KTS)							
	-15	-10	-5	0	10	20	30	40
1200	850	970	1080	1200	1270	1350	1420	1500
1400	1030	1150	1280	1400	1470	1550	1630	1720
1600	1210	1340	1470	1600	1680	1760	1850	1940
1800	1380	1520	1660	1800	1880	1970	2060	2160
2000	1560	1710	1850	2000	2080	2170	2270	2380
2200	1740	1890	2050	2200	2290	2380	2490	2600
2400	1910	2080	2240	2400	2490	2590	2700	2820
2600	2090	2260	2430	2600	2690	2800	2910	3050
2800	2270	2450	2620	2800	2890	3000	3130	3270
3000	2450	2630	2820	3000	3100	3210	3340	3490
3200	2620	2820	3010	3200	3300	3420	3550	3710
3400	2800	3000	3200	3400	3500	3620	3770	3930
3600	2980	3190	3390	3600	3700	3830	3980	4150
3800	3150	3370	3580	3800	3910	4040	4190	4370
4000	3330	3550	3780	4000	4110	4250	4410	4600
4200	3510	3740	3970	4200	4310	4450	4620	4820
4400	3690	3920	4160	4400	4510	4660	4830	5040
4600	3860	4110	4350	4600	4720	4870	5050	5260
4800	4040	4290	4550	4800	4920	5070	5260	5480
5000	4220	4480	4740	5000	5120	5280	5470	5700

Takeoff Field & Climb Limit Weights - Dry Runway

Flaps 5

Sea Level Pressure Altitude

CORR'D FIELD LENGTH (M)	FIELD LIMIT WEIGHT (1000 KG) OAT (°C)										
	-40	10	14	18	22	26	30	38	42	46	50
1250	72.5	58.6	57.4	56.1	54.9	53.6	52.4	49.8	48.5	47.1	45.6
1400	72.5	62.2	60.9	59.5	58.2	56.9	55.6	52.9	51.5	49.9	48.4
1600	72.5	66.8	65.4	63.9	62.5	61.1	59.7	56.8	55.3	53.6	52.0
1800	72.5	71.1	69.6	68.1	66.6	65.0	63.5	60.5	58.9	57.1	55.4
2000	72.5	72.5	72.5	71.8	70.2	68.6	67.0	63.8	62.1	60.2	58.4
2200	72.5	72.5	72.5	72.5	72.5	71.8	70.1	66.7	64.9	63.0	61.0
2400	72.5	72.5	72.5	72.5	72.5	72.5	72.5	69.3	67.4	65.3	63.3
2600	72.5	72.5	72.5	72.5	72.5	72.5	72.5	71.6	69.7	67.5	65.4
2800	72.5	72.5	72.5	72.5	72.5	72.5	72.5	72.5	71.9	69.6	67.4
3000	72.5	72.5	72.5	72.5	72.5	72.5	72.5	72.5	72.5	71.8	69.5
3200	72.5	72.5	72.5	72.5	72.5	72.5	72.5	72.5	72.5	72.5	71.4
3400	72.5	72.5	72.5	72.5	72.5	72.5	72.5	72.5	72.5	72.5	72.5
3600	72.5	72.5	72.5	72.5	72.5	72.5	72.5	72.5	72.5	72.5	72.5
3800	72.5	72.5	72.5	72.5	72.5	72.5	72.5	72.5	72.5	72.5	72.5
4000	72.5	72.5	72.5	72.5	72.5	72.5	72.5	72.5	72.5	72.5	72.5
4200	72.5	72.5	72.5	72.5	72.5	72.5	72.5	72.5	72.5	72.5	72.5
4400	72.5	72.5	72.5	72.5	72.5	72.5	72.5	72.5	72.5	72.5	72.5
4600	72.5	72.5	72.5	72.5	72.5	72.5	72.5	72.5	72.5	72.5	72.5
CLIMB LIMIT WT (1000 KG)	68.7	68.3	68.2	68.1	68.0	67.9	67.8	62.8	60.3	58.1	55.7

2000 FT Pressure Altitude

CORR'D FIELD LENGTH (M)	FIELD LIMIT WEIGHT (1000 KG) OAT (°C)										
	-40	10	14	18	22	26	30	38	42	46	50
1250	55.3	51.4	51.1	50.8	50.5	50.2	49.1	46.5	45.1	43.9	42.6
1400	58.6	54.6	54.3	53.9	53.6	53.3	52.1	49.3	47.9	46.6	45.2
1600	63.0	58.6	58.3	57.9	57.6	57.2	56.0	52.9	51.4	50.0	48.6
1800	67.0	62.4	62.0	61.7	61.3	61.0	59.6	56.4	54.8	53.2	51.7
2000	70.7	65.8	65.4	65.0	64.7	64.3	62.8	59.4	57.7	56.1	54.5
2200	72.5	68.9	68.4	68.0	67.6	67.2	65.7	62.1	60.3	58.7	57.0
2400	72.5	71.5	71.1	70.7	70.2	69.8	68.2	64.5	62.6	60.9	59.1
2600	72.5	72.5	72.5	72.5	72.5	72.2	70.5	66.6	64.7	62.8	61.0
2800	72.5	72.5	72.5	72.5	72.5	72.5	72.5	68.7	66.7	64.7	62.8
3000	72.5	72.5	72.5	72.5	72.5	72.5	72.5	70.9	68.7	66.7	64.7
3200	72.5	72.5	72.5	72.5	72.5	72.5	72.5	72.5	70.6	68.5	66.5
3400	72.5	72.5	72.5	72.5	72.5	72.5	72.5	72.5	72.4	70.3	68.2
3600	72.5	72.5	72.5	72.5	72.5	72.5	72.5	72.5	72.5	71.9	69.8
3800	72.5	72.5	72.5	72.5	72.5	72.5	72.5	72.5	72.5	72.5	71.4
4000	72.5	72.5	72.5	72.5	72.5	72.5	72.5	72.5	72.5	72.5	72.5
4200	72.5	72.5	72.5	72.5	72.5	72.5	72.5	72.5	72.5	72.5	72.5
4400	72.5	72.5	72.5	72.5	72.5	72.5	72.5	72.5	72.5	72.5	72.5
4600	72.5	72.5	72.5	72.5	72.5	72.5	72.5	72.5	72.5	72.5	72.5
CLIMB LIMIT WT (1000 KG)	66.5	66.0	66.0	65.9	65.8	65.7	63.5	58.8	56.4	54.3	52.1

With engine bleed for packs off, increase field limit weight by 550 kg and climb limit weight by 1300 kg.
With engine anti-ice on, decrease field limit weight by 150 kg and climb limit weight by 200 kg.
With engine and wing anti-ice on (optional system), decrease field limit weight by 600 kg and climb limit weight by 1050 kg.

Takeoff Field & Climb Limit Weights - Dry Runway

Flaps 5

4000 FT Pressure Altitude

CORR'D FIELD LENGTH (M)	FIELD LIMIT WEIGHT (1000 KG)										
	OAT (°C)										
	-40	10	14	18	22	26	30	38	42	46	50
1250	52.9	49.1	48.8	48.5	48.1	46.8	45.6	43.3	42.1	40.9	39.9
1400	56.2	52.1	51.7	51.4	51.1	49.7	48.4	46.0	44.7	43.4	42.3
1600	60.3	55.9	55.6	55.2	54.9	53.3	52.0	49.4	48.0	46.6	45.4
1800	64.2	59.5	59.2	58.8	58.4	56.8	55.4	52.6	51.1	49.7	48.4
2000	67.7	62.8	62.4	62.0	61.6	59.9	58.4	55.4	53.8	52.3	51.0
2200	70.9	65.6	65.3	64.8	64.4	62.6	61.0	57.9	56.3	54.7	53.3
2400	72.5	68.2	67.7	67.3	66.9	65.0	63.3	60.1	58.3	56.7	55.2
2600	72.5	70.5	70.0	69.6	69.1	67.1	65.4	62.1	60.2	58.5	57.0
2800	72.5	72.5	72.2	71.8	71.3	69.2	67.4	63.9	62.0	60.2	58.6
3000	72.5	72.5	72.5	72.5	72.5	71.4	69.6	65.9	63.9	62.0	60.4
3200	72.5	72.5	72.5	72.5	72.5	72.5	71.4	67.7	65.6	63.7	62.0
3400	72.5	72.5	72.5	72.5	72.5	72.5	72.5	69.4	67.2	65.3	63.5
3600	72.5	72.5	72.5	72.5	72.5	72.5	72.5	71.0	68.9	66.8	65.0
3800	72.5	72.5	72.5	72.5	72.5	72.5	72.5	72.5	70.4	68.4	66.5
4000	72.5	72.5	72.5	72.5	72.5	72.5	72.5	72.5	72.0	69.9	68.0
4200	72.5	72.5	72.5	72.5	72.5	72.5	72.5	72.5	72.5	71.3	69.4
4400	72.5	72.5	72.5	72.5	72.5	72.5	72.5	72.5	72.5	72.5	70.7
4600	72.5	72.5	72.5	72.5	72.5	72.5	72.5	72.5	72.5	72.5	72.1
CLIMB LIMIT WT (1000 KG)	64.6	64.1	64.0	63.9	63.8	61.5	59.2	54.8	52.6	50.6	48.8

6000 FT Pressure Altitude

CORR'D FIELD LENGTH (M)	FIELD LIMIT WEIGHT (1000 KG)										
	OAT (°C)										
	-40	10	14	18	22	26	30	38	42	46	50
1250	50.2	46.1	45.8	45.6	44.5	43.4	42.3	40.1	39.0	38.0	37.0
1400	53.3	49.0	48.6	48.3	47.3	46.1	44.9	42.6	41.4	40.3	39.3
1600	57.2	52.6	52.3	51.9	50.8	49.5	48.3	45.8	44.5	43.3	42.2
1800	60.9	56.0	55.6	55.3	54.0	52.7	51.4	48.7	47.3	46.1	44.9
2000	64.3	59.0	58.7	58.3	57.0	55.6	54.2	51.3	49.9	48.6	47.3
2200	67.2	61.7	61.3	60.9	59.6	58.1	56.6	53.6	52.1	50.7	49.4
2400	69.8	64.1	63.6	63.2	61.8	60.2	58.7	55.6	54.0	52.6	51.2
2600	72.2	66.2	65.7	65.3	63.8	62.2	60.6	57.4	55.7	54.2	52.8
2800	72.5	68.2	67.8	67.3	65.8	64.1	62.4	59.0	57.3	55.8	54.3
3000	72.5	70.4	69.9	69.4	67.8	66.0	64.3	60.8	59.0	57.4	55.8
3200	72.5	72.3	71.8	71.3	69.6	67.8	66.0	62.4	60.6	58.9	57.3
3400	72.5	72.5	72.5	72.5	71.4	69.5	67.7	64.0	62.1	60.4	58.7
3600	72.5	72.5	72.5	72.5	72.5	71.2	69.3	65.5	63.6	61.8	60.1
3800	72.5	72.5	72.5	72.5	72.5	72.5	70.9	67.0	65.0	63.2	61.5
4000	72.5	72.5	72.5	72.5	72.5	72.5	72.4	68.4	66.4	64.6	62.8
4200	72.5	72.5	72.5	72.5	72.5	72.5	72.5	69.9	67.8	65.9	64.1
4400	72.5	72.5	72.5	72.5	72.5	72.5	72.5	71.3	69.1	67.2	65.4
4600	72.5	72.5	72.5	72.5	72.5	72.5	72.5	72.5	70.4	68.5	66.6
CLIMB LIMIT WT (1000 KG)	61.8	61.3	61.2	61.1	59.0	56.8	54.7	50.6	48.6	46.9	45.3

With engine bleed for packs off, increase field limit weight by 550 kg and climb limit weight by 1300 kg.
With engine anti-ice on, decrease field limit weight by 150 kg and climb limit weight by 200 kg.
With engine and wing anti-ice on (optional system), decrease field limit weight by 600 kg and climb limit weight by 1050 kg.

Takeoff Field & Climb Limit Weights - Dry Runway

Flaps 5

8000 FT Pressure Altitude

CORR'D FIELD LENGTH (M)	FIELD LIMIT WEIGHT (1000 KG)										
	OAT (°C)										
	-40	10	14	18	22	26	30	38	42	46	50
1250	47.4	43.5	43.3	42.1	40.9	39.9	38.9	36.7	35.7	34.8	33.8
1400	50.3	46.2	45.9	44.7	43.4	42.3	41.3	39.0	37.9	36.9	35.9
1600	54.0	49.6	49.3	48.0	46.7	45.5	44.3	41.9	40.8	39.7	38.6
1800	57.5	52.8	52.5	51.1	49.7	48.4	47.2	44.6	43.4	42.2	41.1
2000	60.6	55.7	55.3	53.8	52.4	51.0	49.7	47.0	45.7	44.5	43.3
2200	63.4	58.2	57.8	56.3	54.7	53.3	52.0	49.0	47.7	46.4	45.1
2400	65.8	60.4	60.0	58.3	56.7	55.2	53.8	50.8	49.4	48.1	46.7
2600	68.0	62.4	61.9	60.2	58.5	57.0	55.5	52.4	50.9	49.5	48.1
2800	70.1	64.2	63.8	62.0	60.2	58.6	57.1	53.8	52.3	50.8	49.4
3000	72.3	66.2	65.8	63.9	62.1	60.4	58.8	55.4	53.8	52.3	50.8
3200	72.5	68.0	67.5	65.6	63.7	62.0	60.4	56.8	55.2	53.6	52.1
3400	72.5	69.7	69.2	67.3	65.3	63.5	61.9	58.2	56.6	55.0	53.4
3600	72.5	71.4	70.9	68.9	66.9	65.0	63.4	59.6	57.9	56.3	54.6
3800	72.5	72.5	72.5	70.4	68.4	66.5	64.8	61.0	59.2	57.5	55.9
4000	72.5	72.5	72.5	72.0	69.9	68.0	66.2	62.3	60.5	58.8	57.1
4200	72.5	72.5	72.5	72.5	71.3	69.4	67.6	63.6	61.8	60.0	58.3
4400	72.5	72.5	72.5	72.5	72.5	70.8	68.9	64.9	63.0	61.2	59.4
4600	72.5	72.5	72.5	72.5	72.5	72.1	70.2	66.1	64.2	62.4	60.5
CLIMB LIMIT WT (1000 KG)	58.9	58.6	58.5	55.9	53.5	51.5	49.7	45.8	44.1	42.5	40.9

10000 FT Pressure Altitude

CORR'D FIELD LENGTH (M)	FIELD LIMIT WEIGHT (1000 KG)										
	OAT (°C)										
	-40	10	14	18	22	26	30	38	42	46	50
1250	44.4	41.0	39.9	38.8	37.9	36.9	35.9	33.9	33.0	32.1	31.2
1400	47.2	43.5	42.4	41.2	40.2	39.2	38.1	36.0	35.0	34.1	33.1
1600	50.6	46.8	45.5	44.3	43.2	42.1	41.0	38.7	37.6	36.6	35.6
1800	53.9	49.8	48.5	47.2	46.0	44.8	43.6	41.2	40.1	39.0	37.9
2000	56.8	52.5	51.1	49.7	48.4	47.2	46.0	43.4	42.2	41.0	39.9
2200	59.4	54.8	53.4	51.9	50.6	49.3	48.0	45.3	44.0	42.8	41.6
2400	61.7	56.8	55.3	53.8	52.4	51.1	49.7	46.8	45.5	44.3	43.0
2600	63.7	58.7	57.1	55.5	54.1	52.6	51.2	48.2	46.9	45.6	44.2
2800	65.6	60.4	58.7	57.1	55.6	54.1	52.6	49.5	48.1	46.7	45.3
3000	67.6	62.2	60.5	58.7	57.2	55.7	54.1	50.9	49.4	48.0	46.5
3200	69.5	63.9	62.1	60.3	58.7	57.1	55.5	52.2	50.7	49.2	47.7
3400	71.2	65.5	63.6	61.8	60.2	58.6	56.9	53.5	52.0	50.4	48.9
3600	72.5	67.0	65.1	63.3	61.6	59.9	58.3	54.8	53.2	51.6	50.0
3800	72.5	68.6	66.6	64.7	63.0	61.3	59.6	56.0	54.4	52.8	51.2
4000	72.5	70.0	68.1	66.1	64.4	62.6	60.9	57.2	55.6	53.9	52.3
4200	72.5	71.5	69.5	67.5	65.7	63.9	62.1	58.4	56.7	55.0	53.4
4400	72.5	72.5	70.9	68.8	67.0	65.2	63.4	59.6	57.8	56.1	54.4
4600	72.5	72.5	72.2	70.2	68.3	66.4	64.6	60.7	58.9	57.2	55.5
CLIMB LIMIT WT (1000 KG)	56.1	55.7	53.3	51.2	49.4	47.5	45.7	42.2	40.6	39.0	37.5

With engine bleed for packs off, increase field limit weight by 550 kg and climb limit weight by 1300 kg.
With engine anti-ice on, decrease field limit weight by 150 kg and climb limit weight by 200 kg.
With engine and wing anti-ice on (optional system), decrease field limit weight by 600 kg and climb limit weight by 1050 kg.

Takeoff Field Corrections - Wet Runway

Slope Corrections

FIELD LENGTH AVAILABLE (M)	SLOPE CORRECTED FIELD LENGTH (M)								
	RUNWAY SLOPE (%)								
	-2.0	-1.5	-1.0	-0.5	0.0	0.5	1.0	1.5	2.0
1200	1250	1240	1230	1210	1200	1190	1180	1160	1150
1400	1480	1460	1440	1420	1400	1370	1350	1320	1300
1600	1700	1680	1650	1630	1600	1560	1520	1490	1450
1800	1930	1890	1860	1830	1800	1750	1700	1650	1600
2000	2150	2110	2080	2040	2000	1940	1870	1810	1750
2200	2380	2330	2290	2240	2200	2120	2050	1970	1900
2400	2600	2550	2500	2450	2400	2310	2220	2140	2050
2600	2830	2770	2710	2660	2600	2500	2400	2300	2200
2800	3050	2990	2930	2860	2800	2690	2570	2460	2350
3000	3280	3210	3140	3070	3000	2870	2750	2620	2500
3200	3500	3430	3350	3280	3200	3060	2920	2780	2650
3400	3730	3640	3560	3480	3400	3250	3100	2950	2800
3600	3950	3860	3780	3690	3600	3440	3270	3110	2950
3800	4180	4080	3990	3890	3800	3620	3450	3270	3100
4000	4400	4300	4200	4100	4000	3810	3620	3430	3250
4200	4630	4520	4410	4310	4200	4000	3800	3600	3390
4400	4850	4740	4630	4510	4400	4190	3970	3760	3540
4600	5080	4960	4840	4720	4600	4370	4150	3920	3690
4800	5300	5180	5050	4930	4800	4560	4320	4080	3840
5000	5530	5390	5260	5130	5000	4750	4500	4250	3990

Wind Corrections

SLOPE CORR'D FIELD LENGTH (M)	SLOPE & WIND CORRECTED FIELD LENGTH (M)							
	WIND COMPONENT (KTS)							
	-15	-10	-5	0	10	20	30	40
1200	830	960	1080	1200	1280	1370	1460	1540
1400	1000	1130	1270	1400	1490	1580	1670	1770
1600	1170	1310	1460	1600	1690	1790	1890	2000
1800	1340	1490	1650	1800	1890	2000	2110	2230
2000	1510	1670	1840	2000	2100	2210	2330	2460
2200	1680	1850	2030	2200	2300	2420	2550	2690
2400	1850	2030	2220	2400	2500	2630	2770	2920
2600	2020	2210	2410	2600	2710	2840	2980	3150
2800	2190	2390	2600	2800	2910	3050	3200	3380
3000	2360	2570	2790	3000	3120	3260	3420	3610
3200	2530	2750	2980	3200	3320	3470	3640	3840
3400	2700	2930	3170	3400	3520	3680	3860	4070
3600	2860	3110	3350	3600	3730	3880	4080	4300
3800	3030	3290	3540	3800	3930	4090	4290	4530
4000	3200	3470	3730	4000	4130	4300	4510	4760
4200	3370	3650	3920	4200	4340	4510	4730	4990
4400	3540	3830	4110	4400	4540	4720	4950	5220
4600	3710	4010	4300	4600	4740	4930	5170	5450
4800	3880	4190	4490	4800	4950	5140	5390	5670
5000	4050	4370	4680	5000	5150	5350	5600	5900

Takeoff Field & Climb Limit Weights - Wet Runway

Flaps 5

Sea Level Pressure Altitude

CORR'D FIELD LENGTH (M)	FIELD LIMIT WEIGHT (1000 KG)										
	OAT (°C)										
	-40	10	14	18	22	26	30	38	42	46	50
1500	63.7	59.0	58.7	58.3	57.9	57.5	57.2	54.3	52.8	51.2	49.8
1600	65.7	60.9	60.5	60.1	59.7	59.3	58.9	55.9	54.5	52.8	51.4
1800	69.5	64.4	64.0	63.6	63.2	62.8	62.4	59.2	57.7	55.9	54.4
2000	72.5	68.0	67.5	67.1	66.7	66.3	65.8	62.5	60.8	59.0	57.4
2200	72.5	71.2	70.8	70.3	69.9	69.4	69.0	65.4	63.7	61.8	60.1
2400	72.5	72.5	72.5	72.5	72.5	72.2	71.8	68.1	66.3	64.2	62.5
2600	72.5	72.5	72.5	72.5	72.5	72.5	72.5	70.5	68.6	66.5	64.7
2800	72.5	72.5	72.5	72.5	72.5	72.5	72.5	72.5	70.9	68.7	66.8
3000	72.5	72.5	72.5	72.5	72.5	72.5	72.5	72.5	72.5	71.0	69.0
3200	72.5	72.5	72.5	72.5	72.5	72.5	72.5	72.5	72.5	72.5	71.0
3400	72.5	72.5	72.5	72.5	72.5	72.5	72.5	72.5	72.5	72.5	72.5
3600	72.5	72.5	72.5	72.5	72.5	72.5	72.5	72.5	72.5	72.5	72.5
3800	72.5	72.5	72.5	72.5	72.5	72.5	72.5	72.5	72.5	72.5	72.5
4000	72.5	72.5	72.5	72.5	72.5	72.5	72.5	72.5	72.5	72.5	72.5
4200	72.5	72.5	72.5	72.5	72.5	72.5	72.5	72.5	72.5	72.5	72.5
4400	72.5	72.5	72.5	72.5	72.5	72.5	72.5	72.5	72.5	72.5	72.5
4600	72.5	72.5	72.5	72.5	72.5	72.5	72.5	72.5	72.5	72.5	72.5
4800	72.5	72.5	72.5	72.5	72.5	72.5	72.5	72.5	72.5	72.5	72.5
CLIMB LIMIT WT (1000 KG)	68.7	68.3	68.2	68.1	68.0	67.9	67.8	62.8	60.3	58.1	55.7

2000 FT Pressure Altitude

CORR'D FIELD LENGTH (M)	FIELD LIMIT WEIGHT (1000 KG)										
	OAT (°C)										
	-40	10	14	18	22	26	30	38	42	46	50
1500	60.8	56.1	55.7	55.3	55.0	54.6	53.3	50.4	49.0	47.8	46.5
1600	62.7	57.8	57.4	57.1	56.7	56.3	55.0	51.9	50.6	49.3	48.0
1800	66.3	61.2	60.8	60.4	60.0	59.6	58.2	55.0	53.5	52.2	50.8
2000	70.0	64.6	64.1	63.7	63.3	62.9	61.4	58.0	56.5	55.0	53.5
2200	72.5	67.6	67.2	66.8	66.3	65.9	64.3	60.7	59.1	57.6	56.1
2400	72.5	70.4	69.9	69.5	69.0	68.6	66.9	63.2	61.5	59.9	58.3
2600	72.5	72.5	72.4	71.9	71.5	71.0	69.3	65.4	63.6	62.0	60.3
2800	72.5	72.5	72.5	72.5	72.5	72.5	71.6	67.6	65.7	64.0	62.3
3000	72.5	72.5	72.5	72.5	72.5	72.5	72.5	69.8	67.9	66.1	64.3
3200	72.5	72.5	72.5	72.5	72.5	72.5	72.5	71.8	69.9	68.0	66.1
3400	72.5	72.5	72.5	72.5	72.5	72.5	72.5	72.5	71.8	69.8	67.9
3600	72.5	72.5	72.5	72.5	72.5	72.5	72.5	72.5	72.5	71.6	69.6
3800	72.5	72.5	72.5	72.5	72.5	72.5	72.5	72.5	72.5	72.5	71.3
4000	72.5	72.5	72.5	72.5	72.5	72.5	72.5	72.5	72.5	72.5	72.5
4200	72.5	72.5	72.5	72.5	72.5	72.5	72.5	72.5	72.5	72.5	72.5
4400	72.5	72.5	72.5	72.5	72.5	72.5	72.5	72.5	72.5	72.5	72.5
4600	72.5	72.5	72.5	72.5	72.5	72.5	72.5	72.5	72.5	72.5	72.5
4800	72.5	72.5	72.5	72.5	72.5	72.5	72.5	72.5	72.5	72.5	72.5
CLIMB LIMIT WT (1000 KG)	66.5	66.0	66.0	65.9	65.8	65.7	63.5	58.8	56.4	54.3	52.1

With engine bleed for packs off, increase field limit weight by 450 kg and climb limit weight by 1300 kg.
With engine anti-ice on, decrease field limit weight by 150 kg and climb limit weight by 200 kg.
With engine and wing anti-ice on (optional system), decrease field limit weight by 550 kg and climb limit weight by 1050 kg.

Takeoff Field & Climb Limit Weights - Wet Runway
Flaps 5
4000 FT Pressure Altitude

CORR'D FIELD LENGTH (M)	FIELD LIMIT WEIGHT (1000 KG)										
	OAT (°C)										
	-40	10	14	18	22	26	30	38	42	46	50
1500	58.0	53.2	52.9	52.5	52.0	50.6	49.4	47.0	45.7	44.5	43.5
1600	59.8	54.9	54.5	54.2	53.6	52.2	51.0	48.4	47.1	45.9	44.8
1800	63.3	58.1	57.7	57.3	56.7	55.3	54.0	51.3	49.9	48.6	47.5
2000	66.7	61.3	60.9	60.5	59.9	58.3	56.9	54.1	52.6	51.3	50.0
2200	69.9	64.2	63.8	63.3	62.7	61.1	59.6	56.6	55.1	53.7	52.4
2400	72.5	66.8	66.3	65.9	65.2	63.5	62.0	58.9	57.3	55.8	54.4
2600	72.5	69.2	68.7	68.2	67.5	65.8	64.2	60.9	59.3	57.7	56.3
2800	72.5	71.5	71.0	70.5	69.8	67.9	66.3	62.9	61.2	59.6	58.1
3000	72.5	72.5	72.5	72.5	72.1	70.2	68.5	64.9	63.1	61.5	60.0
3200	72.5	72.5	72.5	72.5	72.5	72.2	70.4	66.8	65.0	63.2	61.7
3400	72.5	72.5	72.5	72.5	72.5	72.5	72.3	68.6	66.7	64.9	63.3
3600	72.5	72.5	72.5	72.5	72.5	72.5	72.5	70.3	68.4	66.6	64.9
3800	72.5	72.5	72.5	72.5	72.5	72.5	72.5	72.1	70.0	68.2	66.5
4000	72.5	72.5	72.5	72.5	72.5	72.5	72.5	72.5	71.7	69.7	68.0
4200	72.5	72.5	72.5	72.5	72.5	72.5	72.5	72.5	72.5	71.3	69.5
4400	72.5	72.5	72.5	72.5	72.5	72.5	72.5	72.5	72.5	72.5	70.9
4600	72.5	72.5	72.5	72.5	72.5	72.5	72.5	72.5	72.5	72.5	72.3
4800	72.5	72.5	72.5	72.5	72.5	72.5	72.5	72.5	72.5	72.5	72.3
CLIMB LIMIT WT (1000 KG)	64.6	64.1	64.0	63.9	63.8	61.5	59.2	54.8	52.6	50.6	48.8

6000 FT Pressure Altitude

CORR'D FIELD LENGTH (M)	FIELD LIMIT WEIGHT (1000 KG)										
	OAT (°C)										
	-40	10	14	18	22	26	30	38	42	46	50
1500	54.7	49.9	49.6	49.3	48.1	46.9	45.8	43.5	42.4	41.3	40.3
1600	56.4	51.5	51.1	50.8	49.6	48.4	47.2	44.8	43.7	42.6	41.6
1800	59.7	54.5	54.1	53.8	52.5	51.2	50.0	47.5	46.2	45.1	44.0
2000	63.0	57.5	57.1	56.7	55.4	54.0	52.7	50.1	48.8	47.6	46.4
2200	66.0	60.2	59.8	59.4	58.0	56.6	55.2	52.4	51.0	49.8	48.6
2400	68.7	62.6	62.2	61.8	60.3	58.8	57.4	54.5	53.0	51.7	50.5
2600	71.1	64.8	64.4	64.0	62.5	60.9	59.4	56.3	54.9	53.5	52.2
2800	72.5	66.9	66.5	66.1	64.5	62.8	61.3	58.1	56.6	55.2	53.8
3000	72.5	69.2	68.7	68.2	66.6	64.9	63.3	60.0	58.4	56.9	55.5
3200	72.5	71.2	70.7	70.2	68.5	66.8	65.1	61.7	60.0	58.5	57.0
3400	72.5	72.5	72.5	72.1	70.4	68.5	66.8	63.3	61.6	60.1	58.5
3600	72.5	72.5	72.5	72.5	72.2	70.3	68.5	64.9	63.2	61.6	60.0
3800	72.5	72.5	72.5	72.5	72.5	72.0	70.2	66.5	64.7	63.1	61.5
4000	72.5	72.5	72.5	72.5	72.5	72.5	71.8	68.0	66.2	64.5	62.9
4200	72.5	72.5	72.5	72.5	72.5	72.5	72.5	69.5	67.6	65.9	64.2
4400	72.5	72.5	72.5	72.5	72.5	72.5	72.5	71.0	69.0	67.3	65.6
4600	72.5	72.5	72.5	72.5	72.5	72.5	72.5	72.3	70.4	68.6	66.8
4800	72.5	72.5	72.5	72.5	72.5	72.5	72.5	72.5	71.7	69.9	68.1
CLIMB LIMIT WT (1000 KG)	61.8	61.3	61.2	61.1	59.0	56.8	54.7	50.6	48.6	46.9	45.3

With engine bleed for packs off, increase field limit weight by 450 kg and climb limit weight by 1300 kg.
With engine anti-ice on, decrease field limit weight by 150 kg and climb limit weight by 200 kg.
With engine and wing anti-ice on (optional system), decrease field limit weight by 550 kg and climb limit weight by 1050 kg.

Takeoff Field & Climb Limit Weights - Wet Runway

Flaps 5

8000 FT Pressure Altitude

CORR'D FIELD LENGTH (M)	FIELD LIMIT WEIGHT (1000 KG)										
	OAT (°C)										
	-40	10	14	18	22	26	30	38	42	46	50
1500	51.2	47.0	46.7	45.4	44.2	43.1	42.1	39.9	38.9	37.9	36.9
1600	52.8	48.5	48.1	46.8	45.5	44.4	43.4	41.1	40.1	39.1	38.1
1800	55.9	51.3	51.0	49.6	48.2	47.0	45.9	43.5	42.4	41.4	40.3
2000	59.0	54.1	53.7	52.3	50.8	49.6	48.4	45.9	44.7	43.6	42.5
2200	61.8	56.7	56.3	54.7	53.2	51.9	50.6	48.0	46.8	45.6	44.4
2400	64.3	58.9	58.5	56.9	55.3	53.9	52.6	49.9	48.6	47.4	46.2
2600	66.5	61.0	60.5	58.9	57.2	55.8	54.4	51.6	50.2	49.0	47.7
2800	68.8	63.0	62.5	60.8	59.0	57.6	56.2	53.2	51.8	50.5	49.1
3000	71.0	65.0	64.5	62.7	60.9	59.4	57.9	54.8	53.4	52.0	50.6
3200	72.5	66.9	66.4	64.5	62.7	61.1	59.6	56.3	54.9	53.4	52.0
3400	72.5	68.7	68.2	66.2	64.3	62.7	61.1	57.8	56.3	54.8	53.4
3600	72.5	70.4	69.9	67.9	66.0	64.3	62.7	59.3	57.7	56.2	54.7
3800	72.5	72.1	71.6	69.6	67.6	65.8	64.2	60.7	59.1	57.5	56.0
4000	72.5	72.5	72.5	71.2	69.1	67.3	65.7	62.1	60.4	58.8	57.3
4200	72.5	72.5	72.5	72.5	70.6	68.8	67.1	63.4	61.7	60.1	58.5
4400	72.5	72.5	72.5	72.5	72.1	70.2	68.5	64.7	63.0	61.4	59.7
4600	72.5	72.5	72.5	72.5	72.5	71.6	69.8	66.0	64.3	62.6	60.9
4800	72.5	72.5	72.5	72.5	72.5	72.5	71.1	67.2	65.5	63.8	62.1
CLIMB LIMIT WT (1000 KG)	58.9	58.6	58.5	55.9	53.5	51.5	49.7	45.8	44.1	42.5	40.9

10000 FT Pressure Altitude

CORR'D FIELD LENGTH (M)	FIELD LIMIT WEIGHT (1000 KG)										
	OAT (°C)										
	-40	10	14	18	22	26	30	38	42	46	50
1500	48.1	44.2	43.0	41.9	40.9	39.9	38.8	36.8	35.9	34.9	34.0
1600	49.6	45.5	44.3	43.2	42.1	41.1	40.0	37.9	37.0	36.0	35.1
1800	52.5	48.2	46.9	45.7	44.6	43.5	42.4	40.2	39.2	38.2	37.2
2000	55.4	50.8	49.5	48.2	47.0	45.9	44.7	42.3	41.3	40.2	39.1
2200	58.0	53.2	51.8	50.4	49.2	48.0	46.8	44.3	43.2	42.0	40.9
2400	60.4	55.3	53.8	52.4	51.1	49.9	48.6	46.0	44.8	43.6	42.5
2600	62.5	57.2	55.7	54.2	52.9	51.6	50.2	47.5	46.3	45.1	43.9
2800	64.5	59.1	57.4	55.9	54.5	53.2	51.8	49.0	47.7	46.4	45.2
3000	66.6	61.0	59.3	57.7	56.2	54.8	53.4	50.5	49.1	47.8	46.5
3200	68.5	62.7	61.0	59.3	57.8	56.3	54.8	51.8	50.5	49.1	47.8
3400	70.4	64.4	62.6	60.8	59.3	57.8	56.3	53.2	51.8	50.4	49.0
3600	72.2	66.0	64.1	62.4	60.8	59.3	57.7	54.5	53.0	51.6	50.2
3800	72.5	67.6	65.7	63.9	62.3	60.7	59.1	55.8	54.3	52.8	51.4
4000	72.5	69.1	67.2	65.3	63.7	62.1	60.4	57.1	55.5	54.0	52.5
4200	72.5	70.6	68.7	66.8	65.1	63.4	61.7	58.3	56.7	55.2	53.7
4400	72.5	72.1	70.1	68.2	66.4	64.7	63.0	59.5	57.9	56.3	54.8
4600	72.5	72.5	71.5	69.5	67.7	66.0	64.2	60.7	59.1	57.5	55.9
4800	72.5	72.5	72.5	70.8	69.0	67.3	65.4	61.8	60.2	58.5	56.9
CLIMB LIMIT WT (1000 KG)	56.1	55.7	53.3	51.2	49.4	47.5	45.7	42.2	40.6	39.0	37.5

With engine bleed for packs off, increase field limit weight by 450 kg and climb limit weight by 1300 kg.
With engine anti-ice on, decrease field limit weight by 150 kg and climb limit weight by 200 kg.
With engine and wing anti-ice on (optional system), decrease field limit weight by 550 kg and climb limit weight by 1050 kg.

Takeoff Obstacle Limit Weight

Flaps 5

Sea Level, 30°C & Below, Zero Wind

Based on engine bleed for packs on and anti-ice off

Reference Obstacle Limit Weight (1000 KG)

OBSTACLE HEIGHT (M)	REFERENCE OBSTACLE LIMIT WEIGHT (1000 KG) DISTANCE FROM BRAKE RELEASE (100 M)										
	25	30	35	40	45	50	55	60	65	70	75
5	67.8	70.8									
20	61.6	65.4	68.0	69.8	71.1						
40	56.6	60.3	63.2	65.5	67.2	68.5	69.6	70.5	71.2	71.8	
60	52.8	56.6	59.6	62.0	63.9	65.5	66.8	67.8	68.7	69.5	70.1
80	49.7	53.5	56.6	59.1	61.1	62.8	64.3	65.5	66.5	67.4	68.1
100	47.1	50.9	54.0	56.6	58.7	60.5	62.0	63.4	64.5	65.5	66.3
120	44.8	48.6	51.8	54.4	56.6	58.4	60.0	61.4	62.6	63.7	64.6
140	42.8	46.6	49.7	52.4	54.6	56.5	58.2	59.6	60.9	62.0	63.0
160	41.0	44.8	47.9	50.6	52.9	54.8	56.5	58.0	59.3	60.5	61.5
180	39.4	43.1	46.3	48.9	51.2	53.2	55.0	56.5	57.8	59.0	60.1
200		41.6	44.7	47.4	49.7	51.7	53.5	55.1	56.5	57.7	58.8
220		40.2	43.3	46.0	48.3	50.4	52.1	53.7	55.2	56.4	57.6
240		38.9	42.0	44.7	47.0	49.1	50.9	52.5	53.9	55.2	56.4
260			40.8	43.5	45.8	47.8	49.7	51.3	52.8	54.1	55.3
280			39.7	42.3	44.6	46.7	48.5	50.2	51.7	53.0	54.2
300				41.3	43.5	45.6	47.4	49.1	50.6	52.0	53.2

Obstacle height must be calculated from lowest point of the runway to conservatively account for runway slope.

OAT Adjustments

OAT (°C)	REFERENCE OBSTACLE LIMIT WEIGHT (1000 KG)								
	40	44	48	52	56	60	64	68	72
30 & BELOW	0	0	0	0	0	0	0	0	0
32	-0.7	-0.8	-0.9	-0.9	-1.0	-1.1	-1.2	-1.3	-1.3
34	-1.4	-1.6	-1.7	-1.9	-2.0	-2.2	-2.3	-2.5	-2.7
36	-2.1	-2.4	-2.6	-2.8	-3.1	-3.3	-3.5	-3.8	-4.0
38	-2.8	-3.1	-3.5	-3.8	-4.1	-4.4	-4.7	-5.0	-5.3
40	-3.5	-3.9	-4.3	-4.7	-5.1	-5.5	-5.9	-6.3	-6.6
42	-4.2	-4.6	-5.1	-5.5	-6.0	-6.5	-6.9	-7.4	-7.8
44	-4.8	-5.3	-5.9	-6.4	-6.9	-7.4	-8.0	-8.5	-9.0
46	-5.4	-6.0	-6.6	-7.2	-7.8	-8.4	-9.0	-9.6	-10.2
48	-6.0	-6.7	-7.4	-8.1	-8.7	-9.4	-10.1	-10.8	-11.4
50	-6.7	-7.4	-8.1	-8.9	-9.6	-10.4	-11.1	-11.9	-12.6

Pressure Altitude Adjustments

ALT (FT)	OAT ADJUSTED OBSTACLE LIMIT WEIGHT (1000 KG)								
	40	44	48	52	56	60	64	68	72
S.L. & BELOW	0	0	0	0	0	0	0	0	0
1000	-1.5	-1.6	-1.7	-1.8	-1.9	-2.1	-2.2	-2.3	-2.4
2000	-2.9	-3.2	-3.4	-3.6	-3.9	-4.1	-4.4	-4.6	-4.9
3000	-4.2	-4.6	-5.0	-5.3	-5.7	-6.1	-6.4	-6.8	-7.1
4000	-5.6	-6.1	-6.5	-7.0	-7.5	-8.0	-8.5	-8.9	-9.4
5000	-6.9	-7.5	-8.2	-8.8	-9.4	-10.0	-10.6	-11.2	-11.8
6000	-8.3	-9.0	-9.8	-10.5	-11.2	-12.0	-12.7	-13.4	-14.2
7000	-9.6	-10.5	-11.4	-12.3	-13.2	-14.1	-15.0	-15.8	-16.7
8000	-10.9	-12.0	-13.0	-14.1	-15.1	-16.2	-17.2	-18.3	-19.3
9000	-12.1	-13.2	-14.4	-15.6	-16.7	-17.9	-19.1	-20.2	-21.4
10000	-13.2	-14.5	-15.8	-17.1	-18.4	-19.6	-20.9	-22.2	-23.5

Takeoff Obstacle Limit Weight
Flaps 5
Wind Adjustments

WIND (KTS)	OAT & ALT ADJUSTED OBSTACLE LIMIT WEIGHT (1000 KG)								
	40	44	48	52	56	60	64	68	72
15 TW	-7.9	-7.6	-7.3	-7.1	-6.8	-6.5	-6.2	-5.9	-5.7
10 TW	-5.3	-5.1	-4.9	-4.7	-4.5	-4.3	-4.1	-4.0	-3.8
5 TW	-2.6	-2.5	-2.4	-2.4	-2.3	-2.2	-2.1	-2.0	-1.9
0	0	0	0	0	0	0	0	0	0
10 HW	1.0	0.9	0.9	0.8	0.7	0.7	0.6	0.5	0.4
20 HW	2.0	1.9	1.7	1.6	1.5	1.3	1.2	1.0	0.9
30 HW	3.1	2.9	2.7	2.4	2.2	2.0	1.8	1.6	1.3
40 HW	4.2	3.9	3.6	3.3	3.0	2.7	2.4	2.1	1.8

With engine bleed for packs off, increase weight by 1000 kg.
With engine anti-ice on, decrease weight by 250 kg.
With engine and wing anti-ice on, decrease weight by 1150 kg (optional system).

Long Range Cruise Maximum Operating Altitude
Max Cruise Thrust
ISA + 10°C and Below

WEIGHT (1000 KG)	OPTIMUM ALT (FT)	TAT (°C)	MARGIN TO INITIAL BUFFET 'G' (BANK ANGLE)				
			1.20 (33°)	1.25 (36°)	1.30 (39°)	1.40 (44°)	1.50 (48°)
70	34300	-14	37700*	37700*	37700*	36400	35100
65	35800	-18	39200*	39200*	39200*	38000	36600
60	37500	-18	40700*	40700*	40700*	39700	38300
55	39300	-18	41000	41000	41000	41000	40100
50	41000	-18	41000	41000	41000	41000	41000
45	41000	-18	41000	41000	41000	41000	41000
40	41000	-18	41000	41000	41000	41000	41000
35	41000	-18	41000	41000	41000	41000	41000

ISA + 15°C

WEIGHT (1000 KG)	OPTIMUM ALT (FT)	TAT (°C)	MARGIN TO INITIAL BUFFET 'G' (BANK ANGLE)				
			1.20 (33°)	1.25 (36°)	1.30 (39°)	1.40 (44°)	1.50 (48°)
70	34300	-9	37000*	37000*	37000*	36400	35100
65	35800	-12	38300*	38300*	38300*	38000	36600
60	37500	-13	39800*	39800*	39800*	39700	38300
55	39300	-13	41000	41000	41000	41000	40100
50	41000	-13	41000	41000	41000	41000	41000
45	41000	-13	41000	41000	41000	41000	41000
40	41000	-13	41000	41000	41000	41000	41000
35	41000	-13	41000	41000	41000	41000	41000

ISA + 20°C

WEIGHT (1000 KG)	OPTIMUM ALT (FT)	TAT (°C)	MARGIN TO INITIAL BUFFET 'G' (BANK ANGLE)				
			1.20 (33°)	1.25 (36°)	1.30 (39°)	1.40 (44°)	1.50 (48°)
70	34300	-3	35700*	35700*	35700*	35700*	35100
65	35800	-7	37200*	37200*	37200*	37200*	36600
60	37500	-7	38700*	38700*	38700*	38700*	38300
55	39300	-7	40200*	40200*	40200*	40200*	40100
50	41000	-7	41000	41000	41000	41000	41000
45	41000	-7	41000	41000	41000	41000	41000
40	41000	-7	41000	41000	41000	41000	41000
35	41000	-7	41000	41000	41000	41000	41000

***Denotes altitude thrust limited in level flight, 100 fpm residual rate of climb.**

Long Range Cruise Trip Fuel and Time
Ground to Air Miles Conversion

AIR DISTANCE (NM)					GROUND DISTANCE (NM)	AIR DISTANCE (NM)				
HEADWIND COMPONENT (KTS)						TAILWIND COMPONENT (KTS)				
100	80	60	40	20		20	40	60	80	100
278	258	240	225	212	200	190	181	173	166	159
551	513	479	450	424	400	381	364	349	334	322
823	767	717	673	635	600	573	548	524	504	485
1095	1021	955	897	846	800	764	731	700	673	648
1366	1274	1192	1120	1057	1000	955	914	877	842	811
1636	1527	1429	1344	1268	1200	1147	1098	1053	1011	974
1906	1780	1666	1567	1480	1400	1338	1281	1229	1181	1137
2175	2032	1903	1790	1691	1600	1530	1465	1405	1350	1300
2443	2283	2139	2013	1901	1800	1721	1648	1581	1520	1464
2711	2535	2375	2236	2112	2000	1913	1832	1757	1689	1627
2978	2785	2611	2458	2323	2200	2104	2016	1934	1859	1791
3245	3035	2846	2681	2534	2400	2296	2199	2110	2028	1954
3511	3285	3081	2903	2744	2600	2488	2383	2287	2198	2118
3776	3534	3316	3125	2955	2800	2679	2567	2463	2368	2281
4041	3783	3550	3346	3165	3000	2871	2751	2640	2538	2445
4305	4032	3784	3568	3375	3200	3062	2935	2816	2708	2609
4569	4280	4018	3789	3586	3400	3254	3119	2993	2878	2773
4831	4527	4252	4011	3796	3600	3446	3302	3170	3048	2936
5093	4774	4485	4232	4006	3800	3637	3486	3346	3218	3100
5355	5021	4718	4453	4216	4000	3829	3670	3523	3388	3264
5616	5267	4951	4674	4426	4200	4021	3854	3699	3557	3428
5876	5513	5184	4894	4636	4400	4212	4038	3876	3727	3592
6136	5758	5416	5114	4846	4600	4404	4221	4052	3897	3755
6395	6003	5648	5335	5055	4800	4595	4405	4229	4067	3919
6653	6247	5879	5555	5265	5000	4787	4589	4405	4237	4083

Long Range Cruise Trip Fuel and Time

Reference Fuel and Time Required

AIR DIST (NM)	PRESSURE ALTITUDE (1000 FT)									
	29		31		33		35		37	
	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)
200	1.4	0:38	1.4	0:37	1.4	0:37	1.4	0:36	1.4	0:36
400	2.4	1:08	2.4	1:07	2.4	1:06	2.3	1:05	2.3	1:04
600	3.4	1:39	3.4	1:37	3.3	1:34	3.3	1:33	3.2	1:31
800	4.5	2:09	4.4	2:06	4.3	2:03	4.2	2:00	4.1	1:59
1000	5.5	2:39	5.4	2:36	5.2	2:31	5.1	2:28	5.0	2:26
1200	6.5	3:09	6.4	3:04	6.2	2:59	6.1	2:56	6.0	2:53
1400	7.6	3:38	7.4	3:33	7.2	3:27	7.1	3:23	6.9	3:20
1600	8.7	4:07	8.4	4:01	8.2	3:55	8.0	3:50	7.8	3:47
1800	9.7	4:37	9.5	4:30	9.2	4:23	9.0	4:18	8.8	4:14
2000	10.8	5:06	10.5	4:58	10.2	4:51	9.9	4:45	9.7	4:41
2200	11.9	5:34	11.6	5:26	11.3	5:18	11.0	5:12	10.7	5:08
2400	13.0	6:03	12.7	5:53	12.3	5:45	12.0	5:39	11.7	5:34
2600	14.1	6:31	13.7	6:21	13.4	6:12	13.0	6:06	12.7	6:01
2800	15.3	6:59	14.8	6:49	14.4	6:39	14.0	6:33	13.7	6:28
3000	16.4	7:28	15.9	7:16	15.5	7:06	15.0	7:00	14.7	6:55
3200	17.5	7:55	17.0	7:43	16.6	7:33	16.1	7:26	15.8	7:21
3400	18.7	8:22	18.2	8:10	17.7	8:00	17.2	7:53	16.9	7:48
3600	19.9	8:50	19.3	8:37	18.8	8:27	18.2	8:20	18.0	8:14
3800	21.1	9:17	20.5	9:04	19.9	8:53	19.3	8:46	19.1	8:41
4000	22.2	9:44	21.6	9:31	21.0	9:20	20.4	9:13	20.1	9:07
4200	23.5	10:11	22.8	9:58	22.1	9:47	21.6	9:39	21.3	9:34
4400	24.7	10:38	24.0	10:24	23.3	10:13	22.7	10:06	22.5	10:00
4600	25.9	11:05	25.2	10:51	24.4	10:39	23.9	10:32	23.7	10:27
4800	27.2	11:31	26.4	11:17	25.6	11:06	25.0	10:59	24.9	10:53
5000	28.4	11:58	27.6	11:44	26.8	11:32	26.2	11:25	26.1	11:20

Fuel Required Adjustments (1000 KG)

REFERENCE FUEL REQUIRED (1000 KG)	LANDING WEIGHT (1000 KG)			
	30	40	50	60
5	-0.8	-0.4	0.0	0.7
10	-1.7	-0.9	0.0	1.5
15	-2.5	-1.3	0.0	2.5
20	-3.4	-1.8	0.0	3.7
25	-4.3	-2.3	0.0	5.1
30	-5.2	-2.7	0.0	6.6

Based on 280/.78 climb, Long Range Cruise and .78/280/250 descent.

Long Range Cruise Step Climb
Ground to Air Miles Conversion

AIR DISTANCE (NM)					GROUND DISTANCE (NM)	AIR DISTANCE (NM)				
HEADWIND COMPONENT (KTS)						TAILWIND COMPONENT (KTS)				
100	80	60	40	20		20	40	60	80	100
1325	1244	1173	1109	1052	1000	953	911	872	836	803
1843	1733	1636	1549	1471	1400	1336	1277	1224	1174	1129
2360	2222	2099	1989	1890	1800	1718	1644	1576	1513	1455
2876	2710	2561	2428	2309	2200	2101	2011	1928	1852	1781
3392	3197	3023	2868	2727	2600	2484	2378	2281	2191	2108
3907	3684	3485	3307	3146	3000	2867	2745	2633	2530	2435
4421	4170	3947	3746	3565	3400	3250	3113	2986	2870	2762
4934	4656	4408	4185	3983	3800	3633	3480	3339	3210	3090
5448	5142	4869	4624	4402	4200	4016	3847	3693	3550	3417
5961	5628	5330	5062	4820	4600	4399	4215	4046	3890	3745
6474	6113	5791	5501	5238	5000	4782	4583	4399	4230	4073

Trip Fuel and Time Required

AIR DIST (NM)	TRIP FUEL (1000 KG)				TIME (HR:MIN)
	LANDING WEIGHT (1000 KG)				
	30	40	50	60	
1000	3.7	4.3	5.0	5.7	2:27
1400	5.1	5.9	6.8	7.9	3:22
1800	6.5	7.5	8.7	10.1	4:16
2200	7.8	9.1	10.7	12.3	5:10
2600	9.3	10.8	12.6	14.7	6:04
3000	10.7	12.5	14.7	17.1	6:58
3400	12.2	14.2	16.8	19.5	7:51
3800	13.7	16.0	19.0	22.1	8:44
4200	15.3	17.9	21.2	24.7	9:37
4600	16.9	19.8	23.5	27.4	10:30
5000	18.5	21.8	25.9	30.1	11:23

Based on 280/.78 climb, Long Range Cruise, and .78/280/250 descent.
Valid for all pressure altitudes with 4000 ft step climb to 2000 ft above optimum altitude.

Short Trip Fuel and Time

Ground to Air Miles Conversion

AIR DISTANCE (NM) HEADWIND COMPONENT (KTS)					GROUND DISTANCE (NM)	AIR DISTANCE (NM) TAILWIND COMPONENT (KTS)				
100	80	60	40	20		20	40	60	80	100
92	79	69	61	55	50	46	42	39	37	34
157	141	128	117	108	100	93	87	82	77	73
222	203	186	172	160	150	141	133	125	119	113
287	264	244	228	213	200	189	178	169	161	153
351	325	302	283	265	250	236	224	213	203	194
415	385	360	337	318	300	284	270	257	246	235
478	446	417	392	370	350	332	316	301	288	276
542	506	475	447	422	400	380	362	346	331	317
607	568	533	502	475	450	428	408	389	373	357
673	629	591	557	527	500	476	453	433	415	398

Trip Fuel and Time Required

AIR DIST (NM)		LANDING WEIGHT (1000 KG) 30	35	40	45	50	55	60	TIME (HRS:MIN)
50	FUEL (1000 KG)	0.5	0.5	0.5	0.6	0.6	0.6	0.7	0:14
	ALT (FT)	13000	11000	11000	11000	11000	9000	9000	
100	FUEL (1000 KG)	0.7	0.8	0.8	0.9	0.9	1.0	1.0	0:22
	ALT (FT)	21000	21000	19000	19000	19000	19000	17000	
150	FUEL (1000 KG)	0.9	1.0	1.1	1.1	1.2	1.3	1.3	0:30
	ALT (FT)	29000	29000	27000	25000	25000	25000	23000	
200	FUEL (1000 KG)	1.1	1.2	1.3	1.4	1.4	1.5	1.6	0:37
	ALT (FT)	41000	39000	35000	31000	29000	29000	27000	
250	FUEL (1000 KG)	1.3	1.4	1.5	1.6	1.7	1.8	1.9	0:43
	ALT (FT)	41000	41000	41000	37000	37000	35000	35000	
300	FUEL (1000 KG)	1.4	1.6	1.7	1.8	1.9	2.0	2.1	0:50
	ALT (FT)	41000	41000	41000	41000	39000	37000	35000	
350	FUEL (1000 KG)	1.6	1.7	1.9	2.0	2.1	2.3	2.4	0:57
	ALT (FT)	41000	41000	41000	41000	39000	37000	35000	
400	FUEL (1000 KG)	1.8	1.9	2.0	2.2	2.3	2.5	2.6	1:03
	ALT (FT)	41000	41000	41000	41000	39000	37000	37000	
450	FUEL (1000 KG)	1.9	2.1	2.2	2.4	2.5	2.7	2.9	1:10
	ALT (FT)	41000	41000	41000	41000	41000	39000	37000	
500	FUEL (1000 KG)	2.1	2.3	2.4	2.6	2.8	3.0	3.1	1:18
	ALT (FT)	41000	41000	41000	41000	41000	39000	37000	

Based on 280/.78 climb, Long Range Cruise and .78/280/250 descent.

Holding Planning

Flaps Up

WEIGHT (1000 KG)	TOTAL FUEL FLOW (KG/HR)								
	PRESSURE ALTITUDE (FT)								
	1500	5000	10000	15000	20000	25000	30000	35000	41000
70	2490	2450	2420	2400	2360	2330	2390	2470	
65	2330	2290	2260	2230	2200	2150	2210	2260	
60	2180	2130	2100	2070	2040	1980	2020	2060	2330
55	2020	1970	1940	1910	1870	1830	1840	1880	2030
50	1870	1820	1780	1750	1710	1680	1690	1710	1810
45	1720	1660	1650	1610	1580	1550	1530	1530	1610
40	1600	1550	1490	1450	1420	1400	1380	1360	1420
35	1450	1400	1350	1310	1280	1250	1230	1210	1240

This table includes 5% additional fuel for holding in a racetrack pattern.

Flight Crew Oxygen Requirements

Required Pressure (PSI) for 76 Cu. Ft. Cylinder

BOTTLE TEMPERATURE		NUMBER OF CREW USING OXYGEN		
°C	°F	2	3	4
50	122	735	1055	1360
45	113	725	1040	1340
40	104	715	1020	1320
35	95	700	1005	1300
30	86	690	990	1280
25	77	680	975	1255
20	68	670	960	1240
15	59	655	940	1215
10	50	645	925	1195
5	41	635	910	1175
0	32	620	890	1150
-5	23	610	875	1130
-10	14	600	860	1110

Required Pressure (PSI) for 114/115 Cu. Ft. Cylinder

BOTTLE TEMPERATURE		NUMBER OF CREW USING OXYGEN		
°C	°F	2	3	4
50	122	530	735	945
45	113	520	725	930
40	104	510	715	915
35	95	505	700	900
30	86	495	690	885
25	77	485	680	870
20	68	480	670	860
15	59	470	655	840
10	50	460	645	830
5	41	455	635	815
0	32	445	620	800
-5	23	440	610	785
-10	14	430	600	770

ENGINE INOP

MAX CONTINUOUS THRUST

Net Level Off Weight

PRESSURE ALTITUDE (1000 FT)	LEVEL OFF WEIGHT (1000 KG)		
	ISA + 10°C & BELOW	ISA + 15°C	ISA + 20°C
30	43.7	42.4	40.9
28	47.3	45.7	44.2
26	51.0	49.3	47.8
24	54.5	52.8	51.0
22	57.7	55.8	53.7
20	61.0	58.7	56.1
18	64.2	61.6	58.6
16	67.3	64.3	61.0
14	70.7	67.4	64.0

Anti-Ice Adjustment

ANTI-ICE CONFIGURATION	LEVEL OFF WEIGHT ADJUSTMENT (1000 KG)								
	PRESSURE ALTITUDE (1000 FT)								
	14	16	18	20	22	24	26	28	30
ENGINE ONLY	-2.1	-1.9	-1.8	-1.8	-1.6	-1.4	-1.2	-1.1	-1.0
ENGINE & WING	-8.1	-7.5	-7.0	-6.6	-5.9	-5.3	-4.9	-4.6	

Performance Dispatch — Chapter PD
Landing — Section 12

Landing Field Limit Weight - Dry Runway
Flaps 40
Based on anti-skid operative and automatic speedbrakes
Wind Corrected Field Length (M)

FIELD LENGTH AVAILABLE (M)	WIND COMPONENT (KTS)							
	-15	-10	-5	0	10	20	30	40
1000		800	900	1000	1070	1140	1200	1280
1200	900	990	1090	1200	1270	1350	1420	1500
1400	1070	1170	1280	1400	1480	1560	1640	1720
1600	1250	1360	1470	1600	1680	1770	1860	1950
1800	1430	1550	1660	1800	1890	1980	2080	2170
2000	1610	1730	1860	2000	2090	2180	2290	2390
2200	1780	1920	2050	2200	2290	2390	2510	2620
2400	1960	2110	2240	2400	2500	2600	2730	
2600	2140	2290	2430	2600	2700			
2800	2320	2480	2620	2800				

Field Limit Weight (1000 KG)

WIND CORR'D FIELD LENGTH (M)	AIRPORT PRESSURE ALTITUDE (FT)					
	0	2000	4000	6000	8000	10000
1000	36.8					
1200	47.5	44.6	42.0	39.4	36.9	
1400	57.4	54.8	51.7	48.6	45.6	42.7
1600	66.2	62.7	59.7	56.8	54.1	50.7
1800	72.5	70.8	67.4	63.6	60.5	57.5
2000		72.5	72.5	70.7	67.2	63.4
2200				72.5	72.5	69.7

Decrease field limit weight by 4450 kg when using manual speedbrakes.

Landing Field Limit Weight - Dry Runway
Flaps 40
Based on anti-skid inoperative and manual speedbrakes
Wind Corrected Field Length (M)

FIELD LENGTH AVAILABLE (M)	WIND COMPONENT (KTS)							
	-15	-10	-5	0	10	20	30	40
1800				1800	1940	2100	2260	2390
2000			1750	2000	2150	2310	2480	2620
2200		1720	1940	2200	2360	2520	2700	2850
2400	1680	1910	2140	2400	2560	2740	2920	3070
2600	1850	2090	2330	2600	2770	2950	3140	3300
2800	2030	2280	2520	2800	2980	3160	3350	3530
3000	2200	2460	2720	3000	3180	3370	3570	3760
3200	2380	2640	2910	3200	3390	3580	3790	3980
3400	2550	2830	3100	3400	3590	3800	4010	4210
3600	2730	3010	3290	3600	3800	4010	4230	4440
3800	2900	3200	3490	3800	4010	4220	4450	4660
4000	3080	3380	3680	4000	4210	4430	4670	4890
4200	3250	3560	3870	4200	4420	4640	4890	5120
4400	3430	3750	4070	4400	4630	4860	5110	5350
4600	3600	3930	4260	4600	4830	5070	5330	5570
4800	3780	4120	4450	4800	5040	5280	5540	5800
5000	3950	4300	4650	5000	5240	5490	5760	6030
5200	4130	4480	4840	5200	5450	5700	5980	6250
5400	4310	4670	5030	5400	5660	5920	6200	6480
5600	4480	4850	5230	5600	5860	6130	6420	6710

Field Limit Weight (1000 KG)

WIND CORR'D FIELD LENGTH (M)	AIRPORT PRESSURE ALTITUDE (FT)					
	0	2000	4000	6000	8000	10000
2000	37.7					
2200	42.9	40.3	37.3			
2400	48.1	45.2	42.0	39.2	36.5	
2600	53.4	50.2	46.7	43.6	40.6	37.8
2800	58.6	55.1	51.3	48.0	44.8	41.7
3000	63.8	60.0	55.9	52.3	48.9	45.5
3200	69.5	64.9	60.5	56.6	52.9	49.3
3400	72.5	70.1	65.1	60.8	56.8	53.0
3600		72.5	69.9	65.0	60.7	56.7
3800			72.5	69.6	64.7	60.3
4000				72.5	69.0	64.0
4200					72.5	68.1
4400						71.8
4600						72.5

Landing Field Limit Weight - Wet Runway
Flaps 40
Based on anti-skid operative and automatic speedbrakes
Wind Corrected Field Length (M)

FIELD LENGTH AVAILABLE (M)	WIND COMPONENT (KTS)							
	-15	-10	-5	0	10	20	30	40
1000				1000	1080	1150	1220	1300
1200		970	1080	1200	1280	1360	1440	1520
1400	1050	1150	1270	1400	1490	1570	1650	1750
1600	1230	1340	1460	1600	1690	1780	1870	1970
1800	1400	1530	1650	1800	1890	1990	2090	2190
2000	1580	1710	1850	2000	2100	2200	2310	2420
2200	1760	1900	2040	2200	2300	2410	2530	2640
2400	1940	2090	2230	2400	2510	2620	2750	2860
2600	2110	2270	2420	2600	2710	2830	2960	3090
2800	2290	2460	2610	2800	2910	3030	3180	
3000	2470	2650	2810	3000	3120			
3200	2650	2830	3000	3200				

Field Limit Weight (1000 KG)

WIND CORR'D FIELD LENGTH (M)	AIRPORT PRESSURE ALTITUDE (FT)					
	0	2000	4000	6000	8000	10000
1200	39.1	36.7				
1400	48.4	45.5	42.8	40.2	37.7	
1600	57.1	54.4	51.3	48.2	45.3	42.3
1800	64.5	61.3	58.5	55.6	52.6	49.3
2000	71.9	68.5	64.8	61.6	58.6	55.7
2200	72.5	72.5	71.4	67.9	64.1	60.8
2400			72.5	72.5	69.9	66.3
2600					72.5	71.5

Decrease field limit weight by 4450 kg when using manual speedbrakes.

Landing Field Limit Weight - Wet Runway

Flaps 40

Based on anti-skid inoperative and manual speedbrakes

Wind Corrected Field Length (M)

FIELD LENGTH AVAILABLE (M)	WIND COMPONENT (KTS)							
	-15	-10	-5	0	10	20	30	40
1800					1960	2130	2300	2450
2000				2000	2160	2340	2520	2670
2200			1920	2200	2370	2550	2740	2900
2400		1860	2110	2400	2580	2760	2960	3130
2600		2050	2300	2600	2780	2980	3180	3350
2800	1960	2230	2500	2800	2990	3190	3400	3580
3000	2140	2410	2690	3000	3190	3400	3620	3810
3200	2310	2600	2880	3200	3400	3610	3840	4040
3400	2490	2780	3070	3400	3610	3820	4050	4260
3600	2660	2970	3270	3600	3810	4040	4270	4490
3800	2840	3150	3460	3800	4020	4250	4490	4720
4000	3010	3340	3650	4000	4230	4460	4710	4940
4200	3190	3520	3850	4200	4430	4670	4930	5170
4400	3370	3700	4040	4400	4640	4880	5150	5400
4600	3540	3890	4230	4600	4840	5100	5370	5630
4800	3720	4070	4430	4800	5050	5310	5590	5850
5000	3890	4260	4620	5000	5260	5520	5810	6080
5200	4070	4440	4810	5200	5460	5730	6030	6310
5400	4240	4620	5010	5400	5670	5940	6240	6530
5600	4420	4810	5200	5600	5880	6160	6460	6760

Field Limit Weight (1000 KG)

WIND CORR'D FIELD LENGTH (M)	AIRPORT PRESSURE ALTITUDE (FT)					
	0	2000	4000	6000	8000	10000
2400	40.0	37.5				
2600	44.5	41.8	38.7	36.1		
2800	49.0	46.1	42.8	39.9	37.2	
3000	53.6	50.4	46.9	43.8	40.8	37.9
3200	58.1	54.7	50.9	47.6	44.4	41.3
3400	62.6	58.9	54.9	51.4	48.0	44.7
3600	67.7	63.2	58.9	55.1	51.5	48.0
3800	72.0	67.8	62.8	58.8	54.9	51.2
4000	72.5	71.9	67.1	62.4	58.3	54.4
4200		72.5	71.1	66.3	61.7	57.6
4400			72.5	70.2	65.3	60.8
4600				72.5	69.0	64.0
4800					72.1	67.6
5000					72.5	70.8
5200						72.5

Landing Climb Limit Weight

Valid for approach with Flaps 15 and landing with Flaps 40

Based on engine bleed for packs on and anti-ice off

AIRPORT OAT (°C)	LANDING CLIMB LIMIT WEIGHT (1000 KG)						
	AIRPORT PRESSURE ALTITUDE (FT)						
	-2000	0	2000	4000	6000	8000	10000
54	56.7	54.1					
52	57.8	55.2					
50	59.0	56.3	52.7				
48	60.2	57.5	53.8				
46	61.4	58.6	54.8	51.2			
44	62.6	59.8	55.9	52.2			
42	63.9	60.9	57.0	53.2	49.1		
40	65.2	62.1	58.1	54.2	50.1		
38	66.5	63.4	59.3	55.3	51.1	46.3	
36	67.7	64.7	60.5	56.4	52.2	47.2	
34	69.0	66.0	61.6	57.5	53.2	48.2	44.3
32	69.0	67.3	62.8	58.6	54.2	49.1	45.2
30	69.1	68.5	64.0	59.7	55.1	50.1	46.1
28	69.2	68.6	65.1	60.7	56.1	51.0	47.0
26	69.2	68.7	66.3	61.8	57.2	51.9	47.9
24	69.3	68.7	66.4	63.0	58.2	52.8	48.8
22	69.4	68.8	66.4	64.1	59.3	53.9	49.7
20	69.4	68.8	66.5	64.2	60.3	54.9	50.6
18	69.5	68.9	66.5	64.2	61.3	56.1	51.5
16	69.5	68.9	66.6	64.2	61.3	57.4	52.4
14	69.6	69.0	66.6	64.3	61.4	58.5	53.5
12	69.6	69.0	66.6	64.3	61.4	58.6	54.7
10	69.7	69.1	66.7	64.4	61.4	58.6	55.7
-40	70.2	69.5	67.2	64.9	61.9	59.0	56.0

With engine bleed for packs off, increase weight by 1050 kg.
With engine anti-ice on, decrease weight by 200 kg.
With engine and wing anti-ice on, decrease weight by 800 kg.
When operating in icing conditions during any part of the flight with forecast landing temperature below 10°C, decrease weight by 4550 kg.

ENGINE INOP

ADVISORY INFORMATION

Go-Around Climb Gradient

Flaps 15

Based on engine bleed for packs on and anti-ice off

OAT (°C)	REFERENCE GO-AROUND GRADIENT (%)					
	PRESSURE ALTITUDE (FT)					
	0	2000	4000	6000	8000	10000
54	2.76					
50	3.30	2.41				
46	3.87	2.93	2.04			
42	4.43	3.46	2.52	1.56		
38	5.03	4.02	3.05	2.03	0.87	
34	5.65	4.60	3.59	2.53	1.32	
30	6.27	5.17	4.11	3.00	1.79	0.84
26	6.31	5.72	4.63	3.49	2.22	1.27
22	6.33	5.74	5.19	4.02	2.69	1.70
18	6.36	5.77	5.21	4.51	3.25	2.13
14	6.38	5.79	5.23	4.53	3.85	2.63
10	6.41	5.81	5.25	4.54	3.87	3.19

Gradient Adjustment for Weight (%)

WEIGHT (1000 KG)	REFERENCE GO-AROUND GRADIENT (%)							
	0	1	2	3	4	5	6	7
65	-2.35	-2.53	-2.84	-3.11	-3.36	-3.61	-3.86	-4.08
60	-1.72	-1.84	-2.06	-2.25	-2.43	-2.61	-2.79	-2.96
55	-0.93	-1.01	-1.13	-1.24	-1.34	-1.44	-1.53	-1.62
50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
45	1.12	1.24	1.36	1.48	1.61	1.74	1.87	2.01
40	2.53	2.84	3.09	3.36	3.65	3.96	4.24	4.60

Gradient Adjustment for Speed (%)

SPEED (KIAS)	WEIGHT ADJUSTED GO-AROUND GRADIENT (%)											
	0	1	2	3	4	5	6	7	8	9	10	11
VREF40	-0.33	-0.34	-0.35	-0.36	-0.36	-0.36	-0.36	-0.36	-0.36	-0.36	-0.36	-0.36
VREF40+5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
VREF40+10	0.17	0.18	0.18	0.19	0.19	0.19	0.18	0.18	0.18	0.18	0.18	0.17
VREF40+15	0.28	0.29	0.29	0.29	0.28	0.27	0.26	0.25	0.24	0.24	0.24	0.22
VREF40+20	0.32	0.33	0.32	0.30	0.27	0.25	0.23	0.22	0.21	0.20	0.19	0.18
VREF40+25	0.31	0.29	0.25	0.21	0.18	0.15	0.13	0.11	0.09	0.08	0.06	0.04
VREF40+30	0.24	0.19	0.12	0.05	-0.02	-0.06	-0.08	-0.09	-0.11	-0.13	-0.17	-0.19

With engine bleed for packs off, increase gradient by 0.3%.
With engine anti-ice on, decrease gradient by 0.1%.
With engine and wing anti-ice on, decrease gradient by 0.3% .
When operating in icing conditions during any part of the flight with forecast landing temperatures below 10°C, decrease gradient by 0.6%.

Quick Turnaround Limit Weight - Category D Steel and Carbon Brakes

Flaps 40

OAT (°C)	AIRPORT PRESSURE ALTITUDE (FT)					
	0	2000	4000	6000	8000	10000
54	71.8					
50	72.2	69.5				
45	72.5	70.0	67.4			
40	72.5	70.6	67.9	65.0		
35	72.5	71.2	68.5	65.8	62.9	
30	72.5	71.8	69.0	66.3	63.4	60.8
25	72.5	72.4	69.6	66.9	63.9	61.3
20	72.5	72.5	70.2	67.4	64.5	61.8
15	72.5	72.5	70.8	68.0	65.1	62.4
10	72.5	72.5	71.4	68.6	65.9	62.9
5	72.5	72.5	72.1	69.2	66.5	63.5
0	72.5	72.5	72.5	69.9	67.1	64.1
-5	72.5	72.5	72.5	70.5	67.7	64.7
-10	72.5	72.5	72.5	71.2	68.4	65.4
-15	72.5	72.5	72.5	71.9	69.0	66.2
-20	72.5	72.5	72.5	72.5	69.7	66.8
-30	72.5	72.5	72.5	72.5	71.1	68.2
-40	72.5	72.5	72.5	72.5	72.5	69.6
-50	72.5	72.5	72.5	72.5	72.5	71.2
-54	72.5	72.5	72.5	72.5	72.5	71.8

**Increase weight by 650 kg per 1% uphill slope. Decrease weight by 950 kg per 1% downhill slope.
Increase weight by 1800 kg per 10 knots headwind. Decrease weight by 6350 kg per 10 knots tailwind.
After landing at weights exceeding those shown above, adjusted for slope and wind, wait at least 62 minutes and check that wheel thermal plugs have not melted before executing a subsequent takeoff.**

The following procedure is only applicable to steel brakes,

As an alternate procedure, ensure that each brake pressure plate temperature, without artificial cooling, is less than 218°C as follows:

No sooner than 10 and no later than 15 minutes after parking, measure each brake pressure plate surface temperature at a minimum of two points per brake by an accurate method (using a Doric Microtemp 450 hand held thermometer or equivalent, hold temperature probe in place for 20 seconds or until reading stabilizes). If each measured temperature is less than 218°C, immediate dispatch is allowed; otherwise the required minimum ground wait period of 62 minutes applies.

The following procedure is applicable to steel and carbon brakes, if a Brake Temperature Monitoring System (BTMS) is installed:

**No sooner than 10 and no later than 15 minutes after parking, check the BRAKE TEMP light. If the BRAKE TEMP light is not on, no ground waiting period is required. If the BRAKE TEMP light is on, do not dispatch until at least 62 minutes after landing, or until all the BTMS readings on the systems Display are below 3.5 and the BRAKE TEMP light is off. Check that wheel thermal plugs have not melted before making a subsequent takeoff.
Note: If any brake temperature display digit is blank or indicates 0.0 or 0.1, then this method cannot be used.**

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Performance Dispatch — Chapter PD
Gear Down — Section 13

GEAR DOWN

Gear Down

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Introduction

This chapter contains self dispatch performance data intended primarily for use by flight crews in the event that information cannot be obtained from the airline dispatch office. The takeoff data provided is for a single takeoff flap at max takeoff thrust. The range of conditions covered is limited to those normally encountered in airline operation. In the event of conflict between the data presented in this chapter and that contained in the approved Airplane Flight Manual, the Flight Manual shall always take precedence.

Takeoff

The maximum allowable takeoff weight will be the least of the Field, Climb, Obstacle, Brake Energy and Tire Speed Limit Weights as determined from the tables shown.

Brake Energy or Tire Speed Limit Weight tables are only provided if they are limiting for the range of conditions covered in the FCOM Section PD.

Field Limit Weight - Slope and Wind Corrections

These tables for dry and wet runways provide corrections to the field length available for the effects of runway slope and wind component along the runway. Enter the appropriate table with the available field length and runway slope to determine the slope corrected field length. Next enter the appropriate table with slope corrected field length and wind component to determine the slope and wind corrected field length.

Field and Climb Limit Weight

Tables are presented for selected airport pressure altitudes and runway conditions and show both Field and Climb Limit Weights. Enter the appropriate table for pressure altitude and runway condition with “Slope and Wind Corrected Field Length” determined above and airport OAT to obtain Field Limit Weight. Also read Climb Limit Weight for the same OAT. Intermediate altitudes may be interpolated or use next higher altitude. When finding a maximum weight for a wet runway, the dry runway limit weight must also be determined and the lower of the two weights used.

Obstacle Limit Weight

The Reference Obstacle Limit Weight table provides obstacle limit weights for reference airport conditions based on obstacle height above the runway surface and distance from brake release. Enter the adjustment tables to adjust the reference Obstacle Limit Weight for the effects of OAT, pressure altitude and wind as indicated. In the case of multiple obstacles, enter the tables successively with each obstacle and determine the most limiting weight.

Tire Speed Limit

Tire Speed Limit Weight tables are only provided if they are limiting for the range of conditions covered in the FCOM Section PD.

Maximum tire speed limited weights are presented for 225 MPH tires. To determine the tire speed limit weight, enter the table with OAT and airport pressure altitude. Adjust the tire speed limit weight according to the notes below the table to account for wind.

Brake Energy Limit VMBE

Brake Energy Limit Weight tables are only provided if they are limiting for the range of conditions covered in the FCOM Section PD.

The Maximum Brake Energy Speed table provides the Reference VMBE for a variety of airport pressure altitudes and temperatures. Enter the Weight Adjusted VMBE table to adjust the Reference VMBE for the actual brake release gross weight. Correct VMBE for slope and wind. If V1 exceeds VMBE, decrease brake release weight as indicated for each knot that V1 exceeds VMBE and determine V1, VR, and V2 for the lower brake release weight.

Enroute

Long Range Cruise Maximum Operating Altitude

These tables provide the maximum operating altitude in the same manner as the FMC. Maximum altitudes are shown for a given cruise weight and maneuver capability. Note that this table considers both thrust and buffet limits, providing the more limiting of the two. Any data that is thrust limited is denoted by an asterisk and represents only a thrust limited condition in level flight with 100 ft/min residual rate of climb. Flying above these altitudes with sustained banks in excess of approximately 15° may cause the airplane to lose speed and/or altitude. The altitudes shown in the table are limited to the maximum certified altitude of 41000 ft.

Long Range Cruise Trip Fuel and Time

Long Range Cruise Trip Fuel and Time tables are provided to determine trip time and fuel required to destination.

To determine trip fuel and time for a constant altitude cruise, first enter the Ground to Air Miles Conversion table to convert ground distance and enroute wind to an equivalent still air distance for use with the Reference Fuel and Time tables. Next, enter the Reference Fuel and Time table with air distance from the Ground to Air Miles Conversion table and the desired altitude and read Reference Fuel and Time Required. Lastly, enter the Fuel Required Adjustment table with the Reference Fuel and the planned landing weight to obtain the adjustment to the fuel required at the planned landing weight.

Long Range Cruise Step Climb Trip Fuel and Time

The Long Range Cruise Step Climb Trip Fuel and Time tables are provided to determine trip time and fuel required to destination when flying a step climb profile. Step climb profiles are based on 4000 ft step climbs to keep the flight within 2000 ft of the optimum altitude for the current cruise weight. To determine trip fuel and time, enter the Ground to Air Miles Conversion table and determine air distance as discussed above. Then enter the Trip Fuel and Time Required table with air distance and planned landing weight to read trip fuel. Continue across the table to read trip time.

Short Trip Fuel and Time

These tables are provided to determine trip fuel and time for short distances or alternates. Obtain air distance from the table using the ground distance and wind component to the alternate. Enter the Trip Fuel and Time Required table with air distance and read trip fuel required for the expected landing weight, together with time to alternate at right. For distances greater than shown or other altitudes, use the Long Range Cruise Trip Fuel and Time tables.

Holding Planning

This table provides total fuel flow information necessary for planning flaps up holding and reserve fuel requirements. Data is based on the FMC holding speed schedule which is the higher of the maximum endurance and flaps up maneuver speeds. As noted, the fuel flow is based on flight in a racetrack holding pattern. For holding in straight and level flight, reduce table values by 5%.

Flight Crew Oxygen Requirements

This airplane is equipped with a chemical passenger oxygen system. Regulations require that sufficient oxygen be provided to the flight crew to account for the greater of supplemental breathing oxygen in the event of a cabin depressurization or protective breathing in the event of smoke or harmful fumes in the flight deck. The oxygen quantity associated with the above requirements is achieved with the minimum dispatch oxygen cylinder pressure.

To determine the minimum dispatch oxygen cylinder pressure enter the appropriate flight crew oxygen table with the number of crew plus observers using oxygen and read the minimum cylinder pressure required for the appropriate cylinder temperature.

Net Level Off Weight

The Net Level Off Weight table is provided to determine terrain clearance capability in straight and level flight following an engine failure. Regulations require terrain clearance planning based on net performance which is the gross (or actual) gradient performance degraded by 1.1%. In addition, the net level off pressure altitude must clear the terrain by 1000 ft.

To determine the maximum weight for terrain clearance, enter the table with required net level off pressure altitude and expected ISA deviation to obtain weight. Adjust weight for anti-ice operation as noted below the table.

Landing

Tables are provided for determining the maximum landing weight as limited by field length or climb requirements for a single landing flap.

Maximum landing weight is the lowest of the field length limit weight, climb limit weight, or maximum certified landing weight.

Landing Field Limit Weight

For the expected runway condition and anti-skid system configuration, obtain wind corrected field length by entering the Wind Corrected Field Length table with field length available and wind component along the runway. Now enter the Field Limit Weight table with wind corrected field length and pressure altitude to read field limit weight.

Landing Climb Limit Weight

Enter the table with airport OAT and pressure altitude to read landing climb limit weight. Apply the noted adjustments as required.

Go-Around Climb Gradient

Enter the Reference Go-Around Gradient table with airport OAT and pressure altitude to determine the reference go-around gradient. Then adjust the reference gradient for airplane weight and speed using the tables provided to determine the weight and speed adjusted go-around gradient. Apply the necessary corrections for engine bleed configuration and icing conditions as noted.

Quick Turnaround Limit Weight

Enter the appropriate table (Steel or Carbon Brakes) with airport pressure altitude and OAT to read maximum quick turnaround weight. Apply the noted adjustments as required.

If the landing weight exceeds the maximum quick turnaround weight, wait the specified time and then check that the wheel thermal plugs have not melted before executing a subsequent takeoff. For Steel Brakes, the alternate procedures on the charts can be used to ensure the brake temperature is within limits. These procedures cannot be used for carbon brakes.

Gear Down

This section provides flight planning data for revenue operation with gear down. Unless otherwise noted, the gear down tables in this section are identical in format and usage to the corresponding gear up tables previously described.

To eliminate erroneous displays the flight crew should enter only gross weight data on the PERF INIT page of the Control Display Unit (CDU). Omission of the cost index and cruise altitude entries on the PERF INIT page will render the VNAV function unavailable during flight. As a result, the following information will not be provided: VNAV guidance and speed schedules, trip fuel and ETA predictions, optimum and maximum altitude data, step climb and top of descent predictions, and the VNAV descent guidance path.

The gross weight entry allows the FMCS takeoff and approach speed schedules to be generated. In addition, the flap maneuver speed and VREF speed bugs will be available for display on the primary flight display speed tape. Except for VNAV, normal autopilot and autothrottle modes will remain available for use during the flight, as will the LNAV mode.

Takeoff/Landing Climb Limit Weight

Enter the appropriate table with airport OAT and pressure altitude to determine Takeoff/Landing Climb Limit Weight with gear down. Correct the weight obtained for engine bleed configuration as required.

Performance Dispatch — Chapter PD
Table of Contents — Section 20

737-700 CFM56-7B24 LB FAA CATF/M

Performance Dispatch Chapter PD
Pkg Model Identification Section 20

General

The table below shows the airplanes that have been identified with the following performance package. Note, some airplanes may be identified with more than one performance package. This configuration table information reflects the Boeing delivered configuration updated for service bulletin incorporations in conformance with the policy stated in the introduction section of the FCOM. The performance data is prepared for the owner/operator named on the title page. The intent of this information is to assist flight crews and airlines in knowing which performance package is applicable to a given airplane. The performance package model identification information is based on Boeing's knowledge of the airline's fleet at a point in time approximately three months prior to the page date. Notice of Errata (NOE) will not be provided to airlines to identify airplanes that are moved between performance packages within this manual or airplanes added to the airline's fleet whose performance packages are already represented in this manual. These types of changes will be updated in the next block revision. Owners/operators are responsible for ensuring the operational documentation they are using is complete and matches the current configuration of their airplanes, and the accuracy and validity of all information furnished by the owner/operator or any other party. Owners/operators receiving active revision service are responsible to ensure that any modifications to the listed airplanes are properly reflected in this manual.

Serial and tabulation number are supplied by Boeing.

Registry Number	Serial Number	Tabulation Number
YX700	YX700	YX700

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Performance Dispatch — Chapter PD
Takeoff — Section 20

Takeoff Field Corrections - Dry Runway
Slope Corrections

FIELD LENGTH AVAILABLE (FT)	SLOPE CORRECTED FIELD LENGTH (FT)								
	RUNWAY SLOPE (%)								
	-2.0	-1.5	-1.0	-0.5	0.0	0.5	1.0	1.5	2.0
4200	4250	4240	4220	4210	4200	4050	3900	3750	3600
4600	4710	4690	4660	4630	4600	4420	4250	4070	3890
5000	5180	5130	5090	5040	5000	4800	4590	4390	4190
5400	5650	5580	5520	5460	5400	5170	4940	4710	4480
5800	6110	6030	5960	5880	5800	5540	5280	5030	4770
6200	6580	6480	6390	6290	6200	5920	5630	5350	5060
6600	7040	6930	6820	6710	6600	6290	5980	5660	5350
7000	7510	7380	7260	7130	7000	6660	6320	5980	5640
7400	7980	7830	7690	7540	7400	7030	6670	6300	5930
7800	8440	8280	8120	7960	7800	7410	7010	6620	6230
8200	8910	8730	8550	8380	8200	7780	7360	6940	6520
8600	9370	9180	8990	8790	8600	8150	7700	7260	6810
9000	9840	9630	9420	9210	9000	8530	8050	7580	7100
9400	10310	10080	9850	9630	9400	8900	8400	7890	7390
9800	10770	10530	10290	10040	9800	9270	8740	8210	7680
10200	11240	10980	10720	10460	10200	9640	9090	8530	7970
10600	11700	11430	11150	10880	10600	10020	9430	8850	8270
11000	12170	11880	11590	11290	11000	10390	9780	9170	8560
11400	12640	12330	12020	11710	11400	10760	10120	9490	8850
11800	13100	12780	12450	12130	11800	11140	10470	9810	9140

Wind Corrections

SLOPE CORR'D FIELD LENGTH (FT)	SLOPE & WIND CORRECTED FIELD LENGTH (FT)							
	WIND COMPONENT (KTS)							
	-15	-10	-5	0	10	20	30	40
4200	3060	3440	3820	4200	4470	4730	4990	5230
4600	3400	3800	4200	4600	4880	5160	5420	5670
5000	3740	4160	4580	5000	5300	5580	5860	6120
5400	4080	4520	4960	5400	5710	6010	6290	6560
5800	4420	4880	5340	5800	6120	6430	6720	7000
6200	4760	5240	5720	6200	6540	6860	7160	7440
6600	5100	5600	6100	6600	6950	7280	7590	7880
7000	5440	5960	6480	7000	7360	7700	8030	8330
7400	5790	6320	6860	7400	7770	8130	8460	8770
7800	6130	6680	7240	7800	8190	8550	8890	9210
8200	6470	7040	7620	8200	8600	8980	9330	9650
8600	6810	7400	8000	8600	9010	9400	9760	10100
9000	7150	7770	8380	9000	9430	9830	10200	10540
9400	7490	8130	8760	9400	9840	10250	10630	10980
9800	7830	8490	9140	9800	10250	10670	11060	11420
10200	8170	8850	9520	10200	10670	11100	11500	11860
10600	8510	9210	9900	10600	11080	11520	11930	12310
11000	8850	9570	10280	11000	11490	11950	12370	12750
11400	9190	9930	10660	11400	11900	12370	12800	13190
11800	9530	10290	11040	11800	12320	12800	13230	13630

Takeoff Field & Climb Limit Weights - Dry Runway

Flaps 5

Sea Level Pressure Altitude

CORR'D FIELD LENGTH (FT)	FIELD LIMIT WEIGHT (1000 LB)										
	OAT (°C)										
	-40	10	14	18	22	26	30	38	42	46	50
4000	130.7	121.1	120.4	119.7	118.9	118.2	117.4	111.6	108.7	105.7	102.7
4200	134.0	124.2	123.5	122.7	122.0	121.2	120.4	114.5	111.6	108.5	105.4
4600	140.6	130.4	129.6	128.8	128.0	127.2	126.3	120.1	117.1	113.9	110.6
5000	146.9	136.2	135.4	134.5	133.7	132.9	132.0	125.5	122.3	119.0	115.6
5400	152.8	141.7	140.8	140.0	139.1	138.2	137.3	130.6	127.2	123.7	120.2
5800	158.6	147.0	146.1	145.2	144.3	143.4	142.4	135.4	132.0	128.3	124.7
6200	164.1	152.1	151.1	150.2	149.3	148.3	147.3	140.1	136.4	132.7	128.9
6600	169.5	157.0	156.0	155.1	154.1	153.1	152.1	144.5	140.8	136.8	132.9
7000	174.7	161.8	160.8	159.8	158.8	157.8	156.7	148.9	145.0	140.9	136.8
7400	179.8	166.5	165.4	164.4	163.4	162.3	161.2	153.1	149.1	144.9	140.7
7800	179.9	171.0	169.9	168.9	167.8	166.7	165.6	157.3	153.1	148.8	144.5
8200	179.9	174.9	173.8	172.8	171.6	170.5	169.4	160.9	156.6	152.2	147.7
8600	179.9	178.4	177.3	176.2	175.1	173.9	172.8	164.0	159.7	155.1	150.5
9000	179.9	179.9	179.9	179.7	178.5	177.3	176.1	167.1	162.7	158.0	153.3
9400	179.9	179.9	179.9	179.9	179.9	179.9	179.6	170.3	165.8	161.0	156.2
9800	179.9	179.9	179.9	179.9	179.9	179.9	179.9	173.5	168.8	163.9	159.0
10200	179.9	179.9	179.9	179.9	179.9	179.9	179.9	176.5	171.7	166.7	161.7
10600	179.9	179.9	179.9	179.9	179.9	179.9	179.9	179.5	174.6	169.5	164.3
CLIMB LIMIT WT (1000 LB)	163.8	162.6	162.3	162.1	161.9	161.6	161.3	149.8	144.2	138.7	133.3

2000 FT Pressure Altitude

CORR'D FIELD LENGTH (FT)	FIELD LIMIT WEIGHT (1000 LB)										
	OAT (°C)										
	-40	10	14	18	22	26	30	38	42	46	50
4000	124.7	114.8	114.0	113.3	112.6	111.8	109.1	103.5	100.7	98.1	95.5
4200	127.9	117.7	117.0	116.2	115.5	114.7	111.9	106.2	103.3	100.6	97.9
4600	134.2	123.5	122.7	121.9	121.2	120.4	117.4	111.5	108.5	105.6	102.8
5000	140.2	129.1	128.2	127.4	126.6	125.8	122.7	116.5	113.3	110.4	107.4
5400	145.8	134.2	133.4	132.5	131.7	130.8	127.6	121.2	117.9	114.8	111.7
5800	151.3	139.3	138.4	137.5	136.6	135.7	132.3	125.6	122.2	119.0	115.8
6200	156.6	144.0	143.1	142.2	141.3	140.3	136.8	129.9	126.3	123.0	119.7
6600	161.7	148.6	147.7	146.7	145.8	144.8	141.2	133.9	130.3	126.8	123.3
7000	166.7	153.1	152.2	151.2	150.2	149.2	145.4	137.9	134.1	130.5	126.9
7400	171.5	157.5	156.5	155.5	154.5	153.4	149.6	141.8	137.9	134.2	130.5
7800	176.1	161.8	160.8	159.7	158.6	157.6	153.6	145.6	141.6	137.8	134.0
8200	179.9	165.5	164.4	163.3	162.3	161.2	157.1	148.9	144.8	140.8	137.0
8600	179.9	168.8	167.7	166.6	165.4	164.3	160.1	151.7	147.5	143.5	139.5
9000	179.9	172.0	170.9	169.8	168.6	167.5	163.2	154.6	150.2	146.1	142.0
9400	179.9	175.4	174.2	173.0	171.9	170.7	166.3	157.4	153.0	148.7	144.6
9800	179.9	178.6	177.4	176.2	175.0	173.8	169.3	160.3	155.7	151.3	147.1
10200	179.9	179.9	179.9	179.3	178.1	176.9	172.3	163.0	158.3	153.9	149.5
10600	179.9	179.9	179.9	179.9	179.9	179.9	175.1	165.7	160.9	156.4	151.9
CLIMB LIMIT WT (1000 LB)	157.7	156.4	156.2	155.9	155.7	154.9	149.9	139.1	133.8	128.7	123.6

With engine bleed for packs off, increase field limit weight by 900 lb and climb limit weight by 3100 lb.
With engine anti-ice on, decrease field limit weight by 400 lb and climb limit weight by 500 lb.
With engine and wing anti-ice on (optional system), decrease field limit weight by 1500 lb and climb limit weight by 3000 lb.

Takeoff Field & Climb Limit Weights - Dry Runway

Flaps 5

4000 FT Pressure Altitude

CORR'D FIELD LENGTH (FT)	FIELD LIMIT WEIGHT (1000 LB)										
	OAT (°C)										
	-40	10	14	18	22	26	30	38	42	46	50
4000	118.3	108.5	107.8	107.1	106.4	103.7	101.1	96.1	93.6	91.1	88.9
4200	121.3	111.3	110.6	109.8	109.1	106.4	103.7	98.6	96.1	93.5	91.2
4600	127.3	116.8	116.0	115.3	114.5	111.7	108.9	103.5	100.9	98.2	95.8
5000	133.0	122.0	121.2	120.4	119.6	116.7	113.7	108.1	105.4	102.6	100.1
5400	138.3	126.9	126.1	125.3	124.5	121.4	118.3	112.4	109.6	106.7	104.1
5800	143.5	131.7	130.8	129.9	129.1	125.9	122.7	116.6	113.6	110.6	107.9
6200	148.5	136.1	135.2	134.3	133.4	130.1	126.8	120.4	117.4	114.2	111.4
6600	153.2	140.4	139.5	138.6	137.6	134.2	130.7	124.1	120.9	117.7	114.7
7000	157.9	144.6	143.7	142.7	141.7	138.1	134.6	127.8	124.4	121.1	118.0
7400	162.5	148.8	147.8	146.8	145.8	142.1	138.4	131.3	127.9	124.4	121.3
7800	166.9	152.8	151.7	150.7	149.7	145.9	142.1	134.8	131.3	127.7	124.5
8200	170.7	156.2	155.2	154.1	153.1	149.2	145.3	137.8	134.3	130.6	127.2
8600	174.1	159.3	158.2	157.1	156.0	152.0	148.0	140.4	136.7	132.9	129.5
9000	177.5	162.3	161.2	160.1	159.0	154.9	150.8	143.0	139.2	135.3	131.8
9400	179.9	165.4	164.2	163.1	162.0	157.7	153.6	145.5	141.6	137.7	134.1
9800	179.9	168.4	167.2	166.0	164.9	160.6	156.3	148.0	144.1	140.0	136.3
10200	179.9	171.3	170.1	168.9	167.7	163.3	158.9	150.5	146.4	142.3	138.5
10600	179.9	174.2	172.9	171.7	170.5	166.0	161.5	152.9	148.7	144.5	140.6
CLIMB LIMIT WT (1000 LB)	151.3	150.2	150.0	149.8	149.1	144.2	138.9	128.7	123.9	119.0	114.8

6000 FT Pressure Altitude

CORR'D FIELD LENGTH (FT)	FIELD LIMIT WEIGHT (1000 LB)										
	OAT (°C)										
	-40	10	14	18	22	26	30	38	42	46	50
4000	111.4	102.3	101.6	101.0	98.6	96.2	93.9	89.1	86.8	84.7	82.7
4200	114.2	104.9	104.3	103.6	101.2	98.7	96.3	91.4	89.1	86.9	84.9
4600	119.9	110.1	109.4	108.7	106.2	103.6	101.1	95.9	93.5	91.3	89.2
5000	125.3	115.1	114.3	113.6	111.0	108.3	105.6	100.2	97.7	95.4	93.2
5400	130.3	119.7	118.9	118.2	115.4	112.6	109.9	104.3	101.6	99.2	96.9
5800	135.2	124.1	123.3	122.5	119.7	116.8	113.9	108.1	105.3	102.8	100.4
6200	139.8	128.3	127.5	126.6	123.7	120.6	117.6	111.6	108.7	106.1	103.6
6600	144.2	132.3	131.4	130.6	127.5	124.3	121.2	114.9	111.9	109.2	106.6
7000	148.6	136.2	135.3	134.4	131.2	128.0	124.8	118.2	115.1	112.3	109.6
7400	152.8	140.1	139.1	138.2	134.9	131.6	128.2	121.5	118.3	115.4	112.6
7800	156.9	143.8	142.9	141.9	138.5	135.1	131.7	124.7	121.5	118.5	115.6
8200	160.5	147.1	146.1	145.1	141.6	138.1	134.6	127.5	124.1	121.1	118.1
8600	163.6	149.8	148.8	147.9	144.3	140.7	137.1	129.8	126.3	123.2	120.2
9000	166.8	152.6	151.6	150.6	146.9	143.2	139.5	132.0	128.5	125.3	122.2
9400	170.0	155.5	154.4	153.4	149.6	145.8	142.0	134.3	130.7	127.4	124.2
9800	173.1	158.2	157.1	156.1	152.2	148.3	144.4	136.6	132.9	129.5	126.2
10200	176.1	160.9	159.8	158.7	154.8	150.8	146.8	138.8	135.0	131.5	128.2
10600	179.1	163.5	162.4	161.3	157.3	153.2	149.1	140.9	137.0	133.5	130.1
CLIMB LIMIT WT (1000 LB)	144.9	144.0	143.9	143.4	138.5	133.3	128.3	118.8	114.3	110.4	106.7

With engine bleed for packs off, increase field limit weight by 900 lb and climb limit weight by 3100 lb.
With engine anti-ice on, decrease field limit weight by 400 lb and climb limit weight by 500 lb.
With engine and wing anti-ice on (optional system), decrease field limit weight by 1500 lb and climb limit weight by 3000 lb.

Takeoff Field & Climb Limit Weights - Dry Runway

Flaps 5

8000 FT Pressure Altitude

CORR'D FIELD LENGTH (FT)	FIELD LIMIT WEIGHT (1000 LB)										
	OAT (°C)										
	-40	10	14	18	22	26	30	38	42	46	50
4000	104.7	96.5	95.9	93.8	91.6	89.2	87.0	82.5	80.5	78.6	76.7
4200	107.4	99.0	98.4	96.3	94.0	91.6	89.2	84.7	82.7	80.7	78.7
4600	112.7	103.9	103.3	101.0	98.7	96.1	93.7	88.9	86.8	84.7	82.7
5000	117.7	108.6	107.9	105.6	103.1	100.4	97.9	92.9	90.7	88.5	86.4
5400	122.5	112.9	112.2	109.8	107.2	104.5	101.8	96.7	94.3	92.1	89.9
5800	127.0	117.1	116.3	113.8	111.2	108.3	105.5	100.2	97.7	95.4	93.1
6200	131.3	121.0	120.2	117.6	114.8	111.8	108.9	103.3	100.8	98.4	96.0
6600	135.4	124.7	123.9	121.2	118.3	115.2	112.2	106.4	103.7	101.2	98.7
7000	139.4	128.3	127.5	124.7	121.7	118.5	115.4	109.4	106.7	104.0	101.5
7400	143.4	131.9	131.1	128.2	125.1	121.8	118.6	112.4	109.6	106.8	104.2
7800	147.2	135.5	134.6	131.6	128.4	125.0	121.7	115.3	112.4	109.6	106.9
8200	150.6	138.5	137.6	134.5	131.2	127.7	124.4	117.8	114.9	112.0	109.2
8600	153.4	141.0	140.1	137.0	133.6	130.0	126.6	119.9	116.8	113.9	111.0
9000	156.3	143.6	142.7	139.4	136.0	132.3	128.8	121.9	118.8	115.8	112.8
9400	159.2	146.2	145.2	141.9	138.4	134.6	131.0	123.9	120.7	117.6	114.6
9800	162.1	148.7	147.7	144.4	140.7	136.9	133.2	125.9	122.7	119.5	116.4
10200	164.9	151.2	150.2	146.7	143.0	139.1	135.3	127.9	124.5	121.3	118.1
10600	167.6	153.6	152.6	149.1	145.3	141.2	137.3	129.8	126.3	123.0	119.8
CLIMB LIMIT WT (1000 LB)	138.2	137.4	136.8	132.7	127.8	122.9	118.3	109.6	105.7	101.9	98.4

10000 FT Pressure Altitude

CORR'D FIELD LENGTH (FT)	FIELD LIMIT WEIGHT (1000 LB)										
	OAT (°C)										
	-40	10	14	18	22	26	30	38	42	46	50
4000	98.3	90.8	89.1	87.1	84.8	82.6	80.5	76.3	74.3	72.3	70.4
4200	100.8	93.2	91.4	89.3	87.0	84.8	82.6	78.3	76.3	74.2	72.3
4600	105.8	97.8	95.9	93.8	91.4	89.0	86.7	82.3	80.1	78.0	76.0
5000	110.6	102.2	100.2	98.0	95.5	93.0	90.6	86.0	83.7	81.5	79.4
5400	115.0	106.3	104.3	101.9	99.3	96.7	94.2	89.4	87.0	84.8	82.5
5800	119.2	110.2	108.1	105.6	102.9	100.2	97.6	92.6	90.2	87.8	85.5
6200	123.2	113.8	111.6	109.1	106.2	103.4	100.7	95.5	92.9	90.5	88.1
6600	127.0	117.2	114.9	112.3	109.4	106.4	103.7	98.2	95.6	93.0	90.5
7000	130.7	120.6	118.2	115.5	112.5	109.4	106.6	100.9	98.2	95.5	92.9
7400	134.4	124.0	121.5	118.7	115.6	112.4	109.5	103.6	100.8	98.1	95.4
7800	138.0	127.3	124.7	121.9	118.6	115.4	112.3	106.3	103.4	100.6	97.9
8200	141.1	130.1	127.5	124.5	121.2	117.9	114.8	108.6	105.6	102.7	99.9
8600	143.7	132.4	129.8	126.7	123.3	120.0	116.7	110.4	107.4	104.4	101.5
9000	146.4	134.8	132.0	128.9	125.5	122.0	118.7	112.2	109.1	106.0	103.1
9400	149.0	137.1	134.3	131.1	127.6	124.0	120.6	114.0	110.8	107.6	104.6
9800	151.6	139.5	136.6	133.3	129.7	126.0	122.5	115.7	112.5	109.2	106.1
10200	154.2	141.7	138.8	135.4	131.7	128.0	124.4	117.4	114.1	110.8	107.6
10600	156.7	143.9	140.9	137.5	133.7	129.9	126.2	119.1	115.7	112.3	109.1
CLIMB LIMIT WT (1000 LB)	131.2	130.4	126.7	122.4	117.7	113.1	108.9	100.7	96.8	93.0	89.5

With engine bleed for packs off, increase field limit weight by 900 lb and climb limit weight by 3100 lb.
With engine anti-ice on, decrease field limit weight by 400 lb and climb limit weight by 500 lb.
With engine and wing anti-ice on (optional system), decrease field limit weight by 1500 lb and climb limit weight by 3000 lb.

Takeoff Field Corrections - Wet Runway

Slope Corrections

FIELD LENGTH AVAILABLE (FT)	SLOPE CORRECTED FIELD LENGTH (FT)								
	RUNWAY SLOPE (%)								
	-2.0	-1.5	-1.0	-0.5	0.0	0.5	1.0	1.5	2.0
4200	4300	4280	4250	4230	4200	4140	4070	4010	3950
4600	4770	4730	4680	4640	4600	4520	4430	4350	4270
5000	5230	5170	5120	5060	5000	4900	4790	4690	4590
5400	5700	5620	5550	5470	5400	5280	5150	5030	4900
5800	6160	6070	5980	5890	5800	5660	5510	5370	5220
6200	6620	6520	6410	6310	6200	6040	5870	5710	5540
6600	7090	6970	6840	6720	6600	6420	6230	6050	5860
7000	7550	7410	7280	7140	7000	6790	6590	6380	6180
7400	8010	7860	7710	7550	7400	7170	6950	6720	6500
7800	8480	8310	8140	7970	7800	7550	7310	7060	6820
8200	8940	8760	8570	8390	8200	7930	7670	7400	7140
8600	9410	9200	9000	8800	8600	8310	8030	7740	7450
9000	9870	9650	9430	9220	9000	8690	8390	8080	7770
9400	10330	10100	9870	9630	9400	9070	8750	8420	8090
9800	10800	10550	10300	10050	9800	9450	9110	8760	8410
10200	11260	11000	10730	10470	10200	9830	9460	9100	8730
10600	11720	11440	11160	10880	10600	10210	9820	9440	9050
11000	12190	11890	11590	11300	11000	10590	10180	9780	9370
11400	12650	12340	12030	11710	11400	10970	10540	10110	9690
11800	13120	12790	12460	12130	11800	11350	10900	10450	10010

Wind Corrections

SLOPE CORR'D FIELD LENGTH (FT)	SLOPE & WIND CORRECTED FIELD LENGTH (FT)							
	WIND COMPONENT (KTS)							
	-15	-10	-5	0	10	20	30	40
4200	2980	3390	3790	4200	4480	4760	5040	5330
4600	3320	3740	4170	4600	4890	5180	5480	5780
5000	3660	4100	4550	5000	5300	5610	5920	6230
5400	3990	4460	4930	5400	5710	6030	6360	6690
5800	4330	4820	5310	5800	6130	6460	6800	7140
6200	4670	5180	5690	6200	6540	6890	7240	7590
6600	5010	5540	6070	6600	6950	7310	7680	8050
7000	5350	5900	6450	7000	7370	7740	8120	8500
7400	5690	6260	6830	7400	7780	8160	8550	8950
7800	6030	6620	7210	7800	8190	8590	8990	9410
8200	6360	6980	7590	8200	8600	9010	9430	9860
8600	6700	7340	7970	8600	9020	9440	9870	10310
9000	7040	7690	8350	9000	9430	9870	10310	10770
9400	7380	8050	8730	9400	9840	10290	10750	11220
9800	7720	8410	9110	9800	10250	10720	11190	11670
10200	8060	8770	9490	10200	10670	11140	11630	12130
10600	8400	9130	9870	10600	11080	11570	12070	12580
11000	8730	9490	10240	11000	11490	12000	12510	13030
11400	9070	9850	10620	11400	11910	12420	12950	13490
11800	9410	10210	11000	11800	12320	12850	13390	13940

Takeoff Field & Climb Limit Weights - Wet Runway

Flaps 5

Sea Level Pressure Altitude

CORR'D FIELD LENGTH (FT)	FIELD LIMIT WEIGHT (1000 LB) OAT (°C)										
	-40	10	14	18	22	26	30	38	42	46	50
4700	142.0	130.6	129.6	128.7	127.8	126.9	126.0	119.6	116.4	113.3	110.3
5000	146.7	134.9	133.9	133.0	132.0	131.1	130.2	123.5	120.2	117.0	113.8
5400	152.4	140.1	139.1	138.1	137.1	136.2	135.2	128.3	124.9	121.5	118.2
5800	157.9	145.2	144.1	143.1	142.1	141.1	140.1	132.9	129.4	125.9	122.4
6200	163.2	150.1	149.0	147.9	146.8	145.8	144.8	137.3	133.6	130.0	126.5
6600	168.4	154.8	153.6	152.5	151.4	150.4	149.3	141.6	137.8	134.1	130.4
7000	173.4	159.3	158.2	157.0	155.9	154.8	153.7	145.7	141.8	137.9	134.2
7400	178.2	163.7	162.5	161.3	160.2	159.0	157.9	149.7	145.6	141.7	137.8
7800	179.9	168.0	166.8	165.6	164.4	163.2	162.0	153.6	149.4	145.3	141.3
8200	179.9	171.9	170.6	169.4	168.2	167.0	165.7	157.1	152.8	148.6	144.5
8600	179.9	175.5	174.2	173.0	171.7	170.5	169.2	160.3	156.0	151.7	147.5
9000	179.9	179.3	177.9	176.6	175.3	174.1	172.8	163.7	159.2	154.8	150.5
9400	179.9	179.9	179.9	179.9	179.1	177.8	176.5	167.1	162.6	158.0	153.6
9800	179.9	179.9	179.9	179.9	179.9	179.9	179.9	170.5	165.9	161.2	156.7
10200	179.9	179.9	179.9	179.9	179.9	179.9	179.9	173.8	169.1	164.3	159.7
10600	179.9	179.9	179.9	179.9	179.9	179.9	179.9	177.0	172.2	167.3	162.6
11000	179.9	179.9	179.9	179.9	179.9	179.9	179.9	179.9	175.2	170.2	165.4
11400	179.9	179.9	179.9	179.9	179.9	179.9	179.9	179.9	178.2	173.1	168.2
CLIMB LIMIT WT (1000 LB)	163.8	162.6	162.3	162.1	161.9	161.6	161.3	149.8	144.2	138.7	133.3

2000 FT Pressure Altitude

CORR'D FIELD LENGTH (FT)	FIELD LIMIT WEIGHT (1000 LB) OAT (°C)										
	-40	10	14	18	22	26	30	38	42	46	50
4700	134.8	123.0	122.2	121.3	120.5	119.7	116.7	110.7	108.0	105.2	102.5
5000	139.2	127.1	126.2	125.3	124.5	123.6	120.5	114.3	111.5	108.6	105.8
5400	144.6	132.0	131.1	130.2	129.3	128.4	125.2	118.7	115.8	112.8	109.9
5800	149.9	136.7	135.8	134.8	133.9	133.0	129.7	123.0	119.9	116.8	113.8
6200	154.9	141.3	140.3	139.3	138.4	137.4	134.0	127.1	123.9	120.7	117.5
6600	159.8	145.7	144.7	143.7	142.7	141.7	138.1	131.0	127.7	124.4	121.1
7000	164.5	150.0	148.9	147.9	146.9	145.8	142.1	134.8	131.4	127.9	124.6
7400	169.1	154.1	153.0	151.9	150.8	149.8	146.0	138.4	134.9	131.3	127.9
7800	173.5	158.1	157.0	155.9	154.8	153.7	149.8	142.0	138.4	134.7	131.2
8200	177.5	161.7	160.6	159.4	158.3	157.2	153.2	145.2	141.5	137.7	134.1
8600	179.9	165.1	163.9	162.8	161.6	160.5	156.4	148.1	144.3	140.5	136.8
9000	179.9	168.6	167.3	166.2	165.0	163.8	159.6	151.2	147.3	143.4	139.5
9400	179.9	172.1	170.9	169.7	168.5	167.3	162.9	154.3	150.3	146.3	142.4
9800	179.9	175.7	174.4	173.2	171.9	170.7	166.3	157.4	153.3	149.2	145.2
10200	179.9	179.1	177.8	176.5	175.3	174.0	169.5	160.4	156.2	152.0	147.9
10600	179.9	179.9	179.9	179.8	178.5	177.2	172.6	163.3	159.0	154.7	150.5
11000	179.9	179.9	179.9	179.9	179.9	179.9	175.6	166.2	161.8	157.4	153.1
11400	179.9	179.9	179.9	179.9	179.9	179.9	178.6	168.9	164.5	160.0	155.6
CLIMB LIMIT WT (1000 LB)	157.7	156.4	156.2	155.9	155.7	154.9	149.9	139.1	133.8	128.7	123.6

With engine bleed for packs off, increase field limit weight by 900 lb and climb limit weight by 3100 lb.
With engine anti-ice on, decrease field limit weight by 400 lb and climb limit weight by 500 lb.
With engine and wing anti-ice on (optional system), decrease field limit weight by 1700 lb and climb limit weight by 3000 lb.

Takeoff Field & Climb Limit Weights - Wet Runway

Flaps 5

4000 FT Pressure Altitude

CORR'D FIELD LENGTH (FT)	FIELD LIMIT WEIGHT (1000 LB)										
	OAT (°C)										
	-40	10	14	18	22	26	30	38	42	46	50
4700	127.0	116.0	115.2	114.4	113.6	110.8	108.1	102.9	100.4	97.8	95.5
5000	131.2	119.8	119.0	118.2	117.3	114.4	111.6	106.2	103.6	101.0	98.6
5400	136.3	124.5	123.6	122.7	121.9	118.8	115.9	110.3	107.6	104.8	102.3
5800	141.2	128.9	128.0	127.1	126.2	123.1	120.1	114.2	111.4	108.5	105.9
6200	145.9	133.2	132.3	131.3	130.4	127.1	124.0	118.0	115.1	112.1	109.4
6600	150.5	137.3	136.4	135.4	134.4	131.0	127.8	121.6	118.6	115.5	112.7
7000	154.9	141.3	140.3	139.3	138.3	134.8	131.5	125.1	122.0	118.8	115.9
7400	159.2	145.1	144.1	143.1	142.1	138.5	135.0	128.4	125.2	121.9	118.9
7800	163.4	148.9	147.9	146.8	145.8	142.0	138.5	131.7	128.4	125.0	121.9
8200	167.1	152.3	151.2	150.1	149.1	145.3	141.7	134.6	131.2	127.8	124.6
8600	170.6	155.4	154.3	153.2	152.1	148.2	144.5	137.3	133.8	130.3	127.1
9000	174.2	158.7	157.5	156.4	155.3	151.2	147.5	140.1	136.5	132.9	129.6
9400	178.0	162.0	160.8	159.7	158.5	154.4	150.5	142.9	139.3	135.5	132.2
9800	179.9	165.3	164.1	162.9	161.7	157.5	153.5	145.7	142.0	138.2	134.7
10200	179.9	168.5	167.2	166.0	164.8	160.5	156.4	148.5	144.6	140.7	137.2
10600	179.9	171.5	170.3	169.1	167.8	163.4	159.2	151.1	147.2	143.2	139.6
11000	179.9	174.6	173.3	172.0	170.8	166.2	162.0	153.7	149.7	145.6	141.9
11400	179.9	177.5	176.2	174.9	173.6	169.0	164.7	156.3	152.2	148.0	144.3
CLIMB LIMIT WT (1000 LB)	151.3	150.2	150.0	149.8	149.1	144.2	138.9	128.7	123.9	119.0	114.8

6000 FT Pressure Altitude

CORR'D FIELD LENGTH (FT)	FIELD LIMIT WEIGHT (1000 LB)										
	OAT (°C)										
	-40	10	14	18	22	26	30	38	42	46	50
4700	119.4	109.3	108.5	107.9	105.3	102.8	100.3	95.4	93.0	90.9	88.9
5000	123.3	112.8	112.1	111.4	108.8	106.1	103.5	98.5	96.0	93.8	91.7
5400	128.1	117.1	116.4	115.6	112.9	110.2	107.5	102.2	99.7	97.4	95.2
5800	132.7	121.3	120.5	119.8	116.9	114.1	111.3	105.8	103.2	100.8	98.5
6200	137.1	125.3	124.5	123.7	120.8	117.8	115.0	109.3	106.5	104.1	101.7
6600	141.3	129.2	128.3	127.5	124.5	121.4	118.5	112.6	109.8	107.2	104.7
7000	145.5	132.9	132.1	131.2	128.1	124.9	121.8	115.8	112.9	110.2	107.7
7400	149.4	136.5	135.6	134.7	131.5	128.2	125.1	118.8	115.8	113.1	110.4
7800	153.3	140.0	139.1	138.2	134.9	131.5	128.3	121.8	118.7	115.9	113.2
8200	156.8	143.2	142.2	141.3	137.9	134.5	131.1	124.5	121.3	118.5	115.7
8600	160.1	146.1	145.1	144.1	140.7	137.2	133.7	127.0	123.7	120.7	117.9
9000	163.4	149.1	148.1	147.1	143.5	139.9	136.4	129.5	126.1	123.1	120.2
9400	166.8	152.1	151.1	150.1	146.5	142.8	139.1	132.0	128.6	125.5	122.5
9800	170.3	155.2	154.1	153.1	149.4	145.6	141.9	134.6	131.1	127.9	124.8
10200	173.6	158.1	157.1	156.0	152.2	148.3	144.5	137.1	133.5	130.2	127.1
10600	176.8	161.0	159.9	158.8	154.9	150.9	147.1	139.5	135.8	132.4	129.3
11000	179.9	163.8	162.7	161.6	157.6	153.5	149.6	141.8	138.1	134.6	131.4
11400	179.9	166.5	165.4	164.3	160.2	156.1	152.0	144.1	140.3	136.8	133.5
CLIMB LIMIT WT (1000 LB)	144.9	144.0	143.9	143.4	138.5	133.3	128.3	118.8	114.3	110.4	106.7

With engine bleed for packs off, increase field limit weight by 900 lb and climb limit weight by 3100 lb.
With engine anti-ice on, decrease field limit weight by 400 lb and climb limit weight by 500 lb.
With engine and wing anti-ice on (optional system), decrease field limit weight by 1700 lb and climb limit weight by 3000 lb.

Takeoff Field & Climb Limit Weights - Wet Runway

Flaps 5

8000 FT Pressure Altitude

CORR'D FIELD LENGTH (FT)	FIELD LIMIT WEIGHT (1000 LB)										
	OAT (°C)										
	-40	10	14	18	22	26	30	38	42	46	50
4700	112.0	102.9	102.3	100.0	97.7	95.3	92.9	88.4	86.3	84.3	82.4
5000	115.7	106.3	105.6	103.3	100.8	98.3	95.9	91.2	89.1	87.0	85.0
5400	120.1	110.3	109.6	107.2	104.7	102.1	99.6	94.7	92.5	90.3	88.2
5800	124.4	114.2	113.5	111.0	108.4	105.7	103.1	98.0	95.7	93.4	91.3
6200	128.5	118.0	117.2	114.6	111.9	109.1	106.4	101.2	98.8	96.4	94.2
6600	132.5	121.6	120.8	118.1	115.3	112.4	109.6	104.2	101.7	99.3	97.0
7000	136.3	125.1	124.3	121.5	118.6	115.6	112.7	107.2	104.6	102.1	99.7
7400	140.0	128.4	127.6	124.7	121.7	118.6	115.7	109.9	107.2	104.7	102.2
7800	143.6	131.7	130.8	127.9	124.8	121.6	118.6	112.7	109.9	107.3	104.7
8200	146.9	134.7	133.8	130.8	127.6	124.3	121.2	115.1	112.3	109.6	107.0
8600	149.9	137.3	136.4	133.3	130.1	126.8	123.6	117.3	114.4	111.7	109.0
9000	153.0	140.1	139.2	136.0	132.7	129.3	126.0	119.6	116.6	113.8	111.0
9400	156.2	143.0	142.0	138.7	135.3	131.8	128.5	121.9	118.9	116.0	113.1
9800	159.3	145.8	144.8	141.5	137.9	134.4	130.9	124.2	121.1	118.1	115.2
10200	162.3	148.5	147.5	144.1	140.5	136.8	133.3	126.4	123.3	120.2	117.3
10600	165.3	151.2	150.1	146.6	143.0	139.2	135.6	128.6	125.4	122.2	119.2
11000	168.2	153.7	152.7	149.1	145.4	141.6	137.9	130.7	127.4	124.2	121.1
11400	171.0	156.3	155.2	151.6	147.8	143.9	140.1	132.8	129.4	126.2	123.0
CLIMB LIMIT WT (1000 LB)	138.2	137.4	136.8	132.7	127.8	122.9	118.3	109.6	105.7	101.9	98.4

10000 FT Pressure Altitude

CORR'D FIELD LENGTH (FT)	FIELD LIMIT WEIGHT (1000 LB)										
	OAT (°C)										
	-40	10	14	18	22	26	30	38	42	46	50
4700	105.2	96.7	94.8	92.7	90.4	88.2	86.0	81.8	79.7	77.7	75.7
5000	108.6	99.8	97.8	95.6	93.3	91.0	88.8	84.3	82.2	80.1	78.1
5400	112.8	103.6	101.6	99.3	96.9	94.4	92.1	87.5	85.3	83.1	81.0
5800	116.8	107.3	105.1	102.8	100.3	97.8	95.3	90.6	88.2	86.0	83.8
6200	120.7	110.8	108.6	106.1	103.5	100.9	98.4	93.5	91.0	88.7	86.5
6600	124.4	114.1	111.9	109.3	106.6	103.9	101.4	96.2	93.7	91.3	89.0
7000	127.9	117.4	115.0	112.4	109.6	106.9	104.2	98.9	96.3	93.8	91.4
7400	131.4	120.5	118.0	115.3	112.5	109.6	106.8	101.4	98.7	96.2	93.7
7800	134.7	123.5	121.0	118.2	115.3	112.3	109.5	103.9	101.2	98.5	96.0
8200	137.8	126.3	123.7	120.8	117.8	114.8	111.9	106.2	103.3	100.6	98.0
8600	140.5	128.7	126.1	123.2	120.1	117.0	114.0	108.1	105.2	102.5	99.8
9000	143.4	131.3	128.6	125.6	122.4	119.2	116.2	110.1	107.2	104.3	101.6
9400	146.3	133.9	131.1	128.0	124.8	121.5	118.4	112.2	109.2	106.3	103.5
9800	149.2	136.5	133.7	130.5	127.2	123.9	120.6	114.3	111.2	108.2	105.3
10200	152.0	139.0	136.1	132.9	129.5	126.1	122.8	116.3	113.1	110.1	107.1
10600	154.7	141.5	138.5	135.2	131.7	128.2	124.9	118.2	115.0	111.9	108.8
11000	157.4	143.9	140.8	137.4	133.9	130.3	126.9	120.1	116.8	113.6	110.5
11400	160.0	146.2	143.1	139.7	136.0	132.4	128.9	122.0	118.6	115.4	112.2
CLIMB LIMIT WT (1000 LB)	131.2	130.4	126.7	122.4	117.7	113.1	108.9	100.7	96.8	93.0	89.5

With engine bleed for packs off, increase field limit weight by 900 lb and climb limit weight by 3100 lb.
With engine anti-ice on, decrease field limit weight by 400 lb and climb limit weight by 500 lb.
With engine and wing anti-ice on (optional system), decrease field limit weight by 1700 lb and climb limit weight by 3000 lb.

Takeoff Obstacle Limit Weight

Flaps 5

Sea Level, 30°C & Below, Zero Wind

Based on engine bleed for packs on and anti-ice off

Reference Obstacle Limit Weight (1000 LB)

OBSTACLE HEIGHT (FT)	DISTANCE FROM BRAKE RELEASE (1000 FT)								
	8	10	12	14	16	18	20	22	24
10	156.6	166.8	173.7						
50	143.4	155.6	163.4	168.3	171.9	174.5			
100	133.9	145.4	153.9	160.2	164.3	167.5	170.0	172.0	173.6
150	126.5	137.8	146.4	153.0	158.0	161.9	164.7	167.1	169.0
200	120.4	131.6	140.2	147.0	152.4	156.6	160.1	162.8	164.9
250	115.1	126.3	134.9	141.8	147.4	151.9	155.6	158.7	161.2
300	110.4	121.6	130.3	137.3	142.9	147.7	151.6	154.8	157.6
350	106.2	117.3	126.1	133.1	138.9	143.8	147.8	151.3	154.2
400	102.4	113.5	122.3	129.4	135.3	140.2	144.4	148.0	151.0
450	98.9	109.9	118.7	125.9	131.9	136.9	141.2	144.8	148.0
500	95.7	106.7	115.5	122.7	128.7	133.8	138.2	141.9	145.2
550	92.7	103.6	112.4	119.7	125.8	130.9	135.4	139.2	142.5
600		100.8	109.6	116.9	123.0	128.2	132.7	136.6	140.0
650		98.2	106.9	114.2	120.4	125.6	130.2	134.1	137.6
700		95.7	104.4	111.7	117.9	123.2	127.8	131.8	135.3
750		93.3	102.0	109.3	115.5	120.8	125.5	129.5	133.1
800		91.1	99.7	107.0	113.2	118.6	123.3	127.4	131.0
850			97.6	104.9	111.1	116.5	121.2	125.3	129.0
900			95.6	102.8	109.0	114.4	119.2	123.4	127.1
950			93.6	100.8	107.1	112.5	117.3	121.5	125.2
1000			91.8	99.0	105.2	110.6	115.4	119.6	123.4

Obstacle height must be calculated from lowest point of the runway to conservatively account for runway slope.

OAT Adjustments

OAT (°C)	REFERENCE OBSTACLE LIMIT WEIGHT (1000 LB)							
	100	110	120	130	140	150	160	170
30 & BELOW	0	0	0	0	0	0	0	0
32	-1.7	-1.9	-2.1	-2.3	-2.4	-2.6	-2.8	-3.0
34	-3.3	-3.7	-4.1	-4.5	-4.9	-5.3	-5.7	-6.1
36	-5.0	-5.6	-6.2	-6.8	-7.3	-7.9	-8.5	-9.1
38	-6.7	-7.5	-8.2	-9.0	-9.8	-10.6	-11.3	-12.1
40	-8.4	-9.3	-10.3	-11.3	-12.2	-13.2	-14.2	-15.2
42	-10.0	-11.2	-12.3	-13.5	-14.6	-15.8	-17.0	-18.1
44	-11.6	-13.0	-14.3	-15.7	-17.0	-18.4	-19.7	-21.1
46	-13.3	-14.8	-16.3	-17.9	-19.4	-21.0	-22.5	-24.0
48	-14.9	-16.6	-18.4	-20.1	-21.8	-23.5	-25.3	-27.0
50	-16.5	-18.5	-20.4	-22.3	-24.2	-26.1	-28.0	-29.9

Takeoff Obstacle Limit Weight

Flaps 5

Sea Level, 30°C & Below, Zero Wind

Pressure Altitude Adjustments

ALT (FT)	OAT ADJUSTED OBSTACLE LIMIT WEIGHT (1000 LB)							
	100	110	120	130	140	150	160	170
S.L.& BELOW	0	0	0	0	0	0	0	0
1000	-3.8	-4.1	-4.5	-4.9	-5.2	-5.6	-5.9	-6.3
2000	-7.6	-8.3	-9.0	-9.7	-10.4	-11.1	-11.8	-12.6
3000	-11.0	-12.1	-13.2	-14.2	-15.3	-16.3	-17.4	-18.5
4000	-14.5	-15.9	-17.3	-18.7	-20.1	-21.5	-23.0	-24.4
5000	-17.9	-19.6	-21.4	-23.1	-24.8	-26.6	-28.3	-30.1
6000	-21.3	-23.3	-25.4	-27.5	-29.5	-31.6	-33.7	-35.8
7000	-24.5	-26.9	-29.3	-31.7	-34.1	-36.5	-38.9	-41.3
8000	-27.7	-30.5	-33.2	-35.9	-38.7	-41.4	-44.1	-46.9
9000	-30.6	-33.6	-36.7	-39.7	-42.8	-45.8	-48.9	-51.9
10000	-33.4	-36.8	-40.1	-43.5	-46.9	-50.3	-53.7	-57.0

Wind Adjustments

WIND (KTS)	OAT & ALT ADJUSTED OBSTACLE LIMIT WEIGHT (1000 LB)							
	100	110	120	130	140	150	160	170
15 TW	-18.7	-18.1	-17.4	-16.7	-16.1	-15.4	-14.7	-14.1
10 TW	-12.5	-12.0	-11.6	-11.1	-10.7	-10.3	-9.8	-9.4
5 TW	-6.2	-6.0	-5.8	-5.6	-5.4	-5.1	-4.9	-4.7
0	0	0	0	0	0	0	0	0
10 HW	2.2	2.0	1.9	1.7	1.5	1.4	1.2	1.0
20 HW	4.4	4.1	3.7	3.4	3.1	2.7	2.4	2.0
30 HW	6.7	6.2	5.7	5.2	4.6	4.1	3.6	3.1
40 HW	9.0	8.3	7.6	6.9	6.2	5.5	4.8	4.1

With engine bleed for packs off, increase weight by 1900 lb.
With engine anti-ice on, decrease weight by 400 lb.
With engine and wing anti-ice on, decrease weight by 2000 lb (optional system).

Long Range Cruise Maximum Operating Altitude

Max Cruise Thrust

ISA + 10°C and Below

WEIGHT (1000 LB)	OPTIMUM ALT (FT)	TAT (°C)	MARGIN TO INITIAL BUFFET 'G' (BANK ANGLE)				
			1.20 (33°)	1.25 (36°)	1.30 (39°)	1.40 (44°)	1.50 (48°)
170	31800	-9	35300*	35300*	35300*	34300	32900
160	33100	-12	36600*	36600*	36600*	35500	34200
150	34500	-15	37900*	37900*	37900*	36900	35500
140	36000	-19	39200*	39200*	39200*	38300	37000
130	37500	-19	40600*	40600*	40600*	39900	38500
120	39200	-19	41000	41000	41000	41000	40200
110	41000	-19	41000	41000	41000	41000	41000
100	41000	-19	41000	41000	41000	41000	41000
90	41000	-19	41000	41000	41000	41000	41000
80	41000	-19	41000	41000	41000	41000	41000

ISA + 15°C

WEIGHT (1000 LB)	OPTIMUM ALT (FT)	TAT (°C)	MARGIN TO INITIAL BUFFET 'G' (BANK ANGLE)				
			1.20 (33°)	1.25 (36°)	1.30 (39°)	1.40 (44°)	1.50 (48°)
170	31800	-4	34100*	34100*	34100*	34100*	32900
160	33100	-7	35700*	35700*	35700*	35500	34200
150	34500	-10	37000*	37000*	37000*	36900	35500
140	36000	-13	38300*	38300*	38300*	38300	37000
130	37500	-13	39700*	39700*	39700*	39700*	38500
120	39200	-13	41000	41000	41000	41000	40200
110	41000	-13	41000	41000	41000	41000	41000
100	41000	-13	41000	41000	41000	41000	41000
90	41000	-13	41000	41000	41000	41000	41000
80	41000	-13	41000	41000	41000	41000	41000

ISA + 20°C

WEIGHT (1000 LB)	OPTIMUM ALT (FT)	TAT (°C)	MARGIN TO INITIAL BUFFET 'G' (BANK ANGLE)				
			1.20 (33°)	1.25 (36°)	1.30 (39°)	1.40 (44°)	1.50 (48°)
170	31800	2	32300*	32300*	32300*	32300*	32300*
160	33100	-1	34200*	34200*	34200*	34200*	34200
150	34500	-4	35800*	35800*	35800*	35800*	35500
140	36000	-7	37200*	37200*	37200*	37200*	37000
130	37500	-8	38600*	38600*	38600*	38600*	38500
120	39200	-8	40000*	40000*	40000*	40000*	40000*
110	41000	-8	41000	41000	41000	41000	41000
100	41000	-8	41000	41000	41000	41000	41000
90	41000	-8	41000	41000	41000	41000	41000
80	41000	-8	41000	41000	41000	41000	41000

***Denotes altitude thrust limited in level flight, 100 fpm residual rate of climb.**

Long Range Cruise Trip Fuel and Time

Ground to Air Miles Conversion

AIR DISTANCE (NM)					GROUND DISTANCE (NM)	AIR DISTANCE (NM)				
HEADWIND COMPONENT (KTS)						TAILWIND COMPONENT (KTS)				
100	80	60	40	20		20	40	60	80	100
278	258	240	225	212	200	190	181	173	166	159
552	514	480	450	424	400	381	364	348	334	322
825	769	718	674	635	600	573	548	525	503	484
1098	1023	956	898	846	800	764	731	700	672	647
1370	1277	1194	1122	1058	1000	956	914	876	842	810
1641	1531	1432	1345	1269	1200	1147	1098	1052	1011	973
1911	1783	1669	1569	1480	1400	1338	1281	1228	1180	1136
2180	2036	1905	1792	1691	1600	1530	1464	1404	1349	1299
2449	2287	2142	2015	1902	1800	1721	1648	1580	1518	1462
2717	2539	2378	2238	2113	2000	1913	1831	1756	1688	1625
2985	2790	2614	2460	2324	2200	2104	2015	1932	1857	1788
3251	3040	2849	2682	2535	2400	2295	2198	2108	2026	1952
3518	3290	3084	2905	2745	2600	2487	2382	2285	2196	2115
3783	3539	3319	3127	2956	2800	2678	2565	2461	2365	2278
4048	3788	3554	3349	3166	3000	2870	2749	2637	2535	2442
4312	4037	3788	3570	3376	3200	3062	2933	2814	2705	2606
4575	4285	4022	3792	3587	3400	3253	3117	2991	2875	2770
4838	4532	4256	4013	3797	3600	3445	3301	3167	3045	2933
5100	4780	4489	4234	4007	3800	3637	3485	3344	3215	3097
5362	5026	4722	4455	4217	4000	3828	3668	3521	3385	3261
5623	5272	4955	4676	4427	4200	4020	3852	3697	3555	3425
5883	5518	5187	4896	4637	4400	4211	4036	3874	3725	3589
6143	5764	5419	5117	4847	4600	4403	4220	4050	3894	3752
6402	6008	5651	5337	5056	4800	4594	4403	4227	4064	3916
6661	6253	5883	5557	5266	5000	4786	4587	4403	4234	4080

Long Range Cruise Trip Fuel and Time

Reference Fuel and Time Required

AIR DIST (NM)	PRESSURE ALTITUDE (1000 FT)									
	29		31		33		35		37	
	FUEL (1000 LB)	TIME (HR:MIN)	FUEL (1000 LB)	TIME (HR:MIN)	FUEL (1000 LB)	TIME (HR:MIN)	FUEL (1000 LB)	TIME (HR:MIN)	FUEL (1000 LB)	TIME (HR:MIN)
200	3.3	0:38	3.3	0:37	3.3	0:37	3.3	0:37	3.3	0:37
400	5.5	1:09	5.5	1:07	5.4	1:06	5.3	1:05	5.3	1:04
600	7.8	1:39	7.7	1:37	7.5	1:35	7.4	1:33	7.3	1:32
800	10.1	2:10	9.9	2:07	9.7	2:04	9.5	2:01	9.3	2:00
1000	12.4	2:40	12.1	2:36	11.8	2:32	11.6	2:29	11.4	2:27
1200	14.7	3:09	14.4	3:05	14.1	3:00	13.7	2:57	13.5	2:54
1400	17.1	3:39	16.7	3:33	16.3	3:28	15.9	3:24	15.6	3:22
1600	19.5	4:08	19.0	4:02	18.5	3:56	18.1	3:52	17.7	3:49
1800	21.9	4:38	21.3	4:31	20.8	4:24	20.2	4:20	19.9	4:16
2000	24.3	5:07	23.6	4:59	23.0	4:52	22.4	4:47	22.0	4:43
2200	26.8	5:36	26.1	5:27	25.4	5:19	24.7	5:14	24.2	5:10
2400	29.3	6:04	28.5	5:55	27.7	5:47	27.0	5:42	26.5	5:37
2600	31.8	6:32	30.9	6:23	30.1	6:14	29.3	6:09	28.8	6:04
2800	34.3	7:01	33.3	6:50	32.4	6:42	31.6	6:36	31.1	6:31
3000	36.8	7:29	35.8	7:18	34.8	7:09	33.8	7:03	33.3	6:58
3200	39.4	7:57	38.3	7:45	37.2	7:36	36.3	7:30	35.8	7:24
3400	42.1	8:24	40.9	8:12	39.7	8:03	38.7	7:57	38.3	7:51
3600	44.7	8:52	43.4	8:40	42.2	8:30	41.1	8:23	40.7	8:17
3800	47.3	9:19	46.0	9:07	44.7	8:57	43.6	8:50	43.2	8:44
4000	49.9	9:47	48.5	9:34	47.2	9:24	46.0	9:17	45.7	9:11
4200	52.7	10:13	51.2	10:01	49.8	9:50	48.7	9:43	48.1	9:37
4400	55.5	10:40	53.9	10:27	52.4	10:17	51.3	10:10	50.6	10:04
4600	58.3	11:07	56.6	10:54	55.1	10:43	54.0	10:36	53.1	10:30
4800	61.0	11:34	59.3	11:21	57.7	11:10	56.6	11:03	55.6	10:57
5000	63.8	12:01	62.0	11:48	60.4	11:37	59.3	11:29	58.0	11:24

Fuel Required Adjustments (1000 LB)

REFERENCE FUEL REQUIRED (1000 LB)	LANDING WEIGHT (1000 LB)					
	80	90	100	110	120	130
10	-1.2	-0.8	-0.4	0.0	0.6	1.2
20	-2.3	-1.6	-0.8	0.0	1.3	2.8
30	-3.6	-2.5	-1.3	0.0	2.1	4.6
40	-4.8	-3.3	-1.7	0.0	3.1	6.8
50	-6.1	-4.2	-2.1	0.0	4.3	9.2
60	-7.4	-5.1	-2.6	0.0	5.6	12.0

Based on 280/.78 climb, Long Range Cruise and .78/280/250 descent.

Long Range Cruise Step Climb

Ground to Air Miles Conversion

AIR DISTANCE (NM) HEADWIND COMPONENT (KTS) 100	80	60	40	20	GROUND DISTANCE (NM)	AIR DISTANCE (NM) TAILWIND COMPONENT (KTS) 20	40	60	80	100
1326	1245	1173	1109	1052	1000	953	910	871	836	803
1845	1735	1637	1549	1471	1400	1336	1277	1223	1174	1128
2363	2224	2100	1990	1890	1800	1718	1643	1575	1512	1454
2880	2712	2563	2429	2309	2200	2101	2010	1927	1850	1780
3396	3200	3026	2869	2728	2600	2484	2377	2279	2189	2106
3912	3688	3488	3309	3147	3000	2866	2744	2632	2528	2433
4427	4175	3950	3748	3565	3400	3249	3111	2984	2868	2760
4942	4662	4412	4187	3984	3800	3632	3478	3337	3207	3087
5456	5148	4873	4626	4403	4200	4015	3846	3690	3547	3414
5970	5635	5335	5065	4821	4600	4398	4213	4043	3886	3741
6484	6121	5796	5504	5240	5000	4781	4581	4396	4226	4069

Trip Fuel and Time Required

AIR DIST (NM)	TRIP FUEL (1000 LB) LANDING WEIGHT (1000 LB) 90	100	110	120	130	TIME (HRS:MIN)
1000	9.8	10.4	11.2	12.0	12.7	2:25
1400	13.3	14.2	15.3	16.4	17.4	3:20
1800	17.0	18.1	19.6	21.0	22.3	4:14
2200	20.7	22.2	23.9	25.6	27.3	5:08
2600	24.5	26.3	28.4	30.5	32.5	6:01
3000	28.4	30.6	33.0	35.4	37.8	6:55
3400	32.5	35.0	37.8	40.5	43.3	7:49
3800	36.6	39.5	42.7	45.8	49.0	8:42
4200	40.9	44.2	47.7	51.3	54.8	9:36
4600	45.3	49.0	52.9	56.8	60.8	10:29
5000	49.8	53.9	58.2	62.6	67.0	11:22

Based on 280/.78 climb, LRC or .78 cruise and .78/280/250 descent.
Valid for all pressure altitudes with 4000 ft step climb to 2000 ft above optimum altitude.

Short Trip Fuel and Time

Ground to Air Miles Conversion

AIR DISTANCE (NM) HEADWIND COMPONENT (KTS)					GROUND DISTANCE (NM)	AIR DISTANCE (NM) TAILWIND COMPONENT (KTS)				
100	80	60	40	20		20	40	60	80	100
94	80	70	62	55	50	46	42	39	36	34
159	142	129	117	108	100	93	87	82	77	73
224	204	187	173	161	150	141	132	125	119	113
289	265	245	228	213	200	188	178	169	161	153
353	326	303	283	265	250	236	224	213	203	194
416	386	360	338	318	300	284	270	257	245	235
480	447	418	393	370	350	332	316	301	288	275
544	508	476	447	422	400	380	362	345	330	316
610	569	534	503	475	450	428	407	389	372	357
676	632	593	558	528	500	475	453	432	414	397

Trip Fuel and Time Required

AIR DIST (NM)		LANDING WEIGHT (1000 LB) 90	100	110	120	130	TIME (HRS:MIN)
50	FUEL (1000 LB)	1.1	1.2	1.3	1.3	1.4	0:14
	ALT (FT)	11000	11000	11000	11000	9000	
100	FUEL (1000 LB)	1.8	1.9	2.0	2.1	2.2	0:22
	ALT (FT)	19000	19000	19000	19000	21000	
150	FUEL (1000 LB)	2.4	2.5	2.6	2.7	2.9	0:30
	ALT (FT)	27000	25000	25000	25000	23000	
200	FUEL (1000 LB)	2.9	3.0	3.2	3.4	3.5	0:37
	ALT (FT)	31000	31000	29000	29000	27000	
250	FUEL (1000 LB)	3.3	3.5	3.7	3.9	4.1	0:43
	ALT (FT)	41000	37000	37000	35000	33000	
300	FUEL (1000 LB)	3.7	4.0	4.2	4.4	4.7	0:50
	ALT (FT)	41000	39000	39000	37000	35000	
350	FUEL (1000 LB)	4.2	4.4	4.7	5.0	5.2	0:56
	ALT (FT)	41000	39000	39000	37000	35000	
400	FUEL (1000 LB)	4.6	4.9	5.2	5.5	5.8	1:03
	ALT (FT)	41000	41000	39000	37000	37000	
450	FUEL (1000 LB)	5.0	5.3	5.7	6.0	6.4	1:10
	ALT (FT)	41000	41000	39000	37000	37000	
500	FUEL (1000 LB)	5.4	5.8	6.2	6.5	6.9	1:17
	ALT (FT)	41000	41000	39000	39000	37000	

Based on 280/.78 climb, Long Range Cruise and .78/280/250 descent.

Holding Planning

Flaps Up

WEIGHT (1000 LB)	TOTAL FUEL FLOW (LB/HR)								
	PRESSURE ALTITUDE (FT)								
	1500	5000	10000	15000	20000	25000	30000	35000	41000
170	6160	6060	6010	5990	5870	5880	6020	6470	
160	5830	5730	5670	5640	5530	5510	5630	5890	
150	5500	5400	5340	5290	5200	5140	5250	5400	
140	5170	5080	5010	4950	4880	4770	4870	4970	
130	4850	4750	4680	4610	4540	4420	4500	4570	5200
120	4530	4420	4350	4280	4210	4100	4130	4190	4560
110	4210	4100	4020	3950	3880	3790	3770	3860	4100
100	3900	3780	3690	3680	3600	3540	3490	3510	3680
90	3670	3550	3430	3350	3280	3220	3190	3150	3290
80	3360	3250	3120	3030	2970	2910	2880	2820	2910
70	3060	2950	2830	2730	2670	2620	2570	2530	2570

This table includes 5% additional fuel for holding in a racetrack pattern.

Flight Crew Oxygen Requirements

Required Pressure (PSI) for 76 Cu. Ft. Cylinder

BOTTLE TEMPERATURE		NUMBER OF CREW USING OXYGEN		
°C	°F	2	3	4
50	122	735	1055	1360
45	113	725	1040	1340
40	104	715	1020	1320
35	95	700	1005	1300
30	86	690	990	1280
25	77	680	975	1255
20	68	670	960	1240
15	59	655	940	1215
10	50	645	925	1195
5	41	635	910	1175
0	32	620	890	1150
-5	23	610	875	1130
-10	14	600	860	1110

Required Pressure (PSI) for 114/115 Cu. Ft. Cylinder

BOTTLE TEMPERATURE		NUMBER OF CREW USING OXYGEN		
°C	°F	2	3	4
50	122	530	735	945
45	113	520	725	930
40	104	510	715	915
35	95	505	700	900
30	86	495	690	885
25	77	485	680	870
20	68	480	670	860
15	59	470	655	840
10	50	460	645	830
5	41	455	635	815
0	32	445	620	800
-5	23	440	610	785
-10	14	430	600	770

ENGINE INOP

MAX CONTINUOUS THRUST

Net Level Off Weight

PRESSURE ALTITUDE (1000 FT)	LEVEL OFF WEIGHT (1000 LB)		
	ISA + 10°C & BELOW	ISA + 15°C	ISA + 20°C
30	95.0	92.1	
28	102.7	99.4	96.2
26	111.0	107.3	103.9
24	119.0	115.3	111.5
22	126.9	122.8	118.3
20	135.2	130.5	125.2
18	143.7	138.3	132.3
16	152.1	146.2	139.4
14	160.8	154.2	146.6
12	168.3	160.7	152.7
10	175.3	166.8	158.7

Anti-Ice Adjustments

ANTI-ICE CONFIGURATION	LEVEL OFF WEIGHT ADJUSTMENT (1000 LB)									
	PRESSURE ALTITUDE (1000 FT)									
	10	12	14	16	18	20	22	24	26	28
ENGINE ONLY	-5.6	-4.9	-4.4	-4.3	-4.0	-3.6	-3.2	-2.9	-2.6	-2.3
ENGINE & WING	-19.2	-18.3	-16.8	-16.0	-15.4	-14.8	-12.9	-11.5	-10.5	

Performance Dispatch — Chapter PD
Landing — Section 22

Landing Field Limit Weight - Dry Runway
Flaps 40

Based on anti-skid operative and automatic speedbrakes

Wind Corrected Field Length (FT)

FIELD LENGTH AVAILABLE (FT)	WIND COMPONENT (KTS)							
	-15	-10	-5	0	10	20	30	40
3000			2670	3000	3220	3430	3630	3850
3400		2710	3050	3400	3630	3850	4070	4300
3800	2780	3080	3440	3800	4040	4270	4500	4740
4200	3140	3460	3830	4200	4440	4690	4930	5190
4600	3500	3830	4210	4600	4850	5110	5370	5630
5000	3850	4200	4600	5000	5260	5530	5800	6070
5400	4210	4570	4980	5400	5670	5950	6240	6520
5800	4570	4940	5370	5800	6080	6370	6670	6960
6200	4930	5320	5750	6200	6490	6790	7100	7410
6600	5280	5690	6140	6600	6900	7210	7540	7850
7000	5640	6060	6530	7000	7300	7630	7970	8290
7400	6000	6430	6910	7400	7710	8050	8410	8740
7800	6350	6810	7300	7800	8120	8470	8840	9180
8200	6710	7180	7680	8200	8530	8890	9270	9630
8600	7070	7550	8070	8600	8940	9310	9710	10070
9000	7350	7840	8370	9000	9350	9730	10140	
9400	7490	7990	8500	9400	9760	10150		
9800	7640	8130	8640	9800	10160			
10200	7780	8270	8780	10200				
10600	7920	8410	8910					

Field Limit Weight (1000 LB)

WIND CORR'D FIELD LENGTH (FT)	AIRPORT PRESSURE ALTITUDE (FT)					
	0	2000	4000	6000	8000	10000
3400	85.0					
3800	99.4	93.5	87.8			
4200	114.0	107.3	100.9	94.7	88.8	
4600	127.1	121.1	114.0	107.1	100.5	94.1
5000	138.7	132.2	125.9	119.3	112.2	105.0
5400	150.9	143.0	136.1	129.3	122.8	115.6
5800	163.5	154.6	146.3	138.7	131.7	125.0
6200	175.7	166.4	157.1	148.4	140.5	133.3
6600		177.5	168.2	158.6	149.8	141.5
7000			178.5	169.1	159.3	150.2
7400				178.6	169.1	159.1
7800					178.1	168.3
8200						176.8
8600						184.9

Decrease field limit weight by 9900 lb when using manual speedbrakes.

Landing Field Limit Weight - Dry Runway
Flaps 40
Based on anti-skid inoperative and manual speedbrakes
Wind Corrected Field Length (FT)

FIELD LENGTH AVAILABLE (FT)	WIND COMPONENT (KTS)							
	-15	-10	-5	0	10	20	30	40
6000				6000	6450	7010	7500	8060
6400				6400	6860	7430	7940	8500
6800			5980	6800	7280	7860	8370	8950
7200			6370	7200	7690	8280	8810	9390
7600		5940	6750	7600	8100	8700	9250	9840
8000		6310	7140	8000	8510	9130	9680	10290
8400	5850	6690	7530	8400	8920	9550	10120	10730
8800	6210	7060	7910	8800	9340	9970	10550	11180
9200	6570	7430	8300	9200	9750	10400	10990	11620
9600	6930	7800	8680	9600	10160	10820	11430	12070
10000	7290	8180	9070	10000	10570	11240	11860	12520
10400	7650	8550	9450	10400	10980	11670	12300	12960
10800	8010	8920	9840	10800	11400	12090	12740	13410
11200	8370	9290	10230	11200	11810	12510	13170	13860
11600	8730	9670	10610	11600	12220	12940	13610	14300
12000	9090	10040	11000	12000	12630	13360	14050	14750
12400	9450	10410	11380	12400	13040	13790	14480	15190
12800	9810	10780	11770	12800	13460	14210	14920	15640
13200	10170	11160	12150	13200	13870	14630	15350	16090
13600	10530	11530	12540	13600	14280	15060	15790	16530

Field Limit Weight (1000 LB)

WIND CORR'D FIELD LENGTH (FT)	AIRPORT PRESSURE ALTITUDE (FT)					
	0	2000	4000	6000	8000	10000
6800	86.3					
7200	93.2	87.4				
7600	100.0	93.9	87.3			
8000	107.0	100.5	93.5	87.4		
8400	113.9	107.0	99.7	93.2	86.9	
8800	120.9	113.6	105.9	99.1	92.5	86.1
9200	127.9	120.2	112.2	104.9	98.0	91.2
9600	134.8	126.8	118.4	110.8	103.6	96.4
10000	141.8	133.3	124.6	116.5	109.1	101.5
10400	149.2	139.7	130.8	122.3	114.4	106.6
10800	156.8	146.4	136.8	128.0	119.7	111.7
11200	164.5	153.4	142.8	133.6	125.0	116.6
11600	172.1	160.5	149.2	139.2	130.2	121.6
12000	179.0	167.8	155.7	145.0	135.5	126.5
12400		174.5	162.4	151.0	140.7	131.4
12800		181.0	169.2	157.2	146.1	136.3
13200			175.4	163.4	151.9	141.2
13600			181.4	169.7	157.6	146.3
14000				175.6	163.5	151.6
14400				181.2	169.5	157.0
14800					174.9	162.4
15200					180.2	168.1
15600						173.4
16000						178.3
16400						183.2

Landing Field Limit Weight - Wet Runway

Flaps 40

Based on anti-skid operative and automatic speedbrakes

Wind Corrected Field Length (FT)

FIELD LENGTH AVAILABLE (FT)	WIND COMPONENT (KTS)							
	-15	-10	-5	0	10	20	30	40
3000				3000	3240	3470	3690	3930
3400			3020	3400	3650	3890	4120	4380
3800		3010	3410	3800	4060	4310	4560	4820
4200	3050	3390	3790	4200	4470	4730	4990	5270
4600	3410	3760	4180	4600	4880	5150	5420	5710
5000	3760	4130	4560	5000	5290	5570	5860	6150
5400	4120	4500	4950	5400	5690	5990	6290	6600
5800	4480	4880	5330	5800	6100	6410	6730	7040
6200	4840	5250	5720	6200	6510	6830	7160	7490
6600	5190	5620	6110	6600	6920	7250	7590	7930
7000	5550	5990	6490	7000	7330	7670	8030	8370
7400	5910	6370	6880	7400	7740	8090	8460	8820
7800	6260	6740	7260	7800	8150	8510	8900	9260
8200	6620	7110	7650	8200	8550	8930	9330	9710
8600	6980	7480	8030	8600	8960	9350	9760	10150
9000	7340	7860	8420	9000	9370	9770	10200	10590
9400	7690	8230	8810	9400	9780	10190	10630	11040
9800	8050	8600	9190	9800	10190	10610	11070	11480
10200	8400	8970	9570	10200	10600	11030	11500	
10600	8540	9110	9710	10600	11010	11450		

Field Limit Weight (1000 LB)

WIND CORR'D FIELD LENGTH (FT)	AIRPORT PRESSURE ALTITUDE (FT)					
	0	2000	4000	6000	8000	10000
4200	94.1	88.4				
4600	106.7	100.4	94.3	88.6		
5000	119.3	112.4	105.7	99.3	93.2	87.3
5400	129.9	123.8	117.2	110.1	103.4	96.7
5800	140.0	133.4	127.0	120.5	113.5	106.1
6200	150.6	142.7	135.9	129.1	122.6	115.4
6600	161.6	152.8	144.6	137.3	130.4	123.7
7000	172.5	163.0	154.0	145.6	138.1	130.9
7400	182.2	173.2	163.5	154.4	145.8	138.1
7800		182.3	173.1	163.3	154.1	145.4
8200			181.7	172.3	162.5	153.1
8600				180.4	171.0	160.9
9000					178.6	168.9
9400						176.2
9800						183.3

Decrease field limit weight by 9900 lb when using manual speedbrakes.

Landing Field Limit Weight - Wet Runway

Flaps 40

Based on anti-skid inoperative and manual speedbrakes

Wind Corrected Field Length (FT)

FIELD LENGTH AVAILABLE (FT)	WIND COMPONENT (KTS)							
	-15	-10	-5	0	10	20	30	40
6000					6490	7110	7640	8260
6400					6910	7530	8080	8710
6800				6800	7320	7950	8520	9150
7200				7200	7730	8380	8950	9600
7600			6670	7600	8140	8800	9390	10040
8000			7050	8000	8550	9230	9820	10490
8400		6520	7440	8400	8970	9650	10260	10940
8800		6890	7830	8800	9380	10070	10700	11380
9200		7260	8210	9200	9790	10500	11130	11830
9600	6680	7630	8600	9600	10200	10920	11570	12270
10000	7040	8010	8980	10000	10610	11340	12010	12720
10400	7400	8380	9370	10400	11030	11770	12440	13170
10800	7760	8750	9750	10800	11440	12190	12880	13610
11200	8120	9120	10140	11200	11850	12610	13320	14060
11600	8480	9500	10530	11600	12260	13040	13750	14510
12000	8840	9870	10910	12000	12670	13460	14190	14950
12400	9200	10240	11300	12400	13090	13880	14620	15400
12800	9560	10610	11680	12800	13500	14310	15060	15840
13200	9920	10990	12070	13200	13910	14730	15500	16290
13600	10280	11360	12450	13600	14320	15150	15930	16740

Field Limit Weight (1000 LB)

WIND CORR'D FIELD LENGTH (FT)	AIRPORT PRESSURE ALTITUDE (FT)					
	0	2000	4000	6000	8000	10000
8000	89.0					
8400	95.0	89.1				
8800	100.9	94.8	88.2			
9200	107.0	100.5	93.5	87.4		
9600	113.0	106.2	98.9	92.4	86.2	
10000	119.1	111.9	104.3	97.5	91.0	
10400	125.1	117.6	109.7	102.6	95.8	89.2
10800	131.2	123.4	115.1	107.8	100.7	93.7
11200	137.2	129.1	120.6	112.8	105.5	98.2
11600	143.3	134.7	126.0	117.8	110.3	102.6
12000	149.8	140.3	131.3	122.8	114.9	107.1
12400	156.5	146.1	136.5	127.8	119.5	111.5
12800	163.2	152.2	141.7	132.7	124.1	115.8
13200	169.9	158.4	147.2	137.5	128.6	120.1
13600	176.0	164.6	152.9	142.4	133.2	124.3
14000	182.0	170.9	158.6	147.6	137.8	128.6
14400		176.5	164.4	152.9	142.3	132.9
14800		182.1	170.3	158.2	147.1	137.1
15200			175.7	163.7	152.1	141.4
15600			180.9	169.2	157.1	145.8
16000				174.4	162.2	150.5
16400				179.3	167.4	155.1
16800				184.1	172.4	159.8
17200					177.0	164.6
17600					181.6	169.5

Landing Climb Limit Weight

Valid for approach with Flaps 15 and landing with Flaps 40

Based on engine bleed for packs on and anti-ice off

AIRPORT OAT (°C)	LANDING CLIMB LIMIT WEIGHT (1000 LB)					
	AIRPORT PRESSURE ALTITUDE (FT)					
	0	2000	4000	6000	8000	10000
54	129.1					
52	131.5					
50	134.0	124.3				
48	136.7	126.8				
46	139.4	129.3	119.7			
44	142.1	131.8	122.1			
42	144.8	134.3	124.5	114.9		
40	147.6	136.9	126.8	117.0		
38	150.4	139.4	129.2	119.2	110.1	
36	153.1	141.9	131.5	121.5	112.1	
34	155.8	144.6	134.0	123.7	114.0	105.0
32	158.8	147.3	136.4	126.0	116.2	107.1
30	161.8	150.0	138.9	128.4	118.4	109.1
28	161.9	152.8	141.4	130.8	120.6	111.2
26	162.1	155.5	144.0	133.1	122.9	113.2
24	162.2	155.6	146.7	135.5	125.1	115.3
22	162.4	155.7	149.3	138.1	127.6	117.6
20	162.5	155.8	149.4	140.7	129.8	119.7
18	162.6	155.9	149.5	143.0	132.1	122.0
16	162.7	156.1	149.6	143.1	134.5	124.1
14	162.8	156.2	149.7	143.1	136.4	126.0
12	163.0	156.3	149.8	143.2	136.5	127.9
10	163.1	156.4	149.9	143.3	136.6	129.4
-40	164.4	157.7	150.9	144.2	137.3	130.2

With engine bleed for packs off, increase weight by 2600 lb.
With engine anti-ice on, decrease weight by 500 lb.
With engine and wing anti-ice on, decrease weight by 1600 lb.
When operating in icing conditions during any part of the flight with forecast landing temperature below 10°C, decrease weight by 10900 lb.

ENGINE INOP

ADVISORY INFORMATION

Go-Around Climb Gradient

Flaps 15

Based on engine bleed for packs on and anti-ice off

OAT (°C)	REFERENCE GO-AROUND GRADIENT (%)					
	PRESSURE ALTITUDE (FT)					
	0	2000	4000	6000	8000	10000
54	3.88					
50	4.44	3.34				
46	5.04	3.90	2.83			
42	5.66	4.46	3.36	2.29		
38	6.28	5.03	3.88	2.77	1.75	
34	6.89	5.62	4.42	3.28	2.19	1.22
30	7.55	6.23	4.98	3.80	2.69	1.67
26	7.59	6.83	5.56	4.33	3.18	2.12
22	7.62	6.85	6.15	4.87	3.71	2.61
18	7.65	6.88	6.17	5.44	4.21	3.11
14	7.67	6.90	6.19	5.46	4.71	3.56
10	7.70	6.93	6.21	5.48	4.72	3.96
6	7.73	6.95	6.23	5.49	4.74	3.97
2	7.75	6.97	6.25	5.50	4.75	3.98

Gradient Adjustment for Weight (%)

WEIGHT (1000 LB)	REFERENCE GO-AROUND GRADIENT (%)							
	1	2	3	4	5	6	7	8
160	-3.40	-3.77	-4.18	-4.55	-4.89	-5.22	-5.55	-5.88
150	-2.93	-3.24	-3.58	-3.90	-4.19	-4.47	-4.76	-5.04
140	-2.35	-2.62	-2.89	-3.15	-3.38	-3.61	-3.84	-4.06
130	-1.69	-1.91	-2.10	-2.27	-2.44	-2.60	-2.77	-2.93
120	-0.92	-1.04	-1.14	-1.24	-1.33	-1.42	-1.51	-1.60
110	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
100	1.13	1.24	1.34	1.45	1.56	1.68	1.80	1.91
90	2.51	2.78	3.01	3.24	3.50	3.77	4.03	4.29

Gradient Adjustment for Speed (%)

SPEED (KIAS)	WEIGHT ADJUSTED GO-AROUND GRADIENT (%)													
	0	1	2	3	4	5	6	7	8	9	10	11	12	13
VREF40	-0.32	-0.34	-0.36	-0.38	-0.38	-0.38	-0.38	-0.39	-0.39	-0.39	-0.39	-0.39	-0.39	-0.39
VREF40+5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
VREF40+10	0.18	0.19	0.19	0.21	0.21	0.21	0.21	0.20	0.20	0.20	0.20	0.20	0.20	0.20
VREF40+15	0.32	0.33	0.33	0.33	0.31	0.30	0.29	0.28	0.26	0.25	0.24	0.22	0.21	0.20
VREF40+20	0.40	0.40	0.39	0.36	0.33	0.31	0.28	0.26	0.23	0.21	0.19	0.16	0.14	0.11
VREF40+25	0.40	0.39	0.37	0.29	0.25	0.22	0.19	0.15	0.12	0.09	0.06	0.02	-0.01	-0.04
VREF40+30	0.35	0.32	0.27	0.12	0.07	0.03	-0.01	-0.05	-0.09	-0.12	-0.16	-0.20	-0.24	-0.28

With engine bleed for packs off, increase gradient by 0.3%.
With engine anti-ice on, decrease gradient by 0.1%.
With engine and wing anti-ice on, decrease gradient by 0.4%.
When operating in icing conditions during any part of the flight with forecast landing temperatures below 10°C decrease gradient by 0.9%.

Quick Turnaround Limit Weight - Category F Steel Brakes

Flaps 40

OAT (°C)	LIMIT WEIGHT (1000 LB)					
	AIRPORT PRESSURE ALTITUDE (FT)					
	0	2000	4000	6000	8000	10000
50	180.0	173.4				
45	180.0	174.8	167.9			
40	180.0	176.2	169.3	162.1		
35	180.0	177.7	170.8	163.5	156.6	
30	180.0	179.2	172.2	165.0	158.0	151.2
25	180.0	180.0	173.7	166.5	159.4	152.5
20	180.0	180.0	175.1	168.0	160.8	153.9
15	180.0	180.0	176.7	169.6	162.3	155.3
10	180.0	180.0	178.2	171.2	163.8	156.7
5	180.0	180.0	179.8	172.7	165.4	158.2
0	180.0	180.0	180.0	174.3	167.0	159.7
-5	180.0	180.0	180.0	175.9	168.7	161.3
-10	180.0	180.0	180.0	177.5	170.4	162.9
-15	180.0	180.0	180.0	179.2	172.1	164.6
-20	180.0	180.0	180.0	180.0	173.8	166.3
-30	180.0	180.0	180.0	180.0	177.3	170.0
-40	180.0	180.0	180.0	180.0	180.0	173.6
-50	180.0	180.0	180.0	180.0	180.0	177.4

Increase weight by 1700 lb per 1% uphill slope. Decrease weight by 2300 lb per 1% downhill slope.
Increase weight by 4100 lb per 10 knots headwind. Decrease weight by 15100 lb per 10 knots tailwind.
After landing at weights exceeding those shown above, adjusted for slope and wind, wait at least 67 minutes and check that wheel thermal plugs have not melted before executing a subsequent takeoff.

As an alternate procedure, ensure that each brake pressure plate temperature, without artificial cooling, is less than 425°F as follows:
No sooner than 10 and no later than 15 minutes after parking, measure each brake pressure plate surface temperature at a minimum of two points per brake by an accurate method (using a Doric Microtemp 450 hand held thermometer or equivalent, hold temperature probe in place for 20 seconds or until reading stabilizes). If each measured temperature is less than 425°F, immediate dispatch is allowed; otherwise the required minimum ground wait period of 67 minutes applies.

If a Brake Temperature Monitoring System (BTMS) is installed:

No sooner than 10 and no later than 15 minutes after parking, check the BRAKE TEMP light. If the BRAKE TEMP light is not on, no ground waiting period is required. If the BRAKE TEMP light is on, do not dispatch until at least 67 minutes after landing, or until all the BTMS readings on the Systems Display are below 3.5 and the BRAKE TEMP light is off. Check that wheel thermal plugs have not melted before making a subsequent takeoff.
Note: If any brake temperature display digit is blank or indicates 0.0 or 0.1, then this method cannot be used.

Quick Turnaround Limit Weight - Category M Carbon Brakes

Flaps 40

OAT		LIMIT WEIGHT (1000 LB) AIRPORT PRESSURE ALTITUDE (FT)					
°C	°F	0	2000	4000	6000	8000	10000
54	129	165.8					
50	122	166.9	160.1				
45	113	168.3	161.5	155.0			
40	104	169.8	162.9	156.3	149.8		
35	95	171.3	164.3	157.6	151.1	144.7	
30	86	172.7	165.8	159.0	152.4	146.0	139.9
25	77	174.2	167.3	160.4	153.7	147.3	141.1
20	68	175.7	168.8	161.8	155.1	148.6	142.3
15	59	177.2	170.4	163.3	156.5	150.0	143.5
10	50	178.7	172.0	164.9	158.0	151.4	144.9
5	41	180.3	173.5	166.4	159.5	152.8	146.2
0	32	181.9	175.0	168.1	161.0	154.3	147.6
-5	23	183.6	176.6	169.7	162.6	155.8	149.1
-10	14	185.3	178.3	171.4	164.2	157.3	150.6
-15	5	187.1	180.0	173.1	165.9	158.9	152.1
-20	-4	188.9	181.7	174.7	167.7	160.5	153.7
-30	-22	189.9	185.3	178.2	171.3	164.0	156.9
-40	-40	189.9	189.3	181.9	174.8	167.7	160.4
-50	-58	189.9	189.9	185.9	178.6	171.6	164.1
-54	-65	189.9	189.9	187.4	180.2	173.1	165.7

Increase weight by 1500 lb per 1% uphill slope. Decrease weight by 2500 lb per 1% downhill slope.
Increase weight by 3700 lb per 10 knots headwind. Decrease weight by 17400 lb per 10 knots tailwind.
After landing at weights exceeding those shown above, adjusted for slope and wind, wait at least 48 minutes and check that wheel thermal plugs have not melted before executing a takeoff.

If a Brake Temperature Monitoring System (BTMS) is installed:

No sooner than 10 and no later than 15 minutes after parking, check the BRAKE TEMP light. If the BRAKE TEMP light is not on, no ground waiting period is required. If the BRAKE TEMP light is on, do not dispatch until at least 48 minutes after landing, or until all the BTMS readings on the systems Display are below 3.0 and the BRAKE TEMP light is off. Check that wheel thermal plugs have not melted before making a subsequent takeoff.
Note: If any brake temperature display digit is blank or indicates 0.0 or 0.1, then this method cannot be used.

Performance Dispatch — Chapter PD

Gear Down — Section 23

GEAR DOWN

Gear Down

TO BE SUPPLIED

Intentionally
Blank

Performance Dispatch — Chapter PD

Text — Section 24

Introduction

This chapter contains self dispatch performance data intended primarily for use by flight crews in the event that information cannot be obtained from the airline dispatch office. The takeoff data provided is for a single takeoff flap at max takeoff thrust. The range of conditions covered is limited to those normally encountered in airline operation. In the event of conflict between the data presented in this chapter and that contained in the approved Airplane Flight Manual, the Flight Manual shall always take precedence.

Takeoff

The maximum allowable takeoff weight will be the least of the Field, Climb, Obstacle, Brake Energy and Tire Speed Limit Weights as determined from the tables shown.

Brake Energy or Tire Speed Limit Weight tables are only provided if they are limiting for the range of conditions covered in the FCOM Section PD.

Field Limit Weight - Slope and Wind Corrections

These tables for dry and wet runways provide corrections to the field length available for the effects of runway slope and wind component along the runway. Enter the appropriate table with the available field length and runway slope to determine the slope corrected field length. Next enter the appropriate table with slope corrected field length and wind component to determine the slope and wind corrected field length.

Field and Climb Limit Weight

Tables are presented for selected airport pressure altitudes and runway conditions and show both Field and Climb Limit Weights. Enter the appropriate table for pressure altitude and runway condition with “Slope and Wind Corrected Field Length” determined above and airport OAT to obtain Field Limit Weight. Also read Climb Limit Weight for the same OAT. Intermediate altitudes may be interpolated or use next higher altitude. When finding a maximum weight for a wet runway, the dry runway limit weight must also be determined and the lower of the two weights used.

Obstacle Limit Weight

The Reference Obstacle Limit Weight table provides obstacle limit weights for reference airport conditions based on obstacle height above the runway surface and distance from brake release. Enter the adjustment tables to adjust the reference Obstacle Limit Weight for the effects of OAT, pressure altitude and wind as indicated. In the case of multiple obstacles, enter the tables successively with each obstacle and determine the most limiting weight.

Tire Speed Limit

Tire Speed Limit Weight tables are only provided if they are limiting for the range of conditions covered in the FCOM Section PD.

Maximum tire speed limited weights are presented for 225 MPH tires. To determine the tire speed limit weight, enter the table with OAT and airport pressure altitude. Adjust the tire speed limit weight according to the notes below the table to account for wind.

Brake Energy Limit VMBE

Brake Energy Limit Weight tables are only provided if they are limiting for the range of conditions covered in the FCOM Section PD.

The Maximum Brake Energy Speed table provides the Reference VMBE for a variety of airport pressure altitudes and temperatures. Enter the Weight Adjusted VMBE table to adjust the Reference VMBE for the actual brake release gross weight. Correct VMBE for slope and wind. If V1 exceeds VMBE, decrease brake release weight as indicated for each knot that V1 exceeds VMBE and determine V1, VR, and V2 for the lower brake release weight.

Enroute

Long Range Cruise Maximum Operating Altitude

These tables provide the maximum operating altitude in the same manner as the FMC. Maximum altitudes are shown for a given cruise weight and maneuver capability. Note that this table considers both thrust and buffet limits, providing the more limiting of the two. Any data that is thrust limited is denoted by an asterisk and represents only a thrust limited condition in level flight with 100 ft/min residual rate of climb. Flying above these altitudes with sustained banks in excess of approximately 15° may cause the airplane to lose speed and/or altitude. The altitudes shown in the table are limited to the maximum certified altitude of 41000 ft.

Long Range Cruise Trip Fuel and Time

Long Range Cruise Trip Fuel and Time tables are provided to determine trip time and fuel required to destination.

To determine trip fuel and time for a constant altitude cruise, first enter the Ground to Air Miles Conversion table to convert ground distance and enroute wind to an equivalent still air distance for use with the Reference Fuel and Time tables. Next, enter the Reference Fuel and Time table with air distance from the Ground to Air Miles Conversion table and the desired altitude and read Reference Fuel and Time Required. Lastly, enter the Fuel Required Adjustment table with the Reference Fuel and the planned landing weight to obtain the adjustment to the fuel required at the planned landing weight.

Long Range Cruise Step Climb Trip Fuel and Time

The Long Range Cruise Step Climb Trip Fuel and Time tables are provided to determine trip time and fuel required to destination when flying a step climb profile. Step climb profiles are based on 4000 ft step climbs to keep the flight within 2000 ft of the optimum altitude for the current cruise weight. To determine trip fuel and time, enter the Ground to Air Miles Conversion table and determine air distance as discussed above. Then enter the Trip Fuel and Time Required table with air distance and planned landing weight to read trip fuel. Continue across the table to read trip time.

Short Trip Fuel and Time

These tables are provided to determine trip fuel and time for short distances or alternates. Obtain air distance from the table using the ground distance and wind component to the alternate. Enter the Trip Fuel and Time Required table with air distance and read trip fuel required for the expected landing weight, together with time to alternate at right. For distances greater than shown or other altitudes, use the Long Range Cruise Trip Fuel and Time tables.

Holding Planning

This table provides total fuel flow information necessary for planning flaps up holding and reserve fuel requirements. Data is based on the FMC holding speed schedule which is the higher of the maximum endurance and flaps up maneuver speeds. As noted, the fuel flow is based on flight in a racetrack holding pattern. For holding in straight and level flight, reduce table values by 5%.

Flight Crew Oxygen Requirements

This airplane is equipped with a chemical passenger oxygen system. Regulations require that sufficient oxygen be provided to the flight crew to account for the greater of supplemental breathing oxygen in the event of a cabin depressurization or protective breathing in the event of smoke or harmful fumes in the flight deck. The oxygen quantity associated with the above requirements is achieved with the minimum dispatch oxygen cylinder pressure.

To determine the minimum dispatch oxygen cylinder pressure enter the appropriate flight crew oxygen table with the number of crew plus observers using oxygen and read the minimum cylinder pressure required for the appropriate cylinder temperature.

Net Level Off Weight

The Net Level Off Weight table is provided to determine terrain clearance capability in straight and level flight following an engine failure. Regulations require terrain clearance planning based on net performance which is the gross (or actual) gradient performance degraded by 1.1%. In addition, the net level off pressure altitude must clear the terrain by 1000 ft.

To determine the maximum weight for terrain clearance, enter the table with required net level off pressure altitude and expected ISA deviation to obtain weight. Adjust weight for anti-ice operation as noted below the table.

Landing

Tables are provided for determining the maximum landing weight as limited by field length or climb requirements for a single landing flap.

Maximum landing weight is the lowest of the field length limit weight, climb limit weight, or maximum certified landing weight.

Landing Field Limit Weight

For the expected runway condition and anti-skid system configuration, obtain wind corrected field length by entering the Wind Corrected Field Length table with field length available and wind component along the runway. Now enter the Field Limit Weight table with wind corrected field length and pressure altitude to read field limit weight.

Landing Climb Limit Weight

Enter the table with airport OAT and pressure altitude to read landing climb limit weight. Apply the noted adjustments as required.

Go-Around Climb Gradient

Enter the Reference Go-Around Gradient table with airport OAT and pressure altitude to determine the reference go-around gradient. Then adjust the reference gradient for airplane weight and speed using the tables provided to determine the weight and speed adjusted go-around gradient. Apply the necessary corrections for engine bleed configuration and icing conditions as noted.

Quick Turnaround Limit Weight

Enter the appropriate table (Steel or Carbon Brakes) with airport pressure altitude and OAT to read maximum quick turnaround weight. Apply the noted adjustments as required.

If the landing weight exceeds the maximum quick turnaround weight, wait the specified time and then check that the wheel thermal plugs have not melted before executing a subsequent takeoff. For Steel Brakes, the alternate procedures on the charts can be used to ensure the brake temperature is within limits. These procedures cannot be used for carbon brakes.

Gear Down

This section provides flight planning data for revenue operation with gear down. Unless otherwise noted, the gear down tables in this section are identical in format and usage to the corresponding gear up tables previously described.

To eliminate erroneous displays the flight crew should enter only gross weight data on the PERF INIT page of the Control Display Unit (CDU). Omission of the cost index and cruise altitude entries on the PERF INIT page will render the VNAV function unavailable during flight. As a result, the following information will not be provided: VNAV guidance and speed schedules, trip fuel and ETA predictions, optimum and maximum altitude data, step climb and top of descent predictions, and the VNAV descent guidance path.

The gross weight entry allows the FMCS takeoff and approach speed schedules to be generated. In addition, the flap maneuver speed and VREF speed bugs will be available for display on the primary flight display speed tape. Except for VNAV, normal autopilot and autothrottle modes will remain available for use during the flight, as will the LNAV mode.

Takeoff/Landing Climb Limit Weight

Enter the appropriate table with airport OAT and pressure altitude to determine Takeoff/Landing Climb Limit Weight with gear down. Correct the weight obtained for engine bleed configuration as required.

Performance Dispatch — Chapter PD
Table of Contents — Section 30

737-700W CFM56-7B26 KG JAA CATF/M

General

The table below shows the airplanes that have been identified with the following performance package. Note, some airplanes may be identified with more than one performance package. This configuration table information reflects the Boeing delivered configuration updated for service bulletin incorporations in conformance with the policy stated in the introduction section of the FCOM. The performance data is prepared for the owner/operator named on the title page. The intent of this information is to assist flight crews and airlines in knowing which performance package is applicable to a given airplane. The performance package model identification information is based on Boeing's knowledge of the airline's fleet at a point in time approximately three months prior to the page date. Notice of Errata (NOE) will not be provided to airlines to identify airplanes that are moved between performance packages within this manual or airplanes added to the airline's fleet whose performance packages are already represented in this manual. These types of changes will be updated in the next block revision. Owners/operators are responsible for ensuring the operational documentation they are using is complete and matches the current configuration of their airplanes, and the accuracy and validity of all information furnished by the owner/operator or any other party. Owners/operators receiving active revision service are responsible to ensure that any modifications to the listed airplanes are properly reflected in this manual.

Serial and tabulation number are supplied by Boeing.

Registry Number	Serial Number	Tabulation Number
YX700	YX700	YX700

Intentionally
Blank

Performance Dispatch — Chapter PD
Takeoff — Section 30

Minimum Takeoff Weight
Weight Limit (1000 KG)

OAT (°C)	AIRPORT PRESSURE ALTITUDE (FT)								
	S.L. & BELOW	1000	2000	3000	4000	5000	6000	7000	8000 & ABOVE
50	49.6	48.3	47.0	45.7	44.3	42.8	41.3	39.8	
45	51.4	50.0	48.7	47.3	45.9	44.4	42.9	41.4	39.8
40	53.0	51.6	50.2	48.8	47.4	45.9	44.4	42.9	41.4
35	54.5	53.1	51.7	50.3	48.8	47.3	45.7	44.1	42.5
30	55.9	54.4	52.9	51.4	49.9	48.4	46.8	45.2	43.6
25	56.5	54.5	53.2	51.8	50.4	48.9	47.4	45.9	44.3
20	56.7	54.6	53.3	52.0	50.7	49.2	47.8	46.3	44.8
15	56.7	54.6	53.3	52.0	50.7	49.3	47.9	46.6	45.2
10 & BELOW	56.7	54.6	53.3	52.0	50.7	49.3	47.9	46.7	45.4

Takeoff at the -7B26 thrust rating requires observance of a minimum takeoff weight in order to maintain airplane controllability during takeoff. For takeoff at weights below the minimum takeoff weight, use of a lower thrust rating (certified derate) is required. Note that the assumed temperature method of reducing thrust may not be used as a means to comply with this restriction.

Takeoff Field Corrections - Dry Runway
Slope Corrections

FIELD LENGTH AVAILABLE (M)	SLOPE CORRECTED FIELD LENGTH (M)								
	RUNWAY SLOPE (%)								
	-2.0	-1.5	-1.0	-0.5	0.0	0.5	1.0	1.5	2.0
1200	1240	1230	1220	1210	1200	1190	1170	1160	1150
1400	1460	1450	1430	1420	1400	1370	1350	1320	1290
1600	1690	1670	1640	1620	1600	1560	1520	1480	1440
1800	1910	1890	1860	1830	1800	1750	1690	1640	1580
2000	2140	2100	2070	2030	2000	1930	1860	1800	1730
2200	2360	2320	2280	2240	2200	2120	2040	1950	1870
2400	2590	2540	2490	2450	2400	2300	2210	2110	2020
2600	2810	2760	2710	2650	2600	2490	2380	2270	2160
2800	3040	2980	2920	2860	2800	2680	2550	2430	2310
3000	3260	3200	3130	3070	3000	2860	2730	2590	2450
3200	3490	3420	3340	3270	3200	3050	2900	2750	2600
3400	3710	3640	3560	3480	3400	3240	3070	2910	2740
3600	3940	3850	3770	3680	3600	3420	3240	3060	2880
3800	4160	4070	3980	3890	3800	3610	3410	3220	3030
4000	4390	4290	4190	4100	4000	3790	3590	3380	3170
4200	4610	4510	4410	4300	4200	3980	3760	3540	3320
4400	4840	4730	4620	4510	4400	4170	3930	3700	3460
4600	5060	4950	4830	4720	4600	4350	4100	3860	3610
4800	5290	5170	5040	4920	4800	4540	4280	4010	3750
5000	5510	5380	5260	5130	5000	4720	4450	4170	3900

Takeoff Field Corrections - Dry Runway
Wind Corrections

SLOPE CORR'D FIELD LENGTH (M)	SLOPE & WIND CORRECTED FIELD LENGTH (M)							
	WIND COMPONENT (KTS)							
	-15	-10	-5	0	10	20	30	40
1200	860	980	1090	1200	1270	1350	1420	1500
1400	1030	1150	1280	1400	1480	1550	1630	1720
1600	1200	1330	1470	1600	1680	1760	1850	1940
1800	1360	1510	1650	1800	1880	1970	2060	2150
2000	1530	1690	1840	2000	2090	2180	2270	2370
2200	1690	1860	2030	2200	2290	2390	2490	2590
2400	1860	2040	2220	2400	2500	2590	2700	2810
2600	2030	2220	2410	2600	2700	2800	2910	3020
2800	2190	2400	2600	2800	2900	3010	3120	3240
3000	2360	2570	2790	3000	3110	3220	3340	3460
3200	2530	2750	2980	3200	3310	3430	3550	3680
3400	2690	2930	3160	3400	3510	3640	3760	3890
3600	2860	3110	3350	3600	3720	3840	3970	4110
3800	3020	3280	3540	3800	3920	4050	4190	4330
4000	3190	3460	3730	4000	4130	4260	4400	4550
4200	3360	3640	3920	4200	4330	4470	4610	4760
4400	3520	3820	4110	4400	4530	4680	4830	4980
4600	3690	3990	4300	4600	4740	4880	5040	5200
4800	3860	4170	4490	4800	4940	5090	5250	5420
5000	4020	4350	4670	5000	5150	5300	5460	5640

Takeoff Field & Climb Limit Weights - Dry Runway

Flaps 5

Sea Level Pressure Altitude

CORR'D FIELD LENGTH (M)	FIELD LIMIT WEIGHT (1000 KG)										
	OAT (°C)										
	-40	10	14	18	22	26	30	38	42	46	50
1400	65.5	62.0	61.6	61.2	60.8	60.4	60.0	57.3	55.9	54.4	53.0
1600	70.2	66.4	66.0	65.6	65.2	64.8	64.4	61.4	59.9	58.3	56.8
1800	74.6	70.6	70.1	69.7	69.3	68.8	68.4	65.2	63.6	62.0	60.3
2000	78.7	74.5	74.0	73.6	73.1	72.6	72.2	68.9	67.2	65.5	63.8
2200	82.4	78.1	77.6	77.1	76.7	76.2	75.7	72.3	70.5	68.8	67.0
2400	85.9	81.4	80.9	80.4	79.9	79.4	78.9	75.4	73.6	71.7	69.9
2600	86.1	84.4	83.8	83.3	82.8	82.3	81.8	78.2	76.2	74.4	72.4
2800	86.1	86.1	86.1	86.1	85.5	85.0	84.5	80.7	78.8	76.8	74.9
3000	86.1	86.1	86.1	86.1	86.1	86.1	86.1	83.2	81.2	79.2	77.2
3200	86.1	86.1	86.1	86.1	86.1	86.1	86.1	85.6	83.5	81.5	79.4
3400	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	85.8	83.7	81.5
3600	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	85.8	83.5
3800	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	85.4
4000	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1
4200	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1
4400	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1
4600	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1
CLIMB LIMIT WT (1000 KG)	85.9	85.4	85.3	85.1	85.0	84.9	84.7	78.9	76.2	73.6	70.9

2000 FT Pressure Altitude

CORR'D FIELD LENGTH (M)	FIELD LIMIT WEIGHT (1000 KG)										
	OAT (°C)										
	-40	10	14	18	22	26	30	38	42	46	50
1400	63.5	58.5	58.1	57.7	57.3	56.9	55.9	53.2	51.9	50.5	49.2
1600	68.1	62.7	62.3	61.9	61.5	61.0	59.9	57.1	55.6	54.2	52.7
1800	72.3	66.6	66.2	65.7	65.3	64.8	63.7	60.6	59.1	57.5	56.0
2000	76.3	70.3	69.9	69.4	68.9	68.5	67.2	64.1	62.4	60.8	59.3
2200	80.0	73.8	73.3	72.8	72.3	71.9	70.6	67.3	65.6	63.9	62.3
2400	83.4	77.0	76.5	76.0	75.5	75.0	73.6	70.2	68.5	66.7	65.0
2600	86.1	79.7	79.2	78.7	78.2	77.7	76.3	72.8	71.0	69.2	67.4
2800	86.1	82.4	81.8	81.3	80.8	80.3	78.8	75.2	73.3	71.5	69.7
3000	86.1	84.9	84.3	83.8	83.2	82.7	81.3	77.5	75.6	73.7	71.9
3200	86.1	86.1	86.1	86.1	85.7	85.1	83.6	79.7	77.8	75.8	73.9
3400	86.1	86.1	86.1	86.1	86.1	86.1	85.9	81.9	79.9	77.9	75.9
3600	86.1	86.1	86.1	86.1	86.1	86.1	86.1	83.9	81.8	79.8	77.8
3800	86.1	86.1	86.1	86.1	86.1	86.1	86.1	85.8	83.7	81.6	79.5
4000	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	85.4	83.3	81.1
4200	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	84.9	82.8
4400	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	84.3
4600	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	85.9
CLIMB LIMIT WT (1000 KG)	81.9	81.4	81.3	81.2	81.1	81.0	79.0	73.8	71.3	68.8	66.4

With engine bleed for packs off, increase field limit weight by 400 kg and climb limit weight by 1350 kg.
With engine anti-ice on, decrease field limit weight by 200 kg and climb limit weight by 250 kg.
With engine and wing anti-ice on (optional system), decrease field limit weight by 700 kg and climb limit weight by 1550 kg.

Takeoff Field & Climb Limit Weights - Dry Runway

Flaps 5

4000 FT Pressure Altitude

CORR'D FIELD LENGTH (M)	FIELD LIMIT WEIGHT (1000 KG)										
	OAT (°C)										
	-40	10	14	18	22	26	30	38	42	46	50
1400	59.5	54.5	54.1	53.7	53.4	52.6	51.7	49.3	48.1	46.9	45.8
1600	63.8	58.4	58.0	57.6	57.2	56.4	55.5	52.9	51.6	50.3	49.2
1800	67.8	62.1	61.6	61.2	60.8	59.9	58.9	56.2	54.8	53.4	52.2
2000	71.6	65.6	65.1	64.7	64.2	63.3	62.3	59.4	58.0	56.6	55.3
2200	75.1	68.8	68.4	67.9	67.5	66.5	65.4	62.4	61.0	59.5	58.1
2400	78.3	71.8	71.4	70.9	70.4	69.4	68.3	65.2	63.7	62.2	60.8
2600	81.1	74.5	74.0	73.5	73.0	72.0	70.8	67.6	66.0	64.5	63.0
2800	83.8	76.9	76.4	75.9	75.4	74.4	73.1	69.9	68.2	66.6	65.2
3000	86.1	79.3	78.8	78.2	77.7	76.7	75.4	72.0	70.4	68.7	67.2
3200	86.1	81.6	81.0	80.5	80.0	78.9	77.6	74.1	72.4	70.7	69.1
3400	86.1	83.8	83.2	82.7	82.1	81.0	79.7	76.1	74.3	72.5	70.9
3600	86.1	85.9	85.3	84.7	84.2	83.0	81.6	78.0	76.1	74.3	72.7
3800	86.1	86.1	86.1	86.1	86.0	84.8	83.4	79.7	77.8	75.9	74.2
4000	86.1	86.1	86.1	86.1	86.1	86.1	85.2	81.3	79.4	77.5	75.8
4200	86.1	86.1	86.1	86.1	86.1	86.1	86.1	83.0	81.0	79.1	77.3
4400	86.1	86.1	86.1	86.1	86.1	86.1	86.1	84.5	82.5	80.6	78.7
4600	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	84.0	82.0	80.2
CLIMB LIMIT WT (1000 KG)	77.1	76.5	76.5	76.4	76.3	75.2	73.6	68.9	66.6	64.2	62.2

6000 FT Pressure Altitude

CORR'D FIELD LENGTH (M)	FIELD LIMIT WEIGHT (1000 KG)										
	OAT (°C)										
	-40	10	14	18	22	26	30	38	42	46	50
1400	55.4	50.6	50.3	49.9	49.2	48.6	47.8	45.7	44.5	43.5	42.5
1600	59.4	54.2	53.9	53.5	52.8	52.1	51.2	49.0	47.8	46.6	45.5
1800	63.1	57.6	57.2	56.8	56.1	55.3	54.4	52.0	50.7	49.5	48.3
2000	66.7	60.9	60.5	60.1	59.3	58.5	57.6	55.1	53.7	52.5	51.2
2200	70.0	64.0	63.6	63.2	62.3	61.5	60.6	57.9	56.5	55.2	54.0
2400	73.0	66.9	66.4	66.0	65.1	64.3	63.3	60.5	59.1	57.8	56.4
2600	75.7	69.3	68.8	68.4	67.5	66.6	65.6	62.8	61.3	59.9	58.5
2800	78.2	71.6	71.1	70.7	69.8	68.9	67.8	64.9	63.4	62.0	60.5
3000	80.6	73.8	73.3	72.9	71.9	71.0	69.9	66.9	65.4	63.9	62.4
3200	82.9	76.0	75.5	75.0	74.0	73.1	71.9	68.8	67.2	65.7	64.2
3400	85.2	78.0	77.5	77.0	76.0	75.0	73.8	70.7	69.0	67.4	65.9
3600	86.1	79.9	79.4	78.9	77.8	76.8	75.6	72.4	70.7	69.1	67.5
3800	86.1	81.7	81.1	80.6	79.6	78.5	77.3	74.0	72.2	70.6	68.9
4000	86.1	83.4	82.8	82.3	81.2	80.2	78.9	75.5	73.7	72.0	70.3
4200	86.1	85.1	84.5	83.9	82.8	81.8	80.5	77.0	75.1	73.4	71.7
4400	86.1	86.1	86.1	85.5	84.4	83.3	82.0	78.4	76.5	74.8	73.0
4600	86.1	86.1	86.1	86.1	86.0	84.9	83.5	79.9	77.9	76.2	74.4
CLIMB LIMIT WT (1000 KG)	72.3	71.9	71.8	71.8	70.8	69.8	68.3	63.9	61.6	59.6	57.7

With engine bleed for packs off, increase field limit weight by 400 kg and climb limit weight by 1350 kg.
With engine anti-ice on, decrease field limit weight by 200 kg and climb limit weight by 250 kg.
With engine and wing anti-ice on (optional system), decrease field limit weight by 700 kg and climb limit weight by 1550 kg.

Takeoff Field & Climb Limit Weights - Dry Runway

Flaps 5

8000 FT Pressure Altitude

CORR'D FIELD LENGTH (M)	FIELD LIMIT WEIGHT (1000 KG)										
	OAT (°C)										
	-40	10	14	18	22	26	30	38	42	46	50
1400	51.4	47.1	46.8	46.2	45.6	44.9	44.0	41.9	40.8	39.8	38.9
1600	55.1	50.5	50.1	49.5	48.9	48.1	47.2	44.9	43.8	42.7	41.7
1800	58.6	53.6	53.2	52.6	51.9	51.1	50.1	47.7	46.5	45.4	44.2
2000	61.9	56.7	56.4	55.7	55.0	54.1	53.1	50.5	49.3	48.1	46.9
2200	65.0	59.7	59.3	58.6	57.8	57.0	55.9	53.2	51.9	50.7	49.5
2400	67.9	62.3	61.9	61.2	60.4	59.6	58.4	55.7	54.3	53.1	51.8
2600	70.4	64.6	64.2	63.5	62.7	61.8	60.6	57.7	56.4	55.1	53.8
2800	72.7	66.8	66.4	65.6	64.8	63.9	62.6	59.7	58.3	57.0	55.6
3000	75.0	68.9	68.4	67.7	66.8	65.9	64.6	61.6	60.2	58.8	57.4
3200	77.1	70.9	70.4	69.6	68.7	67.7	66.4	63.3	61.9	60.4	59.0
3400	79.2	72.7	72.3	71.4	70.6	69.5	68.2	65.0	63.5	62.0	60.5
3600	81.2	74.5	74.0	73.2	72.3	71.2	69.8	66.6	65.0	63.5	62.0
3800	83.0	76.1	75.7	74.8	73.8	72.8	71.3	68.0	66.4	64.8	63.3
4000	84.7	77.7	77.2	76.3	75.4	74.2	72.8	69.4	67.7	66.1	64.5
4200	86.1	79.3	78.8	77.8	76.9	75.7	74.2	70.7	69.0	67.4	65.8
4400	86.1	80.8	80.2	79.3	78.3	77.1	75.6	72.0	70.3	68.7	67.0
4600	86.1	82.2	81.7	80.7	79.7	78.5	77.0	73.3	71.6	69.9	68.2
CLIMB LIMIT WT (1000 KG)	67.8	67.4	67.3	66.5	65.7	64.4	62.5	58.1	56.2	54.4	52.7

10000 FT Pressure Altitude

CORR'D FIELD LENGTH (M)	FIELD LIMIT WEIGHT (1000 KG)										
	OAT (°C)										
	-40	10	14	18	22	26	30	38	42	46	50
1400	47.8	43.8	43.2	42.7	42.1	41.5	40.6	38.4	37.4	36.3	35.3
1600	51.2	47.0	46.4	45.8	45.2	44.5	43.5	41.2	40.1	39.0	37.8
1800	54.4	49.9	49.2	48.6	48.0	47.2	46.2	43.8	42.5	41.4	40.2
2000	57.6	52.8	52.2	51.5	50.8	50.1	49.0	46.5	45.2	43.9	42.7
2200	60.5	55.6	54.9	54.2	53.5	52.8	51.6	49.0	47.7	46.4	45.1
2400	63.2	58.1	57.4	56.7	56.0	55.2	54.0	51.3	49.9	48.6	47.2
2600	65.6	60.3	59.6	58.8	58.1	57.3	56.1	53.2	51.8	50.4	49.0
2800	67.8	62.4	61.6	60.8	60.1	59.2	58.0	55.1	53.6	52.2	50.8
3000	69.9	64.3	63.5	62.8	62.0	61.1	59.8	56.8	55.3	53.9	52.4
3200	71.9	66.1	65.3	64.5	63.7	62.8	61.5	58.4	56.9	55.4	53.8
3400	73.8	67.9	67.0	66.2	65.4	64.4	63.1	59.9	58.3	56.8	55.2
3600	75.6	69.5	68.7	67.8	67.0	66.0	64.6	61.3	59.7	58.1	56.5
3800	77.3	71.0	70.1	69.3	68.4	67.4	66.0	62.6	61.0	59.3	57.7
4000	78.9	72.5	71.6	70.7	69.8	68.8	67.3	63.9	62.2	60.5	58.8
4200	80.4	73.9	73.0	72.1	71.2	70.1	68.6	65.1	63.4	61.6	59.9
4400	82.0	75.3	74.4	73.4	72.5	71.4	69.9	66.3	64.5	62.8	61.0
4600	83.5	76.7	75.7	74.8	73.8	72.7	71.2	67.5	65.7	63.9	62.1
CLIMB LIMIT WT (1000 KG)	63.7	63.1	62.3	61.5	60.6	59.4	57.6	53.4	51.5	49.6	47.6

With engine bleed for packs off, increase field limit weight by 400 kg and climb limit weight by 1350 kg.
With engine anti-ice on, decrease field limit weight by 200 kg and climb limit weight by 250 kg.
With engine and wing anti-ice on (optional system), decrease field limit weight by 700 kg and climb limit weight by 1550 kg.

Takeoff Field Corrections - Wet Runway

Slope Corrections

FIELD LENGTH AVAILABLE (M)	SLOPE CORRECTED FIELD LENGTH (M)								
	RUNWAY SLOPE (%)								
	-2.0	-1.5	-1.0	-0.5	0.0	0.5	1.0	1.5	2.0
1200	1230	1220	1210	1210	1200	1190	1170	1160	1140
1400	1450	1440	1430	1410	1400	1380	1350	1330	1310
1600	1680	1660	1640	1620	1600	1570	1540	1510	1480
1800	1910	1880	1850	1830	1800	1760	1720	1680	1640
2000	2140	2100	2070	2030	2000	1950	1900	1860	1810
2200	2360	2320	2280	2240	2200	2140	2090	2030	1980
2400	2590	2540	2500	2450	2400	2340	2270	2210	2140
2600	2820	2760	2710	2650	2600	2530	2460	2380	2310
2800	3050	2980	2920	2860	2800	2720	2640	2560	2480
3000	3270	3200	3140	3070	3000	2910	2820	2730	2640
3200	3500	3430	3350	3280	3200	3100	3010	2910	2810
3400	3730	3650	3560	3480	3400	3290	3190	3080	2980
3600	3950	3870	3780	3690	3600	3490	3370	3260	3140
3800	4180	4090	3990	3900	3800	3680	3560	3430	3310
4000	4410	4310	4200	4100	4000	3870	3740	3610	3480
4200	4640	4530	4420	4310	4200	4060	3920	3780	3650
4400	4860	4750	4630	4520	4400	4250	4110	3960	3810
4600	5090	4970	4850	4720	4600	4440	4290	4130	3980
4800	5320	5190	5060	4930	4800	4640	4470	4310	4150
5000	5550	5410	5270	5140	5000	4830	4660	4480	4310

Wind Corrections

FIELD LENGTH AVAILABLE (M)	SLOPE & WIND CORRECTED FIELD LENGTH (M)							
	RUNWAY SLOPE (%)							
	-15	-10	-5	0	10	20	30	40
1200	840	960	1080	1200	1270	1350	1430	1530
1400	1010	1140	1270	1400	1470	1560	1650	1750
1600	1180	1320	1460	1600	1680	1770	1870	1970
1800	1350	1500	1650	1800	1890	1980	2080	2190
2000	1520	1680	1840	2000	2090	2190	2300	2410
2200	1690	1860	2030	2200	2300	2400	2510	2630
2400	1860	2040	2220	2400	2500	2610	2730	2860
2600	2030	2220	2410	2600	2710	2820	2940	3080
2800	2200	2400	2600	2800	2910	3030	3160	3300
3000	2370	2580	2790	3000	3120	3240	3380	3520
3200	2540	2760	2980	3200	3320	3450	3590	3740
3400	2710	2940	3170	3400	3530	3660	3810	3960
3600	2880	3120	3360	3600	3730	3870	4020	4180
3800	3050	3300	3550	3800	3940	4080	4240	4400
4000	3230	3480	3740	4000	4140	4290	4450	4620
4200	3400	3660	3930	4200	4350	4510	4670	4840
4400	3570	3840	4120	4400	4550	4720	4890	5060
4600	3740	4020	4310	4600	4760	4930	5100	5280
4800	3910	4200	4500	4800	4960	5140	5320	5500
5000	4080	4380	4690	5000	5170	5350	5530	5720

Takeoff Field & Climb Limit Weights - Wet Runway

Flaps 5

Sea Level Pressure Altitude

CORR'D FIELD LENGTH (M)	FIELD LIMIT WEIGHT (1000 KG)										
	OAT (°C)										
	-40	10	14	18	22	26	30	38	42	46	50
1800	74.8	69.7	69.2	68.8	68.3	67.8	67.4	64.0	62.3	60.7	59.1
2000	78.6	73.3	72.8	72.3	71.8	71.3	70.8	67.3	65.6	63.9	62.2
2200	82.3	76.8	76.3	75.7	75.2	74.7	74.2	70.5	68.7	67.0	65.2
2400	85.8	80.1	79.6	79.0	78.5	78.0	77.4	73.6	71.7	69.9	68.1
2600	86.1	83.1	82.5	82.0	81.4	80.9	80.3	76.3	74.4	72.5	70.6
2800	86.1	85.9	85.3	84.7	84.2	83.6	83.0	78.9	76.9	75.0	73.0
3000	86.1	86.1	86.1	86.1	86.1	86.1	85.7	81.4	79.4	77.4	75.3
3200	86.1	86.1	86.1	86.1	86.1	86.1	86.1	83.9	81.8	79.8	77.6
3400	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	84.2	82.1	79.9
3600	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	84.3	82.1
3800	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	84.1
4000	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1
4200	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1
4400	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1
4600	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1
4800	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1
5000	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1
CLIMB LIMIT WT (1000 KG)	85.9	85.4	85.3	85.1	85.0	84.9	84.7	78.9	76.2	73.6	70.9

2000 FT Pressure Altitude

CORR'D FIELD LENGTH (M)	FIELD LIMIT WEIGHT (1000 KG)										
	OAT (°C)										
	-40	10	14	18	22	26	30	38	42	46	50
1800	71.6	65.4	64.9	64.4	64.0	63.5	62.3	59.3	57.8	56.3	54.9
2000	75.2	68.8	68.3	67.8	67.3	66.8	65.6	62.4	60.8	59.3	57.8
2200	78.8	72.1	71.5	71.0	70.5	70.0	68.7	65.4	63.8	62.2	60.7
2400	82.2	75.2	74.7	74.1	73.6	73.1	71.7	68.3	66.6	64.9	63.3
2600	85.3	78.0	77.4	76.9	76.3	75.8	74.4	70.8	69.1	67.3	65.7
2800	86.1	80.6	80.1	79.5	78.9	78.3	76.9	73.2	71.4	69.6	67.9
3000	86.1	83.2	82.6	82.0	81.4	80.8	79.3	75.6	73.7	71.8	70.1
3200	86.1	85.8	85.1	84.5	83.9	83.3	81.8	77.9	75.9	74.0	72.2
3400	86.1	86.1	86.1	86.1	86.1	85.8	84.2	80.2	78.1	76.2	74.3
3600	86.1	86.1	86.1	86.1	86.1	86.1	86.1	82.3	80.3	78.2	76.3
3800	86.1	86.1	86.1	86.1	86.1	86.1	86.1	84.4	82.2	80.1	78.2
4000	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	84.2	82.0	80.0
4200	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.0	83.8	81.7
4400	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	85.6	83.4
4600	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	85.1
4800	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1
5000	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1
CLIMB LIMIT WT (1000 KG)	81.9	81.4	81.3	81.2	81.1	81.0	79.0	73.8	71.3	68.8	66.4

With engine bleed for packs off, increase field limit weight by 400 kg and climb limit weight by 1350 kg.
With engine anti-ice on, decrease field limit weight by 200 kg and climb limit weight by 250 kg.
With engine and wing anti-ice on (optional system), decrease field limit weight by 750 kg and climb limit weight by 1550 kg.

Takeoff Field & Climb Limit Weights - Wet Runway

Flaps 5

4000 FT Pressure Altitude

CORR'D FIELD LENGTH (M)	FIELD LIMIT WEIGHT (1000 KG)										
	OAT (°C)										
	-40	10	14	18	22	26	30	38	42	46	50
1800	66.8	60.7	60.3	59.8	59.4	58.6	57.6	55.0	53.6	52.3	51.2
2000	70.3	63.9	63.4	63.0	62.5	61.7	60.6	57.9	56.5	55.2	53.9
2200	73.6	67.0	66.5	66.0	65.6	64.6	63.6	60.7	59.3	57.9	56.6
2400	76.8	69.9	69.4	68.9	68.4	67.5	66.3	63.4	61.9	60.4	59.1
2600	79.7	72.5	72.0	71.5	71.0	70.0	68.8	65.8	64.2	62.7	61.3
2800	82.3	75.0	74.4	73.9	73.4	72.4	71.2	68.0	66.4	64.8	63.4
3000	84.9	77.3	76.8	76.2	75.7	74.7	73.4	70.1	68.5	66.9	65.4
3200	86.1	79.7	79.2	78.6	78.1	77.0	75.7	72.3	70.6	68.9	67.4
3400	86.1	82.0	81.5	80.9	80.3	79.2	77.9	74.4	72.6	70.9	69.3
3600	86.1	84.3	83.7	83.1	82.5	81.3	80.0	76.4	74.6	72.8	71.1
3800	86.1	86.1	85.8	85.2	84.6	83.4	81.9	78.2	76.4	74.5	72.8
4000	86.1	86.1	86.1	86.1	86.1	85.3	83.9	80.0	78.1	76.2	74.5
4200	86.1	86.1	86.1	86.1	86.1	86.1	85.7	81.8	79.8	77.8	76.1
4400	86.1	86.1	86.1	86.1	86.1	86.1	86.1	83.5	81.5	79.5	77.6
4600	86.1	86.1	86.1	86.1	86.1	86.1	86.1	85.2	83.1	81.1	79.2
4800	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	84.7	82.6	80.7
5000	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	84.2	82.2
CLIMB LIMIT WT (1000 KG)	77.1	76.5	76.5	76.4	76.3	75.2	73.6	68.9	66.6	64.2	62.2

6000 FT Pressure Altitude

CORR'D FIELD LENGTH (M)	FIELD LIMIT WEIGHT (1000 KG)										
	OAT (°C)										
	-40	10	14	18	22	26	30	38	42	46	50
1800	61.8	56.3	55.9	55.5	54.8	54.1	53.2	50.8	49.6	48.5	47.4
2000	65.1	59.3	58.9	58.5	57.8	57.0	56.1	53.6	52.3	51.2	50.0
2200	68.2	62.2	61.8	61.4	60.6	59.8	58.8	56.3	54.9	53.7	52.5
2400	71.2	64.9	64.5	64.1	63.3	62.4	61.4	58.8	57.4	56.1	54.9
2600	73.8	67.3	66.9	66.5	65.6	64.8	63.7	60.9	59.5	58.2	56.9
2800	76.3	69.6	69.2	68.7	67.9	67.0	65.9	63.0	61.5	60.2	58.9
3000	78.7	71.8	71.3	70.9	70.0	69.1	68.0	65.0	63.5	62.1	60.7
3200	81.2	74.0	73.5	73.1	72.2	71.2	70.1	67.0	65.4	64.0	62.5
3400	83.6	76.2	75.7	75.2	74.2	73.3	72.1	68.9	67.2	65.8	64.3
3600	85.8	78.2	77.7	77.2	76.2	75.2	74.0	70.7	69.0	67.5	66.0
3800	86.1	80.1	79.6	79.1	78.1	77.0	75.8	72.4	70.6	69.0	67.5
4000	86.1	82.0	81.4	80.9	79.9	78.8	77.5	74.0	72.2	70.6	69.0
4200	86.1	83.8	83.2	82.7	81.6	80.5	79.2	75.6	73.7	72.1	70.4
4400	86.1	85.6	85.0	84.4	83.3	82.2	80.8	77.2	75.3	73.6	71.9
4600	86.1	86.1	86.1	86.1	85.0	83.9	82.5	78.7	76.8	75.0	73.3
4800	86.1	86.1	86.1	86.1	86.1	85.5	84.1	80.3	78.3	76.5	74.7
5000	86.1	86.1	86.1	86.1	86.1	86.1	85.6	81.8	79.7	77.9	76.2
CLIMB LIMIT WT (1000 KG)	72.3	71.9	71.8	71.8	70.8	69.8	68.3	63.9	61.6	59.6	57.7

With engine bleed for packs off, increase field limit weight by 400 kg and climb limit weight by 1350 kg.
With engine anti-ice on, decrease field limit weight by 200 kg and climb limit weight by 250 kg.
With engine and wing anti-ice on (optional system), decrease field limit weight by 750 kg and climb limit weight by 1550 kg.

Takeoff Field & Climb Limit Weights - Wet Runway

Flaps 5

8000 FT Pressure Altitude

CORR'D FIELD LENGTH (M)	FIELD LIMIT WEIGHT (1000 KG)										
	OAT (°C)										
	-40	10	14	18	22	26	30	38	42	46	50
1800	57.3	52.4	52.0	51.4	50.7	50.0	48.9	46.6	45.5	44.5	43.5
2000	60.4	55.2	54.9	54.2	53.5	52.7	51.6	49.2	48.1	47.0	45.9
2200	63.3	57.9	57.6	56.9	56.1	55.3	54.2	51.6	50.5	49.4	48.2
2400	66.1	60.5	60.1	59.4	58.6	57.7	56.6	53.9	52.7	51.6	50.4
2600	68.5	62.8	62.3	61.6	60.8	59.9	58.7	56.0	54.7	53.5	52.3
2800	70.9	64.9	64.5	63.7	62.9	61.9	60.7	57.9	56.6	55.3	54.1
3000	73.1	66.9	66.5	65.7	64.9	63.9	62.6	59.7	58.4	57.1	55.8
3200	75.4	69.0	68.5	67.7	66.9	65.8	64.5	61.5	60.1	58.8	57.5
3400	77.5	71.0	70.5	69.6	68.8	67.7	66.4	63.2	61.8	60.4	59.1
3600	79.6	72.8	72.4	71.5	70.6	69.5	68.1	64.9	63.4	62.0	60.6
3800	81.6	74.6	74.1	73.2	72.2	71.1	69.7	66.3	64.8	63.4	61.9
4000	83.5	76.3	75.8	74.8	73.9	72.7	71.2	67.8	66.2	64.7	63.2
4200	85.4	77.9	77.4	76.4	75.5	74.3	72.7	69.2	67.6	66.1	64.5
4400	86.1	79.6	79.0	78.0	77.0	75.8	74.3	70.6	69.0	67.4	65.8
4600	86.1	81.2	80.6	79.6	78.6	77.3	75.7	72.0	70.4	68.8	67.1
4800	86.1	82.7	82.2	81.1	80.1	78.8	77.2	73.4	71.7	70.1	68.4
5000	86.1	84.3	83.7	82.7	81.6	80.3	78.7	74.8	73.1	71.4	69.8
CLIMB LIMIT WT (1000 KG)	67.8	67.4	67.3	66.5	65.7	64.4	62.5	58.1	56.2	54.4	52.7

10000 FT Pressure Altitude

CORR'D FIELD LENGTH (M)	FIELD LIMIT WEIGHT (1000 KG)										
	OAT (°C)										
	-40	10	14	18	22	26	30	38	42	46	50
1800	53.4	48.7	48.1	47.5	46.8	46.1	45.1	42.9	41.8	40.7	39.6
2000	56.2	51.4	50.7	50.1	49.4	48.7	47.6	45.3	44.1	43.0	41.9
2200	59.0	53.9	53.2	52.6	51.9	51.1	50.0	47.6	46.4	45.2	44.0
2400	61.6	56.3	55.6	54.9	54.2	53.4	52.3	49.7	48.5	47.3	46.0
2600	63.9	58.4	57.7	57.0	56.2	55.4	54.2	51.6	50.3	49.0	47.7
2800	66.1	60.4	59.7	58.9	58.2	57.3	56.1	53.4	52.0	50.7	49.4
3000	68.1	62.3	61.5	60.8	60.0	59.1	57.8	55.0	53.7	52.3	50.9
3200	70.2	64.2	63.4	62.6	61.8	60.9	59.6	56.7	55.3	53.9	52.4
3400	72.2	66.0	65.2	64.4	63.5	62.6	61.2	58.3	56.8	55.3	53.9
3600	74.2	67.8	66.9	66.1	65.2	64.2	62.8	59.7	58.2	56.7	55.2
3800	75.9	69.3	68.4	67.6	66.7	65.7	64.2	61.0	59.5	57.9	56.4
4000	77.7	70.9	69.9	69.0	68.1	67.1	65.6	62.3	60.7	59.1	57.5
4200	79.4	72.4	71.4	70.5	69.6	68.5	67.0	63.6	61.9	60.3	58.7
4400	81.0	73.9	72.9	72.0	71.0	69.9	68.3	64.9	63.2	61.5	59.8
4600	82.7	75.4	74.4	73.4	72.4	71.3	69.7	66.2	64.4	62.7	61.0
4800	84.3	76.8	75.8	74.8	73.8	72.7	71.1	67.5	65.7	64.0	62.2
5000	85.8	78.3	77.2	76.2	75.2	74.1	72.4	68.8	67.0	65.2	63.4
CLIMB LIMIT WT (1000 KG)	63.7	63.1	62.3	61.5	60.6	59.4	57.6	53.4	51.5	49.6	47.6

With engine bleed for packs off, increase field limit weight by 400 kg and climb limit weight by 1350 kg.
With engine anti-ice on, decrease field limit weight by 200 kg and climb limit weight by 250 kg.
With engine and wing anti-ice on (optional system), decrease field limit weight by 750 kg and climb limit weight by 1550 kg.

Takeoff Obstacle Limit Weight

Flaps 5

Sea Level, 30°C & Below, Zero Wind

Based on engine bleed for packs on and anti-ice off

Reference Obstacle Limit Weight (1000 KG)

OBSTACLE HEIGHT (M)	DISTANCE FROM BRAKE RELEASE (100 M)										
	25	30	35	40	45	50	55	60	65	70	75
5	75.9										
20	69.7	75.3	79.7								
40	64.5	69.7	74.0	77.5	80.3						
60	60.5	65.5	69.7	73.2	76.1	78.6					
80	57.2	62.1	66.2	69.6	72.6	75.1	77.3	79.1	80.7		
100	54.3	59.2	63.2	66.6	69.6	72.2	74.4	76.3	78.0	79.5	
120	51.8	56.6	60.6	64.0	67.0	69.6	71.8	73.8	75.6	77.1	78.5
140	49.6	54.3	58.2	61.7	64.6	67.2	69.5	71.5	73.3	74.9	76.4
160	47.5	52.2	56.1	59.5	62.5	65.1	67.4	69.5	71.3	72.9	74.4
180	45.7	50.3	54.2	57.6	60.5	63.1	65.4	67.5	69.4	71.1	72.6
200	44.0	48.6	52.4	55.8	58.7	61.3	63.7	65.8	67.6	69.4	70.9
220	42.4	46.9	50.8	54.1	57.1	59.7	62.0	64.1	66.0	67.7	69.3
240		45.4	49.3	52.6	55.5	58.1	60.5	62.6	64.5	66.2	67.8
260		44.0	47.8	51.1	54.1	56.7	59.0	61.1	63.0	64.8	66.4
280		42.7	46.5	49.8	52.7	55.3	57.6	59.7	61.6	63.4	65.0
300		41.5	45.2	48.5	51.4	54.0	56.3	58.4	60.4	62.1	63.7

When using line-up allowances, the obstacle distance from brake release must be reduced by the ASDA adjustment.
Obstacle height must be calculated from lowest point of the runway to conservatively account for runway slope.

OAT Adjustments

OAT (°C)	REFERENCE OBSTACLE LIMIT WEIGHT (1000 KG)								
	40	45	50	55	60	65	70	75	80
30 & BELOW	0	0	0	0	0	0	0	0	0
32	-0.6	-0.7	-0.8	-0.9	-0.9	-1.0	-1.1	-1.2	-1.3
34	-1.2	-1.4	-1.5	-1.7	-1.9	-2.1	-2.2	-2.4	-2.6
36	-1.8	-2.1	-2.3	-2.6	-2.8	-3.1	-3.3	-3.6	-3.8
38	-2.4	-2.7	-3.1	-3.4	-3.8	-4.1	-4.4	-4.8	-5.1
40	-3.0	-3.4	-3.9	-4.3	-4.7	-5.1	-5.5	-6.0	-6.4
42	-3.6	-4.1	-4.6	-5.1	-5.6	-6.1	-6.6	-7.1	-7.6
44	-4.1	-4.7	-5.3	-5.9	-6.5	-7.1	-7.6	-8.2	-8.8
46	-4.7	-5.4	-6.0	-6.7	-7.3	-8.0	-8.7	-9.3	-10.0
48	-5.3	-6.0	-6.7	-7.5	-8.2	-9.0	-9.7	-10.5	-11.2
50	-5.8	-6.6	-7.5	-8.3	-9.1	-9.9	-10.8	-11.6	-12.4

Takeoff Obstacle Limit Weight
Flaps 5
Sea Level, 30°C & Below, Zero Wind
Pressure Altitude Adjustments

ALT (FT)	OAT ADJUSTED OBSTACLE LIMIT WEIGHT (1000 KG)								
	40	45	50	55	60	65	70	75	80
S.L. & BELOW	0	0	0	0	0	0	0	0	0
1000	-1.5	-1.7	-1.9	-2.0	-2.2	-2.4	-2.6	-2.7	-2.9
2000	-3.0	-3.4	-3.7	-4.1	-4.4	-4.8	-5.1	-5.5	-5.8
3000	-4.4	-4.9	-5.5	-6.0	-6.5	-7.0	-7.5	-8.0	-8.5
4000	-5.8	-6.5	-7.2	-7.9	-8.6	-9.2	-9.9	-10.6	-11.3
5000	-7.1	-7.9	-8.7	-9.6	-10.4	-11.3	-12.1	-13.0	-13.8
6000	-8.3	-9.3	-10.3	-11.3	-12.3	-13.3	-14.3	-15.3	-16.3
7000	-9.5	-10.6	-11.8	-13.0	-14.2	-15.3	-16.5	-17.7	-18.9
8000	-10.6	-12.0	-13.3	-14.6	-16.0	-17.3	-18.7	-20.0	-21.4
9000	-11.7	-13.2	-14.7	-16.2	-17.7	-19.2	-20.6	-22.1	-23.6
10000	-12.8	-14.4	-16.0	-17.7	-19.3	-21.0	-22.6	-24.2	-25.9

Wind Adjustments

WIND (KTS)	OAT & ALT ADJUSTED OBSTACLE LIMIT WEIGHT (1000 KG)								
	40	45	50	55	60	65	70	75	80
15 TW	-8.8	-8.7	-8.5	-8.4	-8.3	-8.2	-8.1	-8.0	-7.8
10 TW	-5.8	-5.8	-5.7	-5.6	-5.5	-5.5	-5.4	-5.3	-5.2
5 TW	-2.9	-2.9	-2.8	-2.8	-2.8	-2.7	-2.7	-2.7	-2.6
0	0	0	0	0	0	0	0	0	0
10 HW	1.1	1.1	1.1	1.0	1.0	0.9	0.9	0.9	0.8
20 HW	2.3	2.2	2.1	2.0	2.0	1.9	1.8	1.7	1.6
30 HW	3.5	3.4	3.2	3.1	3.0	2.9	2.7	2.6	2.5
40 HW	4.8	4.6	4.4	4.2	4.0	3.8	3.7	3.5	3.3

With engine bleed for packs off, increase weight by 600 kg.
With engine anti-ice on, decrease weight by 300 kg.
With engine and wing anti-ice on, decrease weight by 1650 kg (optional system).

Takeoff Field Corrections - Dry Runway (24K Derate)

Slope Corrections

FIELD LENGTH AVAILABLE (M)	SLOPE CORRECTED FIELD LENGTH (M)								
	RUNWAY SLOPE (%)								
	-2.0	-1.5	-1.0	-0.5	0.0	0.5	1.0	1.5	2.0
1200	1250	1240	1230	1210	1200	1180	1170	1150	1130
1400	1470	1460	1440	1420	1400	1370	1340	1300	1270
1600	1700	1670	1650	1620	1600	1550	1510	1460	1410
1800	1920	1890	1860	1830	1800	1740	1680	1610	1550
2000	2140	2110	2070	2040	2000	1920	1850	1770	1690
2200	2370	2330	2280	2240	2200	2110	2020	1930	1830
2400	2590	2540	2500	2450	2400	2290	2190	2080	1970
2600	2820	2760	2710	2650	2600	2480	2360	2240	2120
2800	3040	2980	2920	2860	2800	2660	2530	2390	2260
3000	3260	3200	3130	3070	3000	2850	2700	2550	2400
3200	3490	3420	3340	3270	3200	3030	2870	2700	2540
3400	3710	3630	3560	3480	3400	3220	3040	2860	2680
3600	3930	3850	3770	3680	3600	3400	3210	3010	2820
3800	4160	4070	3980	3890	3800	3590	3380	3170	2960
4000	4380	4290	4190	4100	4000	3780	3550	3330	3100
4200	4610	4500	4400	4300	4200	3960	3720	3480	3240
4400	4830	4720	4610	4510	4400	4150	3890	3640	3380
4600	5050	4940	4830	4710	4600	4330	4060	3790	3520
4800	5280	5160	5040	4920	4800	4520	4230	3950	3660
5000	5500	5370	5250	5120	5000	4700	4400	4100	3810

Wind Corrections

SLOPE CORR'D FIELD LENGTH (M)	SLOPE & WIND CORRECTED FIELD LENGTH (M)							
	WIND COMPONENT (KTS)							
	-15	-10	-5	0	10	20	30	40
1200	850	970	1080	1200	1290	1370	1440	1500
1400	1020	1140	1270	1400	1490	1580	1650	1720
1600	1180	1320	1460	1600	1690	1780	1860	1940
1800	1350	1500	1650	1800	1900	1990	2070	2150
2000	1510	1680	1840	2000	2100	2190	2280	2370
2200	1680	1850	2030	2200	2300	2400	2490	2590
2400	1850	2030	2220	2400	2500	2600	2710	2810
2600	2010	2210	2400	2600	2700	2810	2920	3020
2800	2180	2390	2590	2800	2910	3020	3130	3240
3000	2350	2560	2780	3000	3110	3220	3340	3460
3200	2510	2740	2970	3200	3310	3430	3550	3680
3400	2680	2920	3160	3400	3510	3630	3760	3890
3600	2840	3100	3350	3600	3720	3840	3970	4110
3800	3010	3270	3540	3800	3920	4040	4180	4330
4000	3180	3450	3730	4000	4120	4250	4390	4550
4200	3340	3630	3910	4200	4320	4460	4600	4760
4400	3510	3810	4100	4400	4520	4660	4810	4980
4600	3670	3980	4290	4600	4730	4870	5020	5200
4800	3840	4160	4480	4800	4930	5070	5240	5420
5000	4010	4340	4670	5000	5130	5280	5450	5630

Takeoff Field & Climb Limit Weights - Dry Runway (24K Derate)

Flaps 5

Sea Level Pressure Altitude

CORR'D FIELD LENGTH (M)	FIELD LIMIT WEIGHT (1000 KG)										
	OAT (°C)										
	-40	10	14	18	22	26	30	38	42	46	50
1200	58.1	54.2	53.8	53.5	53.2	52.9	52.6	50.3	49.0	47.6	46.3
1400	63.0	58.7	58.4	58.0	57.7	57.3	57.0	54.5	53.1	51.6	50.2
1600	67.5	62.9	62.5	62.1	61.8	61.4	61.0	58.4	56.9	55.3	53.8
1800	71.6	66.7	66.4	66.0	65.6	65.2	64.8	61.9	60.4	58.7	57.0
2000	75.6	70.4	70.0	69.6	69.2	68.8	68.4	65.3	63.6	61.9	60.1
2200	79.5	74.0	73.5	73.1	72.6	72.2	71.8	68.5	66.7	64.9	63.0
2400	81.6	77.3	76.8	76.4	75.9	75.4	75.0	71.6	69.7	67.7	65.7
2600	81.6	80.4	80.0	79.5	79.0	78.5	78.0	74.5	72.5	70.4	68.4
2800	81.6	81.6	81.6	81.6	81.6	81.5	81.0	77.3	75.2	73.1	70.9
3000	81.6	81.6	81.6	81.6	81.6	81.6	81.6	79.4	77.3	75.1	72.9
3200	81.6	81.6	81.6	81.6	81.6	81.6	81.6	81.5	79.3	77.0	74.7
3400	81.6	81.6	81.6	81.6	81.6	81.6	81.6	81.6	81.3	78.9	76.6
3600	81.6	81.6	81.6	81.6	81.6	81.6	81.6	81.6	81.6	80.9	78.4
3800	81.6	81.6	81.6	81.6	81.6	81.6	81.6	81.6	81.6	81.6	80.3
4000	81.6	81.6	81.6	81.6	81.6	81.6	81.6	81.6	81.6	81.6	81.6
4200	81.6	81.6	81.6	81.6	81.6	81.6	81.6	81.6	81.6	81.6	81.6
4400	81.6	81.6	81.6	81.6	81.6	81.6	81.6	81.6	81.6	81.6	81.6
CLIMB LIMIT WT (1000 KG)	78.3	77.7	77.6	77.5	77.3	77.2	77.1	71.6	68.9	66.3	63.6

2000 FT Pressure Altitude

CORR'D FIELD LENGTH (M)	FIELD LIMIT WEIGHT (1000 KG)										
	OAT (°C)										
	-40	10	14	18	22	26	30	38	42	46	50
1200	55.5	51.5	51.2	50.9	50.6	50.3	49.1	46.7	45.4	44.2	42.9
1400	60.2	55.9	55.5	55.2	54.9	54.5	53.2	50.6	49.2	47.9	46.5
1600	64.5	59.8	59.5	59.1	58.8	58.4	57.0	54.2	52.7	51.3	49.8
1800	68.4	63.5	63.1	62.7	62.4	62.0	60.5	57.5	55.9	54.4	52.9
2000	72.3	67.0	66.6	66.2	65.8	65.4	63.8	60.6	58.9	57.3	55.7
2200	75.9	70.3	69.9	69.4	69.0	68.6	66.9	63.5	61.7	60.0	58.3
2400	79.3	73.4	73.0	72.5	72.1	71.6	69.9	66.3	64.4	62.6	60.8
2600	81.6	76.4	75.9	75.5	75.0	74.5	72.7	68.9	67.0	65.1	63.2
2800	81.6	79.3	78.8	78.3	77.8	77.3	75.5	71.5	69.5	67.5	65.6
3000	81.6	81.5	81.0	80.5	80.0	79.5	77.5	73.4	71.4	69.3	67.3
3200	81.6	81.6	81.6	81.6	81.6	81.6	79.6	75.3	73.2	71.0	68.9
3400	81.6	81.6	81.6	81.6	81.6	81.6	81.6	77.2	75.0	72.8	70.6
3600	81.6	81.6	81.6	81.6	81.6	81.6	81.6	79.1	76.8	74.5	72.2
3800	81.6	81.6	81.6	81.6	81.6	81.6	81.6	81.0	78.6	76.3	74.0
4000	81.6	81.6	81.6	81.6	81.6	81.6	81.6	81.6	80.4	78.0	75.6
4200	81.6	81.6	81.6	81.6	81.6	81.6	81.6	81.6	81.6	79.7	77.3
4400	81.6	81.6	81.6	81.6	81.6	81.6	81.6	81.6	81.6	81.3	78.8
CLIMB LIMIT WT (1000 KG)	75.4	74.7	74.6	74.5	74.4	74.3	71.6	66.4	63.9	61.4	59.0

With engine bleed for packs off, increase field limit weight by 400 kg and climb limit weight by 1500 kg.
With engine anti-ice on, decrease field limit weight by 200 kg and climb limit weight by 250 kg.
With engine and wing anti-ice on (optional system), decrease field limit weight by 700 kg and climb limit weight by 1450 kg.

Takeoff Field & Climb Limit Weights - Dry Runway (24K Derate)

Flaps 5

4000 FT Pressure Altitude

CORR'D FIELD LENGTH (M)	FIELD LIMIT WEIGHT (1000 KG)										
	OAT (°C)										
	-40	10	14	18	22	26	30	38	42	46	50
1200	52.8	48.9	48.6	48.2	47.9	46.8	45.6	43.2	42.1	41.0	40.0
1400	57.2	53.0	52.6	52.3	52.0	50.7	49.4	46.8	45.6	44.4	43.4
1600	61.3	56.7	56.4	56.0	55.7	54.3	52.9	50.2	48.9	47.6	46.5
1800	65.1	60.2	59.8	59.4	59.1	57.6	56.2	53.2	51.8	50.5	49.3
2000	68.7	63.5	63.1	62.7	62.3	60.7	59.2	56.0	54.6	53.1	51.8
2200	72.1	66.6	66.1	65.7	65.3	63.7	62.0	58.7	57.1	55.6	54.2
2400	75.3	69.5	69.1	68.6	68.1	66.5	64.7	61.2	59.6	58.0	56.5
2600	78.4	72.3	71.8	71.4	70.9	69.1	67.3	63.6	61.9	60.2	58.7
2800	81.3	75.0	74.5	74.0	73.5	71.7	69.8	66.0	64.2	62.5	60.9
3000	81.6	77.1	76.6	76.1	75.6	73.7	71.7	67.7	65.9	64.1	62.5
3200	81.6	79.1	78.6	78.1	77.5	75.5	73.5	69.4	67.5	65.6	63.9
3400	81.6	81.1	80.6	80.0	79.5	77.4	75.3	71.1	69.1	67.2	65.4
3600	81.6	81.6	81.6	81.6	81.4	79.3	77.1	72.7	70.7	68.7	66.9
3800	81.6	81.6	81.6	81.6	81.6	81.2	79.0	74.5	72.4	70.3	68.4
4000	81.6	81.6	81.6	81.6	81.6	81.6	80.8	76.2	74.0	71.9	70.0
4200	81.6	81.6	81.6	81.6	81.6	81.6	81.6	77.8	75.6	73.4	71.5
4400	81.6	81.6	81.6	81.6	81.6	81.6	81.6	79.4	77.2	74.9	72.9
CLIMB LIMIT WT (1000 KG)	72.3	71.8	71.7	71.6	71.5	68.9	66.4	61.5	59.2	56.9	54.8

6000 FT Pressure Altitude

CORR'D FIELD LENGTH (M)	FIELD LIMIT WEIGHT (1000 KG)										
	OAT (°C)										
	-40	10	14	18	22	26	30	38	42	46	50
1200	50.1	46.1	45.8	45.5	44.4	43.3	42.2	40.1	39.1	38.1	37.3
1400	54.3	50.0	49.7	49.4	48.2	46.9	45.7	43.4	42.4	41.4	40.4
1600	58.2	53.6	53.2	52.9	51.6	50.3	49.0	46.5	45.4	44.3	43.3
1800	61.7	56.8	56.5	56.1	54.7	53.3	51.9	49.3	48.1	47.0	45.9
2000	65.1	59.9	59.5	59.1	57.7	56.1	54.7	51.9	50.6	49.4	48.2
2200	68.3	62.8	62.4	61.9	60.4	58.8	57.3	54.3	52.9	51.6	50.4
2400	71.3	65.5	65.1	64.6	63.0	61.3	59.7	56.6	55.1	53.8	52.5
2600	74.2	68.1	67.7	67.2	65.5	63.7	62.0	58.8	57.3	55.9	54.5
2800	77.0	70.7	70.2	69.7	68.0	66.1	64.4	61.0	59.4	57.9	56.5
3000	79.1	72.6	72.1	71.6	69.8	67.9	66.0	62.6	60.9	59.4	57.9
3200	81.2	74.4	73.9	73.4	71.5	69.5	67.6	64.0	62.3	60.8	59.2
3400	81.6	76.3	75.7	75.2	73.3	71.2	69.2	65.5	63.7	62.1	60.6
3600	81.6	78.1	77.6	77.0	75.0	72.9	70.9	67.0	65.2	63.5	61.9
3800	81.6	80.0	79.4	78.9	76.8	74.6	72.5	68.6	66.7	64.9	63.3
4000	81.6	81.6	81.3	80.7	78.6	76.3	74.2	70.1	68.2	66.4	64.7
4200	81.6	81.6	81.6	81.6	80.3	78.0	75.8	71.6	69.6	67.8	66.0
4400	81.6	81.6	81.6	81.6	81.6	79.6	77.3	73.0	71.0	69.1	67.3
CLIMB LIMIT WT (1000 KG)	69.3	68.9	68.8	68.7	66.2	63.7	61.3	56.8	54.6	52.7	50.9

With engine bleed for packs off, increase field limit weight by 400 kg and climb limit weight by 1500 kg.
With engine anti-ice on, decrease field limit weight by 200 kg and climb limit weight by 250 kg.
With engine and wing anti-ice on (optional system), decrease field limit weight by 700 kg and climb limit weight by 1450 kg.

Takeoff Field & Climb Limit Weights - Dry Runway (24K Derate)

Flaps 5

8000 FT Pressure Altitude

CORR'D FIELD LENGTH (M)	FIELD LIMIT WEIGHT (1000 KG)										
	OAT (°C)										
	-40	10	14	18	22	26	30	38	42	46	50
1200	47.1	43.4	43.1	42.2	41.2	40.1	39.1	37.2	36.3	35.4	34.6
1400	51.1	47.1	46.8	45.7	44.6	43.5	42.4	40.3	39.4	38.4	37.5
1600	54.7	50.4	50.1	49.0	47.8	46.6	45.4	43.2	42.2	41.2	40.2
1800	58.1	53.5	53.1	52.0	50.7	49.4	48.2	45.8	44.7	43.6	42.6
2000	61.2	56.3	55.9	54.7	53.3	52.0	50.7	48.1	47.0	45.8	44.7
2200	64.2	59.0	58.6	57.3	55.8	54.4	53.0	50.3	49.1	47.9	46.7
2400	67.0	61.5	61.1	59.7	58.2	56.7	55.2	52.4	51.1	49.8	48.6
2600	69.7	64.0	63.5	62.1	60.5	58.9	57.4	54.4	53.0	51.7	50.5
2800	72.3	66.3	65.9	64.4	62.7	61.1	59.5	56.4	55.0	53.6	52.3
3000	74.3	68.1	67.6	66.1	64.4	62.6	61.0	57.8	56.3	54.9	53.5
3200	76.2	69.8	69.3	67.7	65.9	64.1	62.4	59.1	57.6	56.1	54.7
3400	78.1	71.5	71.0	69.3	67.5	65.6	63.8	60.4	58.8	57.3	55.8
3600	80.0	73.1	72.6	70.9	69.0	67.1	65.3	61.7	60.1	58.5	57.0
3800	81.6	74.9	74.4	72.6	70.6	68.7	66.8	63.1	61.5	59.8	58.3
4000	81.6	76.6	76.1	74.2	72.2	70.2	68.3	64.5	62.8	61.1	59.5
4200	81.6	78.3	77.7	75.8	73.8	71.7	69.7	65.9	64.1	62.4	60.7
4400	81.6	79.9	79.3	77.4	75.3	73.1	71.1	67.2	65.4	63.6	61.9
CLIMB LIMIT WT (1000 KG)	66.1	65.8	65.7	63.5	61.1	58.8	56.5	52.3	50.5	48.7	47.0

10000 FT Pressure Altitude

CORR'D FIELD LENGTH (M)	FIELD LIMIT WEIGHT (1000 KG)										
	OAT (°C)										
	-40	10	14	18	22	26	30	38	42	46	50
1200	44.2	40.9	40.1	39.1	38.2	37.2	36.3	34.4	33.5	32.7	31.8
1400	47.9	44.3	43.4	42.4	41.4	40.3	39.3	37.3	36.4	35.4	34.5
1600	51.4	47.5	46.5	45.5	44.3	43.2	42.1	40.0	39.0	38.0	37.0
1800	54.5	50.3	49.3	48.2	47.0	45.8	44.6	42.4	41.3	40.2	39.2
2000	57.4	53.0	51.9	50.7	49.4	48.1	46.9	44.5	43.3	42.2	41.1
2200	60.1	55.4	54.3	53.0	51.7	50.3	49.0	46.5	45.2	44.0	42.9
2400	62.7	57.8	56.6	55.2	53.8	52.4	51.0	48.3	47.0	45.8	44.6
2600	65.2	60.0	58.8	57.4	55.9	54.4	53.0	50.2	48.8	47.5	46.2
2800	67.6	62.3	61.0	59.5	58.0	56.4	54.9	52.0	50.6	49.2	47.9
3000	69.4	63.9	62.5	61.0	59.4	57.8	56.3	53.2	51.8	50.3	49.0
3200	71.2	65.4	64.0	62.4	60.8	59.1	57.5	54.4	52.9	51.4	49.9
3400	72.9	66.9	65.5	63.9	62.1	60.4	58.8	55.5	53.9	52.4	50.9
3600	74.6	68.5	67.0	65.3	63.5	61.7	60.0	56.7	55.1	53.5	51.9
3800	76.4	70.1	68.6	66.8	65.0	63.1	61.4	57.9	56.3	54.6	53.0
4000	78.2	71.7	70.1	68.3	66.4	64.5	62.7	59.2	57.5	55.8	54.2
4200	79.9	73.2	71.6	69.7	67.8	65.9	64.0	60.4	58.6	56.9	55.2
4400	81.5	74.7	73.0	71.1	69.1	67.1	65.3	61.5	59.7	58.0	56.3
CLIMB LIMIT WT (1000 KG)	62.8	62.4	60.6	58.6	56.3	54.1	52.0	48.1	46.3	44.4	42.7

With engine bleed for packs off, increase field limit weight by 400 kg and climb limit weight by 1500 kg.
With engine anti-ice on, decrease field limit weight by 200 kg and climb limit weight by 250 kg.
With engine and wing anti-ice on (optional system), decrease field limit weight by 700 kg and climb limit weight by 1450 kg.

Takeoff Field Corrections - Wet Runway (24K Derate)

Slope Corrections

FIELD LENGTH AVAILABLE (M)	SLOPE CORRECTED FIELD LENGTH (M)								
	RUNWAY SLOPE (%)								
	-2.0	-1.5	-1.0	-0.5	0.0	0.5	1.0	1.5	2.0
1200	1240	1230	1220	1210	1200	1190	1180	1160	1150
1400	1470	1450	1430	1420	1400	1380	1350	1330	1300
1600	1700	1670	1650	1620	1600	1560	1530	1490	1460
1800	1930	1890	1860	1830	1800	1750	1710	1660	1610
2000	2150	2120	2080	2040	2000	1940	1880	1820	1760
2200	2380	2340	2290	2250	2200	2130	2060	1990	1920
2400	2610	2560	2510	2450	2400	2320	2240	2150	2070
2600	2840	2780	2720	2660	2600	2510	2410	2320	2230
2800	3070	3000	2930	2870	2800	2690	2590	2480	2380
3000	3300	3220	3150	3070	3000	2880	2770	2650	2530
3200	3530	3440	3360	3280	3200	3070	2940	2820	2690
3400	3750	3670	3580	3490	3400	3260	3120	2980	2840
3600	3980	3890	3790	3700	3600	3450	3300	3150	2990
3800	4210	4110	4010	3900	3800	3640	3470	3310	3150
4000	4440	4330	4220	4110	4000	3830	3650	3480	3300
4200	4670	4550	4430	4320	4200	4010	3830	3640	3460
4400	4900	4770	4650	4520	4400	4200	4000	3810	3610
4600	5130	4990	4860	4730	4600	4390	4180	3970	3760
4800	5350	5220	5080	4940	4800	4580	4360	4140	3920
5000	5580	5440	5290	5150	5000	4770	4540	4300	4070

Wind Corrections

SLOPE CORR'D FIELD LENGTH (M)	SLOPE & WIND CORRECTED FIELD LENGTH (M)							
	WIND COMPONENT (KTS)							
	-15	-10	-5	0	10	20	30	40
1200	840	960	1080	1200	1280	1360	1450	1530
1400	1010	1140	1270	1400	1490	1580	1670	1760
1600	1180	1320	1460	1600	1690	1790	1890	1990
1800	1350	1500	1650	1800	1900	2000	2110	2210
2000	1520	1680	1840	2000	2110	2220	2330	2440
2200	1690	1860	2030	2200	2310	2430	2550	2670
2400	1860	2040	2220	2400	2520	2640	2770	2890
2600	2030	2220	2410	2600	2730	2850	2990	3120
2800	2190	2400	2600	2800	2930	3070	3210	3350
3000	2360	2580	2790	3000	3140	3280	3430	3570
3200	2530	2760	2980	3200	3350	3490	3640	3800
3400	2700	2930	3170	3400	3550	3710	3860	4030
3600	2870	3110	3360	3600	3760	3920	4080	4250
3800	3040	3290	3550	3800	3960	4130	4300	4480
4000	3210	3470	3740	4000	4170	4350	4520	4710
4200	3380	3650	3930	4200	4380	4560	4740	4930
4400	3550	3830	4120	4400	4580	4770	4960	5160
4600	3720	4010	4310	4600	4790	4980	5180	5390
4800	3890	4190	4500	4800	5000	5200	5400	5610
5000	4060	4370	4690	5000	5200	5410	5620	5840

Takeoff Field & Climb Limit Weights - Wet Runway (24K Derate)

Flaps 5

Sea Level Pressure Altitude

CORR'D FIELD LENGTH (M)	FIELD LIMIT WEIGHT (1000 KG)										
	OAT (°C)										
	-40	10	14	18	22	26	30	38	42	46	50
1450	64.3	59.5	59.1	58.7	58.3	57.9	57.6	54.7	53.3	51.9	50.5
1600	67.6	62.5	62.1	61.6	61.2	60.9	60.5	57.5	55.9	54.5	53.0
1800	71.6	66.2	65.7	65.3	64.9	64.4	64.0	60.8	59.2	57.6	56.1
2000	75.4	69.6	69.2	68.7	68.2	67.8	67.4	64.0	62.3	60.6	59.0
2200	79.0	72.9	72.4	72.0	71.5	71.0	70.5	67.0	65.2	63.5	61.7
2400	81.6	76.1	75.6	75.1	74.6	74.1	73.6	69.9	68.0	66.2	64.3
2600	81.6	79.1	78.6	78.0	77.5	77.0	76.5	72.6	70.6	68.7	66.8
2800	81.6	81.6	81.5	80.9	80.4	79.9	79.3	75.3	73.2	71.3	69.3
3000	81.6	81.6	81.6	81.6	81.6	81.6	81.6	77.6	75.4	73.4	71.3
3200	81.6	81.6	81.6	81.6	81.6	81.6	81.6	79.9	77.7	75.6	73.5
3400	81.6	81.6	81.6	81.6	81.6	81.6	81.6	81.6	80.0	77.8	75.5
3600	81.6	81.6	81.6	81.6	81.6	81.6	81.6	81.6	81.6	79.9	77.6
3800	81.6	81.6	81.6	81.6	81.6	81.6	81.6	81.6	81.6	81.6	79.5
4000	81.6	81.6	81.6	81.6	81.6	81.6	81.6	81.6	81.6	81.6	81.4
4200	81.6	81.6	81.6	81.6	81.6	81.6	81.6	81.6	81.6	81.6	81.6
4400	81.6	81.6	81.6	81.6	81.6	81.6	81.6	81.6	81.6	81.6	81.6
CLIMB LIMIT WT (1000 KG)	78.3	77.7	77.6	77.5	77.3	77.2	77.1	71.6	68.9	66.3	63.6

2000 FT Pressure Altitude

CORR'D FIELD LENGTH (M)	FIELD LIMIT WEIGHT (1000 KG)										
	OAT (°C)										
	-40	10	14	18	22	26	30	38	42	46	50
1450	61.1	56.3	55.9	55.5	55.1	54.7	53.3	50.7	49.4	48.1	46.8
1600	64.2	59.1	58.7	58.3	57.9	57.5	56.0	53.2	51.8	50.4	49.1
1800	68.0	62.6	62.2	61.7	61.3	60.9	59.3	56.3	54.8	53.4	52.0
2000	71.6	65.9	65.4	64.9	64.5	64.0	62.4	59.2	57.6	56.1	54.7
2200	75.0	69.0	68.5	68.0	67.5	67.0	65.3	62.0	60.3	58.7	57.2
2400	78.2	71.9	71.4	70.9	70.4	69.9	68.1	64.6	62.9	61.2	59.5
2600	81.4	74.8	74.2	73.7	73.2	72.6	70.7	67.1	65.3	63.5	61.8
2800	81.6	77.6	77.0	76.4	75.9	75.3	73.3	69.5	67.7	65.8	64.1
3000	81.6	79.9	79.3	78.8	78.2	77.6	75.6	71.6	69.7	67.8	66.0
3200	81.6	81.6	81.6	81.2	80.6	80.0	77.8	73.7	71.7	69.8	67.9
3400	81.6	81.6	81.6	81.6	81.6	81.6	80.1	75.8	73.8	71.7	69.8
3600	81.6	81.6	81.6	81.6	81.6	81.6	81.6	77.9	75.7	73.6	71.6
3800	81.6	81.6	81.6	81.6	81.6	81.6	81.6	79.8	77.6	75.4	73.4
4000	81.6	81.6	81.6	81.6	81.6	81.6	81.6	81.6	79.5	77.2	75.1
4200	81.6	81.6	81.6	81.6	81.6	81.6	81.6	81.6	81.3	79.0	76.8
4400	81.6	81.6	81.6	81.6	81.6	81.6	81.6	81.6	81.6	80.7	78.4
CLIMB LIMIT WT (1000 KG)	75.4	74.7	74.6	74.5	74.4	74.3	71.6	66.4	63.9	61.4	59.0

With engine bleed for packs off, increase field limit weight by 400 kg and climb limit weight by 1500 kg.
With engine anti-ice on, decrease field limit weight by 200 kg and climb limit weight by 250 kg.
With engine and wing anti-ice on (optional system), decrease field limit weight by 750 kg and climb limit weight by 1450 kg.

Takeoff Field & Climb Limit Weights - Wet Runway (24K Derate)

Flaps 5

4000 FT Pressure Altitude

CORR'D FIELD LENGTH (M)	FIELD LIMIT WEIGHT (1000 KG)										
	OAT (°C)										
	-40	10	14	18	22	26	30	38	42	46	50
1450	58.0	53.0	52.7	52.3	52.0	50.7	49.4	46.9	45.8	44.7	43.6
1600	61.0	55.7	55.3	54.9	54.5	53.2	51.8	49.2	48.1	46.9	45.8
1800	64.5	58.9	58.5	58.1	57.7	56.3	54.8	52.1	50.8	49.6	48.4
2000	67.9	62.0	61.6	61.1	60.7	59.2	57.7	54.8	53.4	52.1	50.9
2200	71.1	64.9	64.5	64.0	63.6	61.9	60.3	57.3	55.9	54.5	53.2
2400	74.2	67.7	67.2	66.7	66.3	64.6	62.9	59.7	58.2	56.7	55.4
2600	77.1	70.3	69.8	69.3	68.8	67.1	65.3	62.0	60.5	58.9	57.5
2800	80.0	72.9	72.4	71.9	71.4	69.5	67.7	64.2	62.6	61.0	59.6
3000	81.6	75.1	74.6	74.0	73.5	71.6	69.7	66.1	64.5	62.8	61.2
3200	81.6	77.4	76.8	76.3	75.7	73.7	71.8	68.0	66.3	64.6	63.0
3400	81.6	79.6	79.0	78.5	77.9	75.8	73.8	69.9	68.1	66.3	64.7
3600	81.6	81.6	81.2	80.6	80.0	77.9	75.8	71.8	69.9	68.1	66.4
3800	81.6	81.6	81.6	81.6	81.6	79.8	77.7	73.5	71.6	69.7	68.0
4000	81.6	81.6	81.6	81.6	81.6	81.6	79.5	75.3	73.3	71.3	69.5
4200	81.6	81.6	81.6	81.6	81.6	81.6	81.3	77.0	75.0	72.9	71.1
4400	81.6	81.6	81.6	81.6	81.6	81.6	81.6	78.6	76.6	74.5	72.6
CLIMB LIMIT WT (1000 KG)	72.3	71.8	71.7	71.6	71.5	68.9	66.4	61.5	59.2	56.9	54.8

6000 FT Pressure Altitude

CORR'D FIELD LENGTH (M)	FIELD LIMIT WEIGHT (1000 KG)										
	OAT (°C)										
	-40	10	14	18	22	26	30	38	42	46	50
1450	54.7	49.9	49.6	49.3	48.0	46.9	45.7	43.5	42.5	41.5	40.6
1600	57.4	52.4	52.1	51.7	50.4	49.2	48.0	45.7	44.6	43.6	42.6
1800	60.8	55.5	55.1	54.7	53.3	52.0	50.8	48.3	47.1	46.1	45.0
2000	63.9	58.3	57.9	57.6	56.1	54.7	53.4	50.8	49.5	48.4	47.3
2200	66.9	61.0	60.6	60.2	58.7	57.2	55.8	53.1	51.8	50.6	49.4
2400	69.8	63.6	63.2	62.8	61.1	59.6	58.1	55.3	53.9	52.6	51.4
2600	72.5	66.1	65.6	65.2	63.5	61.9	60.4	57.4	55.9	54.6	53.4
2800	75.2	68.5	68.0	67.6	65.8	64.1	62.5	59.4	58.0	56.6	55.3
3000	77.5	70.5	70.0	69.6	67.7	66.0	64.3	61.1	59.6	58.2	56.8
3200	79.9	72.6	72.1	71.6	69.7	67.9	66.2	62.9	61.3	59.8	58.4
3400	81.6	74.7	74.2	73.7	71.7	69.8	68.0	64.6	62.9	61.4	59.9
3600	81.6	76.7	76.1	75.6	73.6	71.6	69.8	66.2	64.5	62.9	61.4
3800	81.6	78.6	78.1	77.5	75.4	73.4	71.5	67.8	66.1	64.4	62.9
4000	81.6	80.5	79.9	79.4	77.2	75.1	73.2	69.4	67.6	65.9	64.3
4200	81.6	81.6	81.6	81.2	79.0	76.8	74.8	70.9	69.0	67.3	65.7
4400	81.6	81.6	81.6	81.6	80.7	78.5	76.4	72.4	70.5	68.8	67.1
CLIMB LIMIT WT (1000 KG)	69.3	68.9	68.8	68.7	66.2	63.7	61.3	56.8	54.6	52.7	50.9

With engine bleed for packs off, increase field limit weight by 400 kg and climb limit weight by 1500 kg.
With engine anti-ice on, decrease field limit weight by 200 kg and climb limit weight by 250 kg.
With engine and wing anti-ice on (optional system), decrease field limit weight by 750 kg and climb limit weight by 1450 kg.

Takeoff Field & Climb Limit Weights - Wet Runway (24K Derate)

Flaps 5

8000 FT Pressure Altitude

CORR'D FIELD LENGTH (M)	FIELD LIMIT WEIGHT (1000 KG)										
	OAT (°C)										
	-40	10	14	18	22	26	30	38	42	46	50
1450	51.3	47.0	46.7	45.6	44.5	43.5	42.4	40.4	39.5	38.6	37.7
1600	53.8	49.3	49.0	47.9	46.7	45.6	44.5	42.4	41.4	40.4	39.5
1800	57.0	52.1	51.8	50.7	49.4	48.2	47.0	44.8	43.7	42.7	41.8
2000	59.9	54.8	54.5	53.3	52.0	50.7	49.4	47.0	46.0	44.9	43.9
2200	62.7	57.3	57.0	55.7	54.3	53.0	51.7	49.2	48.0	46.9	45.8
2400	65.4	59.7	59.3	58.0	56.6	55.1	53.8	51.1	49.9	48.8	47.6
2600	67.9	62.0	61.6	60.2	58.7	57.2	55.8	53.1	51.8	50.6	49.4
2800	70.4	64.3	63.9	62.4	60.9	59.3	57.8	55.0	53.7	52.4	51.1
3000	72.5	66.1	65.7	64.2	62.6	61.0	59.5	56.5	55.1	53.8	52.5
3200	74.7	68.1	67.6	66.1	64.4	62.7	61.1	58.0	56.6	55.3	53.9
3400	76.8	70.0	69.5	67.9	66.1	64.4	62.8	59.6	58.1	56.7	55.3
3600	78.9	71.8	71.3	69.7	67.9	66.1	64.4	61.1	59.6	58.1	56.7
3800	80.9	73.6	73.1	71.4	69.5	67.7	65.9	62.5	60.9	59.4	58.0
4000	81.6	75.3	74.8	73.0	71.1	69.2	67.4	63.9	62.3	60.7	59.2
4200	81.6	77.0	76.5	74.7	72.7	70.8	68.9	65.3	63.6	62.0	60.5
4400	81.6	78.7	78.1	76.3	74.3	72.3	70.4	66.7	65.0	63.3	61.7
CLIMB LIMIT WT (1000 KG)	66.1	65.8	65.7	63.5	61.1	58.8	56.5	52.3	50.5	48.7	47.0

10000 FT Pressure Altitude

CORR'D FIELD LENGTH (M)	FIELD LIMIT WEIGHT (1000 KG)										
	OAT (°C)										
	-40	10	14	18	22	26	30	38	42	46	50
1450	48.0	44.2	43.3	42.3	41.3	40.3	39.3	37.4	36.5	35.6	34.7
1600	50.4	46.3	45.4	44.4	43.3	42.2	41.2	39.2	38.2	37.3	36.3
1800	53.3	49.0	48.0	46.9	45.8	44.6	43.5	41.4	40.4	39.4	38.4
2000	56.1	51.5	50.5	49.3	48.1	46.9	45.7	43.5	42.4	41.3	40.3
2200	58.7	53.8	52.8	51.6	50.3	49.0	47.8	45.4	44.3	43.1	42.1
2400	61.1	56.1	54.9	53.6	52.3	51.0	49.7	47.2	46.0	44.8	43.7
2600	63.5	58.2	57.0	55.7	54.3	52.9	51.6	49.0	47.7	46.5	45.3
2800	65.8	60.3	59.1	57.7	56.2	54.8	53.4	50.7	49.4	48.1	46.9
3000	67.7	62.0	60.7	59.3	57.8	56.3	54.9	52.0	50.7	49.4	48.1
3200	69.7	63.8	62.5	61.0	59.4	57.8	56.3	53.4	52.0	50.6	49.3
3400	71.7	65.5	64.2	62.6	61.0	59.3	57.8	54.8	53.3	51.9	50.5
3600	73.6	67.2	65.8	64.2	62.5	60.8	59.3	56.1	54.6	53.2	51.7
3800	75.4	68.9	67.4	65.7	64.0	62.3	60.6	57.4	55.9	54.3	52.9
4000	77.2	70.4	68.9	67.2	65.4	63.7	62.0	58.7	57.1	55.5	54.0
4200	78.9	72.0	70.5	68.7	66.9	65.0	63.3	59.9	58.3	56.7	55.1
4400	80.6	73.6	72.0	70.2	68.3	66.4	64.6	61.1	59.5	57.8	56.2
CLIMB LIMIT WT (1000 KG)	62.8	62.4	60.6	58.6	56.3	54.1	52.0	48.1	46.3	44.4	42.7

With engine bleed for packs off, increase field limit weight by 400 kg and climb limit weight by 1500 kg.
With engine anti-ice on, decrease field limit weight by 200 kg and climb limit weight by 250 kg.
With engine and wing anti-ice on (optional system), decrease field limit weight by 750 kg and climb limit weight by 1450 kg.

Takeoff Obstacle Limit Weight (24K Derate)

Flaps 5

Sea Level, 30°C & Below, Zero Wind

Based on engine bleed for packs on and anti-ice off

Reference Obstacle Limit Weight (1000 KG)

OBSTACLE HEIGHT (M)	DISTANCE FROM BRAKE RELEASE (100 M)										
	25	30	35	40	45	50	55	60	65	70	75
5	71.4	76.6	79.7								
20	65.4	70.3	74.2	77.0	79.0						
40	60.4	64.9	68.7	71.8	74.2	76.2	77.6	78.9	79.9	80.8	
60	56.5	61.0	64.7	67.7	70.3	72.4	74.1	75.7	76.9	78.0	78.8
80	53.4	57.8	61.4	64.5	67.1	69.3	71.0	72.8	74.1	75.4	76.4
100	50.6	55.0	58.6	61.7	64.3	66.6	68.4	70.2	71.6	73.0	74.1
120	48.2	52.6	56.2	59.3	61.9	64.2	66.1	67.9	69.4	70.9	72.0
140	46.1	50.4	54.0	57.1	59.7	62.0	64.0	65.9	67.4	68.9	70.1
160	44.2	48.4	52.0	55.1	57.8	60.1	62.0	64.0	65.5	67.1	68.3
180	42.4	46.7	50.2	53.3	56.0	58.3	60.3	62.2	63.8	65.4	66.7
200		45.0	48.6	51.6	54.3	56.7	58.6	60.6	62.2	63.8	65.1
220		43.5	47.0	50.1	52.8	55.1	57.1	59.1	60.7	62.3	63.7
240		42.1	45.6	48.7	51.3	53.7	55.7	57.7	59.3	61.0	62.3
260			44.3	47.3	50.0	52.3	54.3	56.4	58.0	59.6	61.0
280			43.1	46.0	48.7	51.1	53.1	55.1	56.8	58.4	59.8
300			41.9	44.9	47.5	49.9	51.9	53.9	55.6	57.2	58.6

When using line-up allowances, the obstacle distance from brake release must be reduced by the ASDA adjustment.
Obstacle height must be calculated from lowest point of the runway to conservatively account for runway slope.

OAT Adjustments

OAT (°C)	REFERENCE OBSTACLE LIMIT WEIGHT (1000 KG)								
	40	45	50	55	60	65	70	75	80
30 & BELOW	0	0	0	0	0	0	0	0	0
32	-0.7	-0.8	-0.8	-0.9	-1.0	-1.1	-1.2	-1.3	-1.4
34	-1.3	-1.5	-1.7	-1.9	-2.0	-2.2	-2.4	-2.6	-2.8
36	-2.0	-2.3	-2.5	-2.8	-3.1	-3.3	-3.6	-3.9	-4.2
38	-2.6	-3.0	-3.4	-3.7	-4.1	-4.5	-4.8	-5.2	-5.6
40	-3.3	-3.8	-4.2	-4.7	-5.1	-5.6	-6.0	-6.5	-6.9
42	-3.9	-4.5	-5.0	-5.6	-6.1	-6.6	-7.2	-7.7	-8.3
44	-4.5	-5.2	-5.8	-6.4	-7.1	-7.7	-8.3	-9.0	-9.6
46	-5.2	-5.9	-6.6	-7.3	-8.1	-8.8	-9.5	-10.2	-11.0
48	-5.8	-6.6	-7.4	-8.2	-9.0	-9.9	-10.7	-11.5	-12.3
50	-6.4	-7.3	-8.2	-9.1	-10.0	-10.9	-11.8	-12.7	-13.6

Takeoff Obstacle Limit Weight (24K Derate)

Flaps 5

Sea Level, 30°C & Below, Zero Wind

Pressure Altitude Adjustments

ALT (FT)	OAT ADJUSTED OBSTACLE LIMIT WEIGHT (1000 KG)								
	40	45	50	55	60	65	70	75	80
S.L. & BELOW	0	0	0	0	0	0	0	0	0
1000	-1.5	-1.7	-1.9	-2.1	-2.3	-2.4	-2.6	-2.8	-3.0
2000	-3.1	-3.4	-3.8	-4.1	-4.5	-4.9	-5.2	-5.6	-5.9
3000	-4.4	-4.9	-5.5	-6.0	-6.5	-7.1	-7.6	-8.2	-8.7
4000	-5.7	-6.5	-7.2	-7.9	-8.6	-9.3	-10.0	-10.7	-11.4
5000	-7.0	-7.9	-8.8	-9.7	-10.5	-11.4	-12.3	-13.2	-14.0
6000	-8.3	-9.3	-10.4	-11.4	-12.5	-13.5	-14.5	-15.6	-16.6
7000	-9.5	-10.7	-11.9	-13.1	-14.3	-15.5	-16.7	-17.9	-19.1
8000	-10.6	-12.0	-13.3	-14.7	-16.1	-17.4	-18.8	-20.1	-21.5
9000	-11.7	-13.2	-14.7	-16.2	-17.8	-19.3	-20.8	-22.3	-23.8
10000	-12.8	-14.5	-16.1	-17.8	-19.5	-21.1	-22.8	-24.4	-26.1

Wind Adjustments

WIND (KTS)	OAT & ALT ADJUSTED OBSTACLE LIMIT WEIGHT (1000 KG)								
	40	45	50	55	60	65	70	75	80
15 TW	-8.5	-8.4	-8.2	-8.0	-7.8	-7.6	-7.4	-7.2	-7.0
10 TW	-5.7	-5.6	-5.4	-5.3	-5.2	-5.1	-4.9	-4.8	-4.7
5 TW	-2.8	-2.8	-2.7	-2.7	-2.6	-2.5	-2.5	-2.4	-2.3
0	0	0	0	0	0	0	0	0	0
10 HW	1.0	1.0	0.9	0.9	0.8	0.7	0.7	0.6	0.6
20 HW	2.0	1.9	1.8	1.7	1.6	1.5	1.4	1.3	1.1
30 HW	3.1	2.9	2.8	2.6	2.4	2.2	2.1	1.9	1.7
40 HW	4.2	3.9	3.7	3.5	3.2	3.0	2.8	2.5	2.3

With engine bleed for packs off, increase weight by 650 kg.
With engine anti-ice on, decrease weight by 300 kg.
With engine and wing anti-ice on, decrease weight by 1550 kg (optional system).

Intentionally
Blank

Performance Dispatch — Chapter PD
Enroute — Section 31

Long Range Cruise Maximum Operating Altitude
Max Cruise Thrust
ISA + 10°C and Below

WEIGHT (1000 KG)	OPTIMUM ALT (FT)	TAT (°C)	MARGIN TO INITIAL BUFFET 'G' (BANK ANGLE)				
			1.20 (33°)	1.25 (36°)	1.30 (39°)	1.40 (44°)	1.50 (48°)
85	31000	-8	34200*	33900	33000	31500	30000
80	32300	-10	35700*	35200	34300	32800	31400
75	33700	-14	37000*	36500	35700	34200	32700
70	35200	-17	38300*	37900	37100	35600	34200
65	36700	-19	39700*	39500	38600	37200	35800
60	38400	-19	41000	41000	40300	38800	37400
55	40200	-19	41000	41000	41000	40600	39200
50	41000	-19	41000	41000	41000	41000	41000
45	41000	-19	41000	41000	41000	41000	41000
40	41000	-19	41000	41000	41000	41000	41000

ISA + 15°C

WEIGHT (1000 KG)	OPTIMUM ALT (FT)	TAT (°C)	MARGIN TO INITIAL BUFFET 'G' (BANK ANGLE)				
			1.20 (33°)	1.25 (36°)	1.30 (39°)	1.40 (44°)	1.50 (48°)
85	31000	-2	32900*	32900*	32900*	31500	30000
80	32300	-5	34600*	34600*	34300	32800	31400
75	33700	-8	36100*	36100*	35700	34200	32700
70	35200	-11	37500*	37500*	37100	35600	34200
65	36700	-13	38900*	38900*	38600	37200	35800
60	38400	-13	40300*	40300*	40300	38800	37400
55	40200	-13	41000	41000	41000	40600	39200
50	41000	-13	41000	41000	41000	41000	41000
45	41000	-13	41000	41000	41000	41000	41000
40	41000	-13	41000	41000	41000	41000	41000

ISA + 20°C

WEIGHT (1000 KG)	OPTIMUM ALT (FT)	TAT (°C)	MARGIN TO INITIAL BUFFET 'G' (BANK ANGLE)				
			1.20 (33°)	1.25 (36°)	1.30 (39°)	1.40 (44°)	1.50 (48°)
85	31000	4	30400*	30400*	30400*	30400*	30000
80	32300	1	32900*	32900*	32900*	32800	31400
75	33700	-2	34800*	34800*	34800*	34200	32700
70	35200	-6	36300*	36300*	36300*	35600	34200
65	36700	-8	37800*	37800*	37800*	37200	35800
60	38400	-8	39200*	39200*	39200*	38800	37400
55	40200	-8	40700*	40700*	40700*	40600	39200
50	41000	-8	41000	41000	41000	41000	41000
45	41000	-8	41000	41000	41000	41000	41000
40	41000	-8	41000	41000	41000	41000	41000

***Denotes altitude thrust limited in level flight, 100 fpm residual rate of climb.**

Long Range Cruise Trip Fuel and Time

Ground to Air Miles Conversion

AIR DISTANCE (NM)					GROUND DISTANCE (NM)	AIR DISTANCE (NM)				
HEADWIND COMPONENT (KTS)						TAILWIND COMPONENT (KTS)				
100	80	60	40	20		20	40	60	80	100
279	259	241	226	212	200	190	181	173	166	159
555	516	481	451	424	400	381	364	348	334	321
830	772	720	675	636	600	572	547	524	503	484
1105	1028	959	900	847	800	764	731	700	672	646
1378	1283	1198	1124	1059	1000	955	914	875	840	808
1651	1538	1436	1348	1270	1200	1146	1097	1051	1009	971
1923	1792	1674	1572	1482	1400	1338	1280	1226	1178	1133
2194	2045	1912	1795	1693	1600	1529	1463	1402	1347	1296
2465	2299	2149	2019	1904	1800	1720	1646	1578	1516	1459
2735	2551	2386	2242	2115	2000	1912	1830	1754	1685	1622
3004	2803	2622	2465	2326	2200	2103	2013	1930	1854	1785
3273	3055	2859	2688	2537	2400	2295	2197	2106	2023	1948
3541	3306	3095	2911	2748	2600	2486	2380	2282	2193	2111
3808	3557	3330	3133	2959	2800	2678	2564	2459	2362	2275
4075	3807	3566	3356	3169	3000	2869	2747	2635	2532	2438
4341	4057	3801	3578	3380	3200	3061	2931	2811	2702	2602
4606	4306	4035	3800	3590	3400	3252	3115	2988	2871	2765
4870	4555	4270	4021	3801	3600	3444	3298	3164	3041	2929
5134	4803	4504	4243	4011	3800	3635	3482	3341	3211	3092
5397	5051	4738	4464	4221	4000	3827	3666	3517	3380	3256
5660	5298	4972	4686	4431	4200	4018	3850	3694	3550	3420
5922	5545	5205	4907	4642	4400	4210	4033	3870	3720	3583
6183	5792	5438	5128	4852	4600	4402	4217	4046	3890	3747
6444	6038	5671	5349	5062	4800	4593	4401	4223	4059	3910
6704	6284	5903	5569	5271	5000	4785	4584	4399	4229	4074

Long Range Cruise Trip Fuel and Time

Reference Fuel and Time Required

AIR DIST (NM)	PRESSURE ALTITUDE (1000 FT)									
	29		31		33		35		37	
	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)
200	1.5	0:38	1.5	0:38	1.5	0:37	1.5	0:37	1.5	0:37
400	2.5	1:09	2.4	1:08	2.4	1:07	2.4	1:06	2.4	1:05
600	3.5	1:41	3.4	1:38	3.4	1:36	3.3	1:34	3.3	1:33
800	4.5	2:12	4.4	2:09	4.3	2:05	4.2	2:03	4.1	2:00
1000	5.5	2:42	5.4	2:38	5.3	2:34	5.1	2:31	5.0	2:28
1200	6.5	3:12	6.4	3:07	6.2	3:02	6.1	2:59	6.0	2:56
1400	7.6	3:42	7.4	3:37	7.2	3:31	7.0	3:27	6.9	3:23
1600	8.6	4:12	8.4	4:06	8.2	3:59	8.0	3:54	7.8	3:51
1800	9.7	4:42	9.4	4:35	9.2	4:28	8.9	4:22	8.8	4:18
2000	10.7	5:12	10.5	5:04	10.2	4:56	9.9	4:50	9.7	4:46
2200	11.8	5:41	11.5	5:32	11.2	5:24	10.9	5:18	10.7	5:13
2400	12.9	6:10	12.6	6:00	12.2	5:51	11.9	5:45	11.6	5:40
2600	14.0	6:39	13.7	6:29	13.3	6:19	12.9	6:12	12.6	6:07
2800	15.1	7:08	14.7	6:57	14.3	6:47	13.9	6:40	13.6	6:34
3000	16.2	7:37	15.8	7:25	15.3	7:15	14.9	7:07	14.6	7:01
3200	17.4	8:05	16.9	7:52	16.4	7:42	16.0	7:34	15.6	7:28
3400	18.5	8:33	18.0	8:20	17.5	8:09	17.0	8:01	16.7	7:55
3600	19.7	9:01	19.2	8:47	18.6	8:36	18.1	8:28	17.7	8:21
3800	20.9	9:29	20.3	9:15	19.7	9:03	19.1	8:55	18.8	8:48
4000	22.0	9:57	21.4	9:42	20.8	9:31	20.2	9:23	19.8	9:15
4200	23.2	10:24	22.6	10:09	21.9	9:57	21.3	9:49	21.0	9:42
4400	24.4	10:51	23.7	10:36	23.0	10:24	22.4	10:16	22.1	10:08
4600	25.7	11:18	24.9	11:03	24.2	10:51	23.5	10:43	23.3	10:35
4800	26.9	11:46	26.1	11:30	25.3	11:18	24.7	11:09	24.4	11:02
5000	28.1	12:13	27.3	11:57	26.5	11:45	25.8	11:36	25.5	11:28

Fuel Required Adjustments (1000 KG)

REFERENCE FUEL REQUIRED (1000 KG)	LANDING WEIGHT (1000 KG)				
	30	40	50	60	70
2	-0.3	-0.2	0.0	0.3	0.5
4	-0.6	-0.3	0.0	0.5	1.1
6	-0.9	-0.5	0.0	0.8	1.9
8	-1.2	-0.7	0.0	1.0	2.7
10	-1.6	-0.8	0.0	1.4	3.6
12	-1.9	-1.0	0.0	1.7	4.6
14	-2.2	-1.2	0.0	2.1	5.6
16	-2.6	-1.4	0.0	2.6	6.8
18	-2.9	-1.6	0.0	3.0	8.0
20	-3.3	-1.7	0.0	3.5	9.3
22	-3.7	-1.9	0.0	4.0	10.7
24	-4.1	-2.1	0.0	4.6	12.2
26	-4.5	-2.3	0.0	5.2	13.8
28	-4.9	-2.5	0.0	5.8	15.4
30	-5.3	-2.7	0.0	6.4	17.1

Based on 280/.78 climb, Long Range Cruise speed and .78/280/250 descent.

Long Range Cruise Step Climb
Ground to Air Miles Conversion

AIR DISTANCE (NM) HEADWIND COMPONENT (KTS)					GROUND DISTANCE (NM)	AIR DISTANCE (NM) TAILWIND COMPONENT (KTS)				
100	80	60	40	20		20	40	60	80	100
1320	1241	1170	1108	1051	1000	954	912	873	837	805
1836	1729	1633	1547	1470	1400	1336	1278	1225	1176	1131
2352	2216	2095	1986	1889	1800	1719	1646	1578	1515	1458
2867	2703	2557	2426	2307	2200	2102	2013	1930	1855	1785
3382	3190	3019	2865	2726	2600	2485	2380	2283	2194	2112
3897	3677	3481	3304	3145	3000	2868	2747	2636	2534	2439
4411	4164	3942	3743	3563	3400	3251	3114	2989	2873	2766
4925	4650	4404	4182	3982	3800	3634	3482	3342	3213	3093
5439	5136	4865	4621	4401	4200	4017	3849	3695	3553	3421
5953	5622	5326	5060	4819	4600	4400	4217	4048	3892	3748
6466	6108	5787	5499	5238	5000	4783	4584	4401	4232	4076

Trip Fuel and Time Required

AIR DIST (NM)	TRIP FUEL (1000 KG) LANDING WEIGHT (1000 KG)							TIME (HRS:MIN)
	40	45	50	55	60	65	70	
1000	4.3	4.6	4.9	5.4	5.7	6.1	6.4	2:26
1400	5.9	6.3	6.7	7.3	7.8	8.3	8.8	3:20
1800	7.5	8.0	8.6	9.3	9.9	10.6	11.2	4:13
2200	9.1	9.7	10.5	11.3	12.1	13.0	13.8	5:07
2600	10.7	11.5	12.4	13.4	14.4	15.4	16.4	6:01
3000	12.4	13.3	14.4	15.6	16.7	17.9	19.0	6:54
3400	14.1	15.2	16.5	17.8	19.1	20.5	21.8	7:48
3800	15.8	17.2	18.6	20.1	21.6	23.1	24.6	8:41
4200	17.7	19.1	20.7	22.5	24.1	25.8	27.5	9:34
4600	19.5	21.2	23.0	24.9	26.7	28.6	30.5	10:27
5000	21.5	23.3	25.3	27.4	29.4	31.5	33.6	11:20

Based on 280/.78 climb, Long Range Cruise speed and .78/280/250 descent.
Valid for all pressure altitudes with 4000 ft step climb to 2000 ft above optimum altitude.

Short Trip Fuel and Time

Ground to Air Miles Conversion

AIR DISTANCE (NM) HEADWIND COMPONENT (KTS)					GROUND DISTANCE (NM)	AIR DISTANCE (NM) TAILWIND COMPONENT (KTS)				
100	80	60	40	20		20	40	60	80	100
95	81	70	62	55	50	46	42	39	36	34
161	144	130	118	108	100	93	87	81	77	72
227	206	188	174	161	150	140	132	125	118	112
291	267	246	229	213	200	188	178	168	160	152
354	327	304	283	266	250	236	224	212	202	193
417	387	361	338	318	300	284	270	257	245	234
480	447	418	393	370	350	332	316	301	288	275
543	507	475	447	422	400	380	362	345	330	316
608	568	533	502	475	450	428	408	389	373	357
675	631	592	558	527	500	475	453	433	414	397

Trip Fuel and Time Required

AIR DIST (NM)		LANDING WEIGHT (1000 KG)						TIME (HRS:MIN)
		40	45	50	55	60	65	
50	FUEL (1000 KG)	0.5	0.6	0.6	0.6	0.7	0.7	0:14
	ALT (FT)	11000	11000	11000	9000	9000	9000	
100	FUEL (1000 KG)	0.8	0.9	0.9	1.0	1.0	1.1	0:23
	ALT (FT)	17000	17000	17000	15000	15000	15000	
150	FUEL (1000 KG)	1.1	1.2	1.2	1.3	1.3	1.4	0:31
	ALT (FT)	25000	25000	23000	23000	23000	23000	
200	FUEL (1000 KG)	1.3	1.4	1.5	1.6	1.6	1.7	0:38
	ALT (FT)	31000	29000	27000	27000	25000	25000	
250	FUEL (1000 KG)	1.5	1.6	1.7	1.8	1.9	2.0	0:44
	ALT (FT)	41000	37000	35000	33000	31000	31000	
300	FUEL (1000 KG)	1.7	1.8	1.9	2.0	2.2	2.3	0:51
	ALT (FT)	41000	41000	37000	37000	35000	35000	
350	FUEL (1000 KG)	1.9	2.0	2.1	2.3	2.4	2.5	0:57
	ALT (FT)	41000	41000	39000	37000	37000	35000	
400	FUEL (1000 KG)	2.1	2.2	2.4	2.5	2.7	2.8	1:03
	ALT (FT)	41000	41000	41000	39000	37000	35000	
450	FUEL (1000 KG)	2.3	2.4	2.6	2.7	2.9	3.1	1:10
	ALT (FT)	41000	41000	41000	39000	37000	35000	
500	FUEL (1000 KG)	2.5	2.6	2.8	3.0	3.2	3.3	1:18
	ALT (FT)	41000	41000	41000	39000	37000	35000	

Based on 280/.78 climb, Long Range Cruise speed and .78/280/250 descent.

Holding Planning

Flaps Up

WEIGHT (1000 KG)	TOTAL FUEL FLOW (KG/HR)								
	PRESSURE ALTITUDE (FT)								
	1500	5000	10000	15000	20000	25000	30000	35000	41000
80	2810	2770	2740	2730	2670	2670	2710		
75	2650	2610	2580	2560	2500	2490	2530	2610	
70	2500	2450	2420	2390	2350	2310	2350	2400	
65	2340	2290	2260	2230	2190	2140	2180	2210	
60	2180	2130	2100	2070	2030	1970	2000	2020	
55	2030	1980	1940	1910	1870	1820	1830	1850	1960
50	1870	1820	1780	1750	1710	1710	1680	1690	1770
45	1720	1670	1650	1620	1580	1550	1530	1520	1580
40	1610	1550	1500	1460	1430	1400	1380	1360	1400

This table includes 5% additional fuel for holding in a racetrack pattern.

Flight Crew Oxygen Requirements

For Aircraft with Chemical Passenger Oxygen System

Required Pressure (PSI) for 76 Cubic Ft. Cylinder

BOTTLE TEMPERATURE		NUMBER OF CREW USING OXYGEN		
°C	°F	2	3	4
50	122	735	1055	1360
45	113	725	1040	1340
40	104	715	1020	1320
35	95	700	1005	1300
30	86	690	990	1280
25	77	680	975	1255
20	68	670	960	1240
15	59	655	940	1215
10	50	645	925	1195
5	41	635	910	1175
0	32	620	890	1150
-5	23	610	875	1130
-10	14	600	860	1110

Required Pressure (PSI) for 114/115 Cubic Ft. Cylinder

BOTTLE TEMPERATURE		NUMBER OF CREW USING OXYGEN		
°C	°F	2	3	4
50	122	530	735	945
45	113	520	725	930
40	104	510	715	915
35	95	505	700	900
30	86	495	690	885
25	77	485	680	870
20	68	480	670	860
15	59	470	655	840
10	50	460	645	830
5	41	455	635	815
0	32	445	620	800
-5	23	440	610	785
-10	14	430	600	770

ENGINE INOP

MAX CONTINUOUS THRUST

Net Level Off Weight

PRESSURE ALTITUDE (1000 FT)	LEVEL OFF WEIGHT (1000 KG)		
	ISA + 10°C & BELOW	ISA + 15°C	ISA + 20°C
30	44.5	43.1	41.5
28	48.1	46.5	44.9
26	51.8	50.1	48.4
24	55.6	53.7	51.9
22	59.2	57.3	55.1
20	63.0	60.8	58.3
18	67.0	64.4	61.6
16	70.8	68.1	64.9
14	74.9	71.8	68.2
12	78.4	74.8	71.0
10	81.6	77.6	73.8

Anti-Ice Adjustments

ANTI-ICE CONFIGURATION	LEVEL OFF WEIGHT ADJUSTMENT (1000 KG)									
	PRESSURE ALTITUDE (1000 FT)									
	10	12	14	16	18	20	22	24	26	28
ENGINE ONLY	-2.7	-2.4	-2.1	-2.1	-2.0	-1.8	-1.6	-1.5	-1.3	-1.2
ENGINE & WING	-9.1	-8.7	-8.0	-7.5	-7.3	-7.0	-6.2	-5.5	-5.0	-4.5

Performance Dispatch — Chapter PD
Landing — Section 32

Landing Field Limit Weight - Dry Runway
Flaps 40
Based on anti-skid operative and automatic speedbrakes
Wind Corrected Field Length (M)

FIELD LENGTH AVAILABLE (M)	WIND COMPONENT (KTS) -15	-10	-5	0	10	20	30	40
1000			900	1000	1070	1140	1200	1270
1200	890	980	1090	1200	1270	1350	1420	1490
1400	1060	1160	1280	1400	1480	1560	1630	1710
1600	1240	1350	1470	1600	1680	1770	1850	1940
1800	1420	1540	1670	1800	1890	1980	2070	2160
2000	1600	1720	1860	2000	2090	2190	2290	2380
2200	1780	1910	2050	2200	2290	2400	2500	2600
2400	1960	2100	2250	2400	2500	2610	2720	2820
2600	2140	2280	2440	2600	2700	2820	2940	3050
2800	2260	2410	2570	2800	2910	3030	3150	
3000	2330	2480	2640	3000	3110			
3200	2400	2550	2710	3200				
3400	2480	2630	2780					
3600	2550	2700	2840					
3800	2620	2770	2910					
4000	2690	2840	2980					
4200	2760	2910	3050					
4400	2830	2980	3120					
4600	2900	3050	3190					
4800	2980	3130						

Field Limit Weight (1000 KG)

WIND CORR'D FIELD LENGTH (M)	AIRPORT PRESSURE ALTITUDE (FT) 0	2000	4000	6000	8000	10000
1200	47.3	44.5	41.8	39.3		
1400	57.5	54.8	51.6	48.5	45.5	42.6
1600	66.3	63.0	60.0	57.0	54.1	50.6
1800	75.7	71.5	67.6	64.0	60.8	57.7
2000		80.0	75.8	71.5	67.5	63.8
2200			83.4	79.1	74.6	70.3
2400					81.5	77.1
2600						83.2

Decrease field limit weight by 4500 kg when using manual speedbrakes.

Landing Field Limit Weight - Dry Runway

Flaps 40

Based on anti-skid inoperative and manual speedbrakes

Wind Corrected Field Length (M)

FIELD LENGTH AVAILABLE (M)	WIND COMPONENT (KTS)							
	-15	-10	-5	0	10	20	30	40
1800				1800	1940	2110	2250	2420
2000			1750	2000	2140	2320	2470	2650
2200		1700	1950	2200	2350	2530	2690	2870
2400	1640	1890	2140	2400	2560	2740	2910	3090
2600	1820	2080	2330	2600	2760	2950	3130	3320
2800	2000	2260	2530	2800	2970	3160	3350	3540
3000	2180	2450	2720	3000	3170	3380	3560	3760
3200	2360	2630	2910	3200	3380	3590	3780	3980
3400	2540	2820	3100	3400	3590	3800	4000	4210
3600	2720	3010	3300	3600	3790	4010	4220	4430
3800	2900	3190	3490	3800	4000	4220	4440	4650
4000	3080	3380	3680	4000	4200	4440	4650	4880
4200	3260	3570	3880	4200	4410	4650	4870	5100
4400	3440	3750	4070	4400	4620	4860	5090	5320
4600	3620	3940	4260	4600	4820	5070	5310	5550
4800	3800	4120	4450	4800	5030	5280	5530	5770
5000	3980	4310	4650	5000	5230	5490	5750	
5200	4160	4500	4840	5200	5440	5710		
5400	4340	4680	5030	5400	5650			
5600	4520	4870	5230	5600				

Field Limit Weight (1000 KG)

WIND CORR'D FIELD LENGTH (M)	AIRPORT PRESSURE ALTITUDE (FT)					
	0	2000	4000	6000	8000	10000
2200	42.4	39.8				
2400	47.5	44.6	41.5	38.8		
2600	52.7	49.5	46.1	43.1	40.2	
2800	57.9	54.4	50.8	47.5	44.3	41.3
3000	63.0	59.3	55.4	51.8	48.5	45.1
3200	68.5	64.1	60.0	56.1	52.5	48.9
3400	74.2	69.2	64.4	60.3	56.4	52.6
3600	79.7	74.5	69.2	64.5	60.3	56.3
3800		79.6	74.1	68.9	64.2	59.9
4000			79.0	73.5	68.4	63.6
4200			83.5	78.2	72.6	67.4
4400				82.4	77.1	71.4
4600					81.1	75.5
4800						79.4
5000						83.1

Landing Field Limit Weight - Wet Runway

Flaps 40

Based on anti-skid operative and automatic speedbrakes

Wind Corrected Field Length (M)

FIELD LENGTH AVAILABLE (M)	WIND COMPONENT (KTS)							
	-15	-10	-5	0	10	20	30	40
1000				1000	1080	1150	1220	1290
1200		960	1080	1200	1280	1360	1430	1520
1400	1040	1140	1270	1400	1480	1570	1650	1740
1600	1210	1330	1460	1600	1690	1780	1870	1960
1800	1390	1520	1660	1800	1890	1990	2090	2180
2000	1570	1700	1850	2000	2100	2200	2300	2400
2200	1750	1890	2040	2200	2300	2410	2520	2630
2400	1930	2070	2240	2400	2510	2620	2740	2850
2600	2110	2260	2430	2600	2710	2830	2950	3070
2800	2290	2450	2620	2800	2910	3040	3170	3290
3000	2470	2630	2810	3000	3120	3250	3390	3510
3200	2590	2770	2950	3200	3320	3460	3600	
3400	2660	2840	3020	3400	3530	3670		
3600	2740	2910	3080	3600				
3800	2810	2980	3150					
4000	2880	3050	3220					
4200	2950	3120	3290					
4400	3020	3190	3360					
4600	3090	3270	3430					
4800	3160	3340	3500					

Field Limit Weight (1000 KG)

WIND CORR'D FIELD LENGTH (M)	AIRPORT PRESSURE ALTITUDE (FT)					
	0	2000	4000	6000	8000	10000
1200	38.9					
1400	48.3	45.4	42.7	40.1		
1600	57.2	54.4	51.2	48.1	45.1	42.2
1800	64.7	61.6	58.7	55.7	52.6	49.2
2000	72.8	68.8	65.2	61.9	58.8	55.8
2200	80.6	76.5	72.2	68.2	64.5	61.1
2400		83.4	79.2	74.8	70.6	66.6
2600				81.2	76.9	72.3
2800					82.6	78.2
3000						83.4

Decrease field limit weight by 4500 kg when using manual speedbrakes.

Landing Field Limit Weight - Wet Runway

Flaps 40

Based on anti-skid inoperative and manual speedbrakes

Wind Corrected Field Length (M)

FIELD LENGTH AVAILABLE (M)	WIND COMPONENT (KTS)							
	-15	-10	-5	0	10	20	30	40
1800					1950	2140	2300	2490
2000				2000	2160	2350	2520	2710
2200			1920	2200	2360	2560	2730	2930
2400			2110	2400	2570	2770	2950	3150
2600		2020	2310	2600	2770	2980	3170	3380
2800	1920	2210	2500	2800	2980	3190	3390	3600
3000	2100	2400	2690	3000	3190	3410	3610	3820
3200	2280	2580	2880	3200	3390	3620	3830	4050
3400	2460	2770	3080	3400	3600	3830	4040	4270
3600	2640	2950	3270	3600	3800	4040	4260	4490
3800	2820	3140	3460	3800	4010	4250	4480	4720
4000	3000	3330	3660	4000	4220	4470	4700	4940
4200	3180	3510	3850	4200	4420	4680	4920	5160
4400	3360	3700	4040	4400	4630	4890	5130	5390
4600	3540	3890	4230	4600	4830	5100	5350	5610
4800	3720	4070	4430	4800	5040	5310	5570	5830
5000	3900	4260	4620	5000	5250	5520	5790	6050
5200	4080	4440	4810	5200	5450	5740	6010	6280
5400	4260	4630	5010	5400	5660	5950	6230	6500
5600	4440	4820	5200	5600	5860	6160	6440	

Field Limit Weight (1000 KG)

WIND CORR'D FIELD LENGTH (M)	AIRPORT PRESSURE ALTITUDE (FT)					
	0	2000	4000	6000	8000	10000
2400	39.5					
2600	43.9	41.2	38.3			
2800	48.4	45.5	42.3	39.5		
3000	52.9	49.7	46.3	43.3	40.4	
3200	57.4	54.0	50.4	47.1	44.0	40.9
3400	61.9	58.2	54.4	50.9	47.6	44.3
3600	66.5	62.4	58.4	54.6	51.1	47.6
3800	71.5	66.7	62.3	58.3	54.5	50.9
4000	76.5	71.3	66.3	61.9	57.9	54.1
4200	81.0	75.9	70.5	65.6	61.3	57.2
4400		80.3	74.8	69.5	64.7	60.4
4600			79.0	73.5	68.4	63.6
4800			82.9	77.6	72.1	66.9
5000				81.3	75.9	70.4
5200					79.5	73.9
5400					82.9	77.5
5600						80.7

Landing Climb Limit Weight

Valid for approach with Flaps 15 and landing with Flaps 40

Based on engine bleed for packs on and anti-ice off

AIRPORT OAT		LANDING CLIMB LIMIT WEIGHT (1000 KG)					
		AIRPORT PRESSURE ALTITUDE (FT)					
°C	°F	0	2000	4000	6000	8000	10000
54	129	60.0					
52	126	61.1					
50	122	62.3	57.8				
48	118	63.6	59.0				
46	115	64.8	60.1	55.7			
44	111	66.1	61.3	56.8			
42	108	67.3	62.4	57.9	53.4		
40	104	68.7	63.6	59.0	54.4		
38	100	70.0	64.8	60.0	55.4	51.2	
36	97	71.2	66.0	61.1	56.5	52.1	
34	93	72.5	67.2	62.3	57.5	53.0	48.8
32	90	73.9	68.5	63.4	58.6	54.0	49.8
30	86	75.3	69.8	64.5	59.7	55.0	50.7
28	82	75.4	71.0	65.7	60.8	56.1	51.7
26	79	75.4	72.3	67.0	61.9	57.1	52.6
24	75	75.5	72.4	68.2	62.9	58.1	53.6
22	72	75.6	72.4	69.4	64.1	59.3	54.6
20	68	75.6	72.5	69.5	65.3	60.3	55.6
18	64	75.7	72.5	69.5	66.4	61.4	56.7
16	61	75.7	72.6	69.5	66.5	62.5	57.6
14	57	75.8	72.6	69.6	66.5	63.4	58.5
12	54	75.8	72.7	69.6	66.5	63.4	59.4
10	50	75.9	72.7	69.7	66.6	63.4	60.1
-40	-40	76.5	73.4	70.2	67.0	63.8	60.5

With engine bleed for packs off, increase weight by 1250 kg.
With engine anti-ice on, decrease weight by 250 kg.
With engine and wing anti-ice on, decrease weight by 750 kg.
When operating in icing conditions during any part of the flight with forecast landing temperature below 10°C, decrease weight by 6900 kg.

ENGINE INOP

Go-Around Climb Gradient

Flaps 15

Based on engine bleed for packs on and anti-ice off

OAT (°C)	REFERENCE GO-AROUND GRADIENT (%) PRESSURE ALTITUDE (FT)					
	0	2000	4000	6000	8000	10000
54	2.93					
50	3.44	2.45				
46	3.98	2.95	1.99			
42	4.54	3.46	2.47	1.51		
38	5.09	3.98	2.94	1.95	1.03	
34	5.64	4.51	3.43	2.41	1.44	0.56
30	6.24	5.06	3.94	2.88	1.88	0.96
26	6.27	5.60	4.46	3.36	2.33	1.37
22	6.30	5.62	4.99	3.85	2.81	1.81
18	6.32	5.64	5.01	4.37	3.26	2.27
14	6.35	5.67	5.03	4.38	3.72	2.68
10	6.37	5.69	5.04	4.40	3.73	3.03

Gradient Adjustment for Weight (%)

WEIGHT (1000 KG)	REFERENCE GO-AROUND GRADIENT (%)						
	1	2	3	4	5	6	7
80	-3.36	-3.69	-4.03	-4.36	-4.70	-5.04	-5.37
75	-2.89	-3.17	-3.46	-3.75	-4.04	-4.33	-4.61
70	-2.34	-2.57	-2.80	-3.03	-3.27	-3.50	-3.73
65	-1.69	-1.86	-2.03	-2.19	-2.36	-2.53	-2.69
60	-0.92	-1.01	-1.11	-1.20	-1.29	-1.38	-1.47
55	0.00	0.00	0.00	0.00	0.00	0.00	0.00
50	1.04	1.16	1.28	1.39	1.51	1.63	1.75
45	2.37	2.63	2.89	3.14	3.40	3.66	3.92
40	4.04	4.48	4.92	5.36	5.80	6.24	6.68

Gradient Adjustment for Speed (%)

SPEED (KIAS)	WEIGHT ADJUSTED GO-AROUND GRADIENT (%)										
	0	1	2	3	4	5	6	7	8	9	10
VREF40	-0.25	-0.26	-0.26	-0.27	-0.28	-0.28	-0.29	-0.30	-0.30	-0.31	-0.32
VREF40+5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
VREF40+10	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13
VREF40+15	0.22	0.21	0.20	0.20	0.19	0.19	0.18	0.18	0.17	0.17	0.16
VREF40+20	0.25	0.23	0.21	0.20	0.18	0.17	0.15	0.14	0.12	0.11	0.09
VREF40+25	0.22	0.19	0.16	0.12	0.09	0.06	0.03	0.00	-0.03	-0.06	-0.09
VREF40+30	0.14	0.08	0.03	-0.02	-0.07	-0.12	-0.17	-0.22	-0.27	-0.32	-0.37

With engine bleed for packs off, increase gradient by 0.3%.
With engine anti-ice on, decrease gradient by 0.1%.
With engine and wing anti-ice on, decrease gradient by 0.3%.
When operating in icing conditions during any part of the flight with forecast landing temperatures below 10°C, decrease gradient by 0.9%.

Quick Turnaround Limit Weight - Category F Steel Brakes

Flaps 40

OAT (°C)	LIMIT WEIGHT (1000 KG)					
	AIRPORT PRESSURE ALTITUDE (FT)					
	0	2000	4000	6000	8000	10000
54	81.3					
50	81.6	78.6				
45	81.6	79.3	76.1			
40	81.6	79.9	76.8	73.5		
35	81.6	80.6	77.5	74.2	71.0	
30	81.6	81.3	78.1	74.8	71.6	68.6
25	81.6	81.6	78.8	75.5	72.3	69.2
20	81.6	81.6	79.4	76.2	72.9	69.8
15	81.6	81.6	80.1	76.9	73.6	70.4
10	81.6	81.6	80.8	77.6	74.3	71.1
5	81.6	81.6	81.5	78.3	75.0	71.7
0	81.6	81.6	81.6	79.0	75.7	72.4
-5	81.6	81.6	81.6	79.8	76.5	73.1
-10	81.6	81.6	81.6	80.5	77.3	73.9
-15	81.6	81.6	81.6	81.3	78.0	74.6
-20	81.6	81.6	81.6	81.6	78.8	75.4
-30	81.6	81.6	81.6	81.6	80.4	77.1
-40	81.6	81.6	81.6	81.6	81.6	78.7
-50	81.6	81.6	81.6	81.6	81.6	80.4
-54	81.6	81.6	81.6	81.6	81.6	81.2

**Increase weight by 800 kg per 1% uphill slope. Decrease weight by 1050 kg per 1% downhill slope.
Increase weight by 1850 kg per 10 knots headwind. Decrease weight by 6850 kg per 10 knots tailwind.
After landing at weights exceeding those shown above, adjusted for slope and wind, wait at least 67 minutes and check that wheel thermal plugs have not melted before executing a subsequent takeoff.**

**As an alternate procedure, ensure that each brake pressure plate temperature, without artificial cooling, is less than 425°F as follows:
No sooner than 10 and no later than 15 minutes after parking, measure each brake pressure plate surface temperature at a minimum of two points per brake by an accurate method (using a Doric Microtemp 450 hand held thermometer or equivalent, hold temperature probe in place for 20 seconds or until reading stabilizes). If each measured temperature is less than 425°F, immediate dispatch is allowed; otherwise the required minimum ground wait period of 67 minutes applies.**

If a Brake Temperature Monitoring System (BTMS) is installed:

**No sooner than 10 and no later than 15 minutes after parking, check the BRAKE TEMP light. If the BRAKE TEMP light is not on, no ground waiting period is required. If the BRAKE TEMP light is on, do not dispatch until at least 67 minutes after landing, or until all the BTMS readings on the Systems Display are below 3.5 and the BRAKE TEMP light is off. Check that wheel thermal plugs have not melted before making a subsequent takeoff.
Note: If any brake temperature display digit is blank or indicates 0.0 or 0.1, then this method cannot be used.**

Quick Turnaround Limit Weight - Category M Carbon Brakes

Flaps 40

OAT		LIMIT WEIGHT (1000 KG)					
		AIRPORT PRESSURE ALTITUDE (FT)					
°C	°F	0	2000	4000	6000	8000	10000
54	129	75.2					
50	122	75.7	72.6				
45	113	76.3	73.2	70.3			
40	104	77.0	73.9	70.9	67.9		
35	95	77.7	74.5	71.5	68.5	65.6	
30	86	78.3	75.2	72.1	69.1	66.2	63.4
25	77	79.0	75.9	72.7	69.7	66.8	64.0
20	68	79.7	76.6	73.4	70.3	67.4	64.5
15	59	80.3	77.3	74.1	71.0	68.0	65.1
10	50	81.0	78.0	74.8	71.6	68.6	65.7
5	41	81.8	78.7	75.5	72.3	69.3	66.3
0	32	82.5	79.4	76.2	73.0	69.9	66.9
-5	23	83.3	80.1	77.0	73.7	70.6	67.6
-10	14	84.0	80.8	77.7	74.5	71.3	68.3
-15	5	84.8	81.6	78.5	75.2	72.1	69.0
-20	-4	85.7	82.4	79.2	76.0	72.8	69.7
-30	-22	86.1	84.0	80.8	77.7	74.4	71.2
-40	-40	86.1	85.8	82.5	79.3	76.0	72.7
-50	-58	86.1	86.1	84.3	81.0	77.8	74.4
-54	-65	86.1	86.1	85.0	81.7	78.5	75.1

Increase weight by 650 kg per 1% uphill slope. Decrease weight by 1150 kg per 1% downhill slope. Increase weight by 1650 kg per 10 knots headwind. Decrease weight by 7900 kg per 10 knots tailwind. After landing at weights exceeding those shown above, adjusted for slope and wind, wait at least 55 minutes and check that wheel thermal plugs have not melted before executing a takeoff.

If a Brake Temperature Monitoring System (BTMS) is installed:

No sooner than 10 and no later than 15 minutes after parking, check the BRAKE TEMP light. If the BRAKE TEMP light is not on, no ground waiting period is required. If the BRAKE TEMP light is on, do not dispatch until at least 55 minutes after landing, or until all the BTMS readings on the systems Display are below 3.0 and the BRAKE TEMP light is off. Check that wheel thermal plugs have not melted before making a subsequent takeoff.
Note: If any brake temperature display digit is blank or indicates 0.0 or 0.1, then this method cannot be used.

Performance Dispatch — Chapter PD

Gear Down Planning — Section 33

GEAR DOWN

Gear Down

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Performance Dispatch — Chapter PD
Text — Section 34

Introduction

This chapter contains self dispatch performance data intended primarily for use by flight crews in the event that information cannot be obtained from the airline dispatch office. The takeoff data provided is for a single takeoff flap. The range of conditions covered is limited to those normally encountered in airline operation. In the event of conflict between the data presented in this chapter and that contained in the approved Airplane Flight Manual, the Flight Manual shall always take precedence.

Takeoff

The maximum allowable takeoff weight will be the least of the Field, Climb, Obstacle, Brake Energy and Tire Speed Limit Weights as determined from the tables shown.

Brake Energy or Tire Speed Limit Weight tables are only provided if they are limiting for the range of conditions covered in the FCOM Section PD.

EUOPS-1 requires that the runway length be adjusted to account for alignment of the airplane prior to takeoff. The table below provides TORA, TODA and ASDA adjustments for both 90 degree taxiway entry and 180 degree turnaround. These values may be used when obtaining takeoff weights from the Airplane Flight Manual or a takeoff analysis program. When using line-up allowances with the Field Length Limit chart, the field length available must be reduced by the ASDA adjustment.

	90 DEGREE TAXIWAY ENTRY	180 DEGREE TURNAROUND	
		60 M (200 FT) RUNWAY	45 M (150 FT) RUNWAY
	LINE-UP DISTANCE - M (FT)	LINE-UP DISTANCE - M (FT)	LINE-UP DISTANCE - M (FT)
TORA & TODA	10 (32)	16 (54)	16 (54)
ASDA	22 (74)	29 (95)	29 (95)

Minimum Takeoff Weight

Takeoff at the -7B26 thrust rating requires observance of a minimum takeoff weight in order to maintain airplane controllability during takeoff. For takeoff at weights below the minimum takeoff weight, use of a lower thrust rating (certified derate) is required. Note that the assumed temperature method of reducing thrust may not be used as a means to comply with this restriction. The conservative minimum takeoff weight is 56699 kg at the -7B26 takeoff thrust. Alternatively, lower minimum takeoff weights may be obtained, for the actual pressure altitude and outside air temperature, by using the Minimum Takeoff Weight table provided.

Field Limit Weight - Slope and Wind Corrections

These tables for dry and wet runways provide corrections to the field length available for the effects of runway slope and wind component along the runway. Enter the appropriate table with the available field length and runway slope to determine the slope corrected field length. Next enter the appropriate table with slope corrected field length and wind component to determine the slope and wind corrected field length.

Field and Climb Limit Weight

Tables are presented for selected airport pressure altitudes and runway conditions and show both Field and Climb Limit Weights. Enter the appropriate table for pressure altitude and runway condition with “Slope and Wind Corrected Field Length” determined above and airport OAT to obtain Field Limit Weight. Also read Climb Limit Weight for the same OAT. Intermediate altitudes may be interpolated or use next higher altitude. When finding a maximum weight for a wet runway, the dry runway limit weight must also be determined and the lower of the two weights used.

Obstacle Limit Weight

The Reference Obstacle Limit Weight table provides obstacle limit weights for reference airport conditions based on obstacle height above the runway surface and distance from brake release. Enter the adjustment tables to adjust the reference Obstacle Limit Weight for the effects of OAT, pressure altitude and wind as indicated. In the case of multiple obstacles, enter the tables successively with each obstacle and determine the most limiting weight.

When using line-up allowances with the Obstacle Limit chart, the obstacle distance from brake release must be reduced by the ASDA adjustment.

Tire Speed Limit

Tire Speed Limit Weight tables are only provided if they are limiting for the range of conditions covered in the FCOM Section PD.

Maximum tire speed limited weights are presented for 225 MPH tires. To determine the tire speed limit weight, enter the table with OAT and airport pressure altitude. Adjust the tire speed limit weight according to the notes below the table to account for wind.

Brake Energy Limit VMBE

Brake Energy Limit Weight tables are only provided if they are limiting for the range of conditions covered in the FCOM Section PD.

The Maximum Brake Energy Speed table provides the Reference VMBE for a variety of airport pressure altitudes and temperatures. Enter the Weight Adjusted VMBE table to adjust the Reference VMBE for the actual brake release gross weight. Correct VMBE for slope and wind. If V1 exceeds VMBE, decrease brake release weight as indicated for each knot that V1 exceeds VMBE and determine V1, VR, and V2 for the lower brake release weight.

Enroute

Long Range Cruise Maximum Operating Altitude

These tables provide the maximum operating altitude in the same manner as the FMC. Maximum altitudes are shown for a given cruise weight and maneuver capability. Note that this table considers both thrust and buffet limits, providing the more limiting of the two. Any data that is thrust limited is denoted by an asterisk and represents only a thrust limited condition in level flight with 100 ft/min residual rate of climb. Flying above these altitudes with sustained banks in excess of approximately 15° may cause the airplane to lose speed and/or altitude. The altitudes shown in the table are limited to the maximum certified altitude of 41000 ft.

Long Range Cruise Trip Fuel and Time

Long Range Cruise Trip Fuel and Time tables are provided to determine trip time and fuel required to destination.

To determine trip fuel and time for a constant altitude cruise, first enter the Ground to Air Miles Conversion table to convert ground distance and enroute wind to an equivalent still air distance for use with the Reference Fuel and Time tables. Next, enter the Reference Fuel and Time table with air distance from the Ground to Air Miles Conversion table and the desired altitude and read Reference Fuel and Time Required. Lastly, enter the Fuel Required Adjustment table with the Reference Fuel and the planned landing weight to obtain the adjustment to the fuel required at the planned landing weight.

Long Range Cruise Step Climb Trip Fuel and Time

The Long Range Cruise Step Climb Trip Fuel and Time tables are provided to determine trip time and fuel required to destination when flying a step climb profile. Step climb profiles are based on 4000 ft step climbs to keep the flight within 2000 ft of the optimum altitude for the current cruise weight. To determine trip fuel and time, enter the Ground to Air Miles Conversion table and determine air distance as discussed above. Then enter the Trip Fuel and Time Required table with air distance and planned landing weight to read trip fuel. Continue across the table to read trip time.

Short Trip Fuel and Time

These tables are provided to determine trip fuel and time for short distances or alternates. Obtain air distance from the table using the ground distance and wind component to the alternate. Enter the Trip Fuel and Time Required table with air distance and read trip fuel required for the expected landing weight, together with time to alternate at right. For distances greater than shown or other altitudes, use the Long Range Cruise Trip Fuel and Time tables.

Holding Planning

This table provides total fuel flow information necessary for planning flaps up holding and reserve fuel requirements. Data is based on the FMC holding speed schedule which is the higher of the maximum endurance and flaps up maneuver speeds. As noted, the fuel flow is based on flight in a racetrack holding pattern. For holding in straight and level flight, reduce table values by 5%.

Flight Crew Oxygen Requirements

This airplane is equipped with a chemical passenger oxygen system. Regulations require that sufficient oxygen be provided to the flight crew to account for the greater of supplemental breathing oxygen in the event of a cabin depressurization or protective breathing in the event of smoke or harmful fumes in the flight deck. The oxygen quantity associated with the above requirements is achieved with the minimum dispatch oxygen cylinder pressure.

To determine the minimum dispatch oxygen cylinder pressure enter the appropriate flight crew oxygen table with the number of crew plus observers using oxygen and read the minimum cylinder pressure required for the appropriate cylinder temperature.

Net Level Off Weight

The Net Level Off Weight table is provided to determine terrain clearance capability in straight and level flight following an engine failure. Regulations require terrain clearance planning based on net performance which is the gross (or actual) gradient performance degraded by 1.1%. In addition, the net level off pressure altitude must clear the terrain by 1000 ft.

To determine the maximum weight for terrain clearance, enter the table with required net level off pressure altitude and expected ISA deviation to obtain weight. Adjust weight for anti-ice operation as noted below the table.

Landing

Tables are provided for determining the maximum landing weight as limited by field length or climb requirements for a single landing flap.

Maximum landing weight is the lowest of the field length limit weight, climb limit weight, or maximum certified landing weight.

Landing Field Limit Weight

For the expected runway condition and anti-skid system configuration, obtain wind corrected field length by entering the Wind Corrected Field Length table with field length available and wind component along the runway. Now enter the Field Limit Weight table with wind corrected field length and pressure altitude to read field limit weight.

Landing Climb Limit Weight

Enter the table with airport OAT and pressure altitude to read landing climb limit weight. Apply the noted adjustments as required.

Go-Around Climb Gradient

Enter the Reference Go-Around Gradient table with airport OAT and pressure altitude to determine the reference go-around gradient. Then adjust the reference gradient for airplane weight and speed using the tables provided to determine the weight and speed adjusted go-around gradient. Apply the necessary corrections for engine bleed configuration and icing conditions as noted.

Quick Turnaround Limit Weight

Enter the appropriate table (Steel or Carbon Brakes) with airport pressure altitude and OAT to read maximum quick turnaround weight. Apply the noted adjustments as required.

If the landing weight exceeds the maximum quick turnaround weight, wait the specified time and then check that the wheel thermal plugs have not melted before executing a subsequent takeoff. For Steel Brakes, the alternate procedures on the charts can be used to ensure the brake temperature is within limits. These procedures cannot be used for carbon brakes.

Gear Down

This section provides flight planning data for revenue operation with gear down. Unless otherwise noted, the gear down tables in this section are identical in format and usage to the corresponding gear up tables previously described.

To eliminate erroneous displays the flight crew should enter only gross weight data on the PERF INIT page of the Control Display Unit (CDU). Omission of the cost index and cruise altitude entries on the PERF INIT page will render the VNAV function unavailable during flight. As a result, the following information will not be provided: VNAV guidance and speed schedules, trip fuel and ETA predictions, optimum and maximum altitude data, step climb and top of descent predictions, and the VNAV descent guidance path.

The gross weight entry allows the FMCS takeoff and approach speed schedules to be generated. In addition, the flap maneuver speed and VREF speed bugs will be available for display on the primary flight display speed tape. Except for VNAV, normal autopilot and autothrottle modes will remain available for use during the flight, as will the LNAV mode.

Takeoff/Landing Climb Limit Weight

Enter the appropriate table with airport OAT and pressure altitude to determine Takeoff/Landing Climb Limit Weight with gear down. Correct the weight obtained for engine bleed configuration as required.

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Performance Dispatch — Chapter PD

Table of Contents — Section 40

737-800 CFM56-7B26 C KG M FAA CATC/N

Performance Dispatch — Chapter PD
Pkg Model Identification — Section 40

General

The table below shows the airplanes that have been identified with the following performance package. Note, some airplanes may be identified with more than one performance package. This configuration table information reflects the Boeing delivered configuration updated for service bulletin incorporations in conformance with the policy stated in the introduction section of the FCOM. The performance data is prepared for the owner/operator named on the title page. The intent of this information is to assist flight crews and airlines in knowing which performance package is applicable to a given airplane. The performance package model identification information is based on Boeing's knowledge of the airline's fleet at a point in time approximately three months prior to the page date. Notice of Errata (NOE) will not be provided to airlines to identify airplanes that are moved between performance packages within this manual or airplanes added to the airline's fleet whose performance packages are already represented in this manual. These types of changes will be updated in the next block revision. Owners/operators are responsible for ensuring the operational documentation they are using is complete and matches the current configuration of their airplanes, and the accuracy and validity of all information furnished by the owner/operator or any other party. Owners/operators receiving active revision service are responsible to ensure that any modifications to the listed airplanes are properly reflected in this manual.

Serial and tabulation number are supplied by Boeing.

Registry Number	Serial Number	Tabulation Number
YX800	YX800	YX800

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Performance Dispatch — Chapter PD
Takeoff — Section 40

Takeoff Field Corrections - Dry Runway
Slope Corrections

FIELD LENGTH AVAILABLE (M)	SLOPE CORRECTED FIELD LENGTH (M)								
	RUNWAY SLOPE (%)								
	-2.0	-1.5	-1.0	-0.5	0.0	0.5	1.0	1.5	2.0
1200	1240	1230	1220	1210	1200	1190	1180	1170	1150
1400	1460	1450	1430	1420	1400	1380	1350	1330	1310
1600	1680	1660	1640	1620	1600	1570	1530	1500	1460
1800	1900	1870	1850	1820	1800	1750	1710	1660	1610
2000	2110	2090	2060	2030	2000	1940	1880	1820	1770
2200	2330	2300	2270	2230	2200	2130	2060	1990	1920
2400	2550	2510	2470	2440	2400	2320	2240	2150	2070
2600	2770	2730	2690	2640	2600	2510	2410	2320	2220
2800	3000	2950	2900	2850	2800	2690	2590	2480	2380
3000	3220	3170	3110	3060	3000	2880	2770	2650	2530
3200	3450	3390	3320	3260	3200	3070	2940	2810	2680
3400	3670	3600	3540	3470	3400	3260	3120	2980	2840
3600	3900	3820	3750	3670	3600	3450	3290	3140	2990
3800	4130	4050	3970	3880	3800	3640	3470	3310	3140
4000	4370	4280	4190	4090	4000	3820	3650	3470	3290
4200	4610	4510	4410	4300	4200	4010	3820	3640	3450
4400	4850	4740	4630	4510	4400	4200	4000	3800	3600
4600	5090	4970	4850	4720	4600	4390	4180	3960	3750
4800	5330	5200	5070	4930	4800	4580	4350	4130	3910
5000	5570	5430	5290	5140	5000	4760	4530	4290	4060

Wind Corrections

SLOPE CORR'D FIELD LENGTH (M)	SLOPE & WIND CORRECTED FIELD LENGTH (M)							
	WIND COMPONENT (KTS)							
	-15	-10	-5	0	10	20	30	40
1200	880	990	1090	1200	1270	1340	1410	1490
1400	1050	1170	1280	1400	1480	1550	1630	1710
1600	1220	1350	1470	1600	1680	1760	1850	1930
1800	1390	1530	1660	1800	1890	1980	2070	2160
2000	1560	1700	1850	2000	2090	2190	2280	2380
2200	1720	1880	2040	2200	2300	2400	2500	2600
2400	1890	2060	2230	2400	2500	2610	2720	2830
2600	2060	2240	2420	2600	2710	2820	2930	3050
2800	2230	2420	2610	2800	2910	3030	3150	3270
3000	2400	2600	2800	3000	3120	3240	3370	3500
3200	2570	2780	2990	3200	3330	3450	3590	3720
3400	2730	2960	3180	3400	3530	3660	3800	3940
3600	2900	3140	3370	3600	3740	3880	4020	4170
3800	3070	3310	3560	3800	3940	4090	4240	4390
4000	3240	3490	3750	4000	4150	4300	4450	4610
4200	3410	3670	3940	4200	4350	4510	4670	4840
4400	3580	3850	4130	4400	4560	4720	4890	5060
4600	3740	4030	4310	4600	4760	4930	5110	5280
4800	3910	4210	4500	4800	4970	5140	5320	5510
5000	4080	4390	4690	5000	5170	5350	5540	5730

Takeoff Field & Climb Limit Weights - Dry Runway

Flaps 5

Sea Level Pressure Altitude

CORR'D FIELD LENGTH (M)	FIELD LIMIT WEIGHT (1000 KG)										
	OAT (°C)										
	-40	10	14	18	22	26	30	38	42	46	50
1200	58.1	53.3	52.9	52.6	52.2	51.9	51.5	49.1	47.9	46.7	45.4
1400	63.7	58.5	58.1	57.7	57.3	57.0	56.6	53.9	52.5	51.2	49.8
1600	68.9	63.3	62.8	62.4	62.0	61.6	61.2	58.3	56.8	55.4	53.9
1800	73.7	67.6	67.2	66.7	66.3	65.9	65.4	62.4	60.7	59.2	57.6
2000	78.2	71.8	71.3	70.8	70.3	69.9	69.4	66.1	64.4	62.7	61.0
2200	82.5	75.6	75.1	74.6	74.1	73.6	73.1	69.7	67.8	66.0	64.3
2400	86.1	79.2	78.7	78.2	77.6	77.1	76.6	73.0	71.0	69.2	67.3
2600	86.1	82.4	81.8	81.3	80.7	80.2	79.6	75.8	73.8	71.9	69.9
2800	86.1	85.4	84.8	84.2	83.6	83.1	82.5	78.6	76.5	74.4	72.4
3000	86.1	86.1	86.1	86.1	86.1	85.9	85.3	81.2	79.0	76.9	74.8
3200	86.1	86.1	86.1	86.1	86.1	86.1	86.1	83.4	81.2	79.0	76.9
3400	86.1	86.1	86.1	86.1	86.1	86.1	86.1	85.6	83.3	81.1	78.8
3600	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	85.3	83.1	80.8
3800	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	84.9	82.6
4000	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	84.4
4200	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1
4400	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1
4600	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1
CLIMB LIMIT WT (1000 KG)	82.4	81.9	81.8	81.7	81.6	81.5	81.3	76.0	73.5	71.0	68.4

2000 FT Pressure Altitude

CORR'D FIELD LENGTH (M)	FIELD LIMIT WEIGHT (1000 KG)										
	OAT (°C)										
	-40	10	14	18	22	26	30	38	42	46	50
1200	54.7	50.3	50.0	49.6	49.3	49.0	48.2	45.8	44.6	43.5	42.4
1400	60.1	55.2	54.9	54.5	54.2	53.8	52.8	50.3	49.0	47.7	46.5
1600	65.0	59.7	59.3	59.0	58.6	58.2	57.2	54.4	53.0	51.6	50.3
1800	69.5	63.9	63.5	63.1	62.7	62.3	61.1	58.1	56.6	55.2	53.8
2000	73.7	67.7	67.3	66.8	66.4	66.0	64.8	61.6	60.0	58.4	56.9
2200	77.7	71.3	70.9	70.4	70.0	69.5	68.2	64.8	63.2	61.5	59.9
2400	81.4	74.7	74.2	73.8	73.3	72.8	71.4	67.9	66.1	64.4	62.7
2600	84.6	77.7	77.2	76.7	76.2	75.7	74.3	70.5	68.7	66.9	65.2
2800	86.1	80.5	80.0	79.4	78.9	78.4	76.9	73.1	71.1	69.3	67.5
3000	86.1	83.1	82.6	82.1	81.5	81.0	79.5	75.5	73.5	71.5	69.6
3200	86.1	85.5	84.9	84.4	83.8	83.3	81.7	77.6	75.5	73.5	71.6
3400	86.1	86.1	86.1	86.1	86.0	85.5	83.8	79.6	77.5	75.4	73.4
3600	86.1	86.1	86.1	86.1	86.1	86.1	85.8	81.5	79.4	77.3	75.2
3800	86.1	86.1	86.1	86.1	86.1	86.1	86.1	83.4	81.2	79.0	76.9
4000	86.1	86.1	86.1	86.1	86.1	86.1	86.1	85.2	82.9	80.7	78.6
4200	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	84.6	82.4	80.2
4400	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	84.0	81.8
4600	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	85.7	83.4
CLIMB LIMIT WT (1000 KG)	78.5	78.1	78.0	77.9	77.8	77.7	75.9	71.1	68.7	66.4	64.0

With engine bleed for packs off, increase field limit weight by 350 kg and climb limit weight by 1250 kg.
With engine anti-ice on, decrease field limit weight by 200 kg and climb limit weight by 250 kg.
With engine and wing anti-ice on (optional system), decrease field limit weight by 950 kg and climb limit weight by 1400 kg.

Takeoff Field & Climb Limit Weights - Dry Runway

Flaps 5

4000 FT Pressure Altitude

CORR'D FIELD LENGTH (M)	FIELD LIMIT WEIGHT (1000 KG)										
	OAT (°C)										
	-40	10	14	18	22	26	30	38	42	46	50
1200	51.1	47.0	46.7	46.4	46.1	45.5	44.7	42.7	41.6	40.5	39.6
1400	56.1	51.6	51.3	50.9	50.6	49.9	49.1	46.8	45.7	44.5	43.5
1600	60.7	55.8	55.4	55.1	54.8	54.0	53.1	50.6	49.4	48.2	47.0
1800	64.9	59.6	59.3	58.9	58.5	57.7	56.7	54.1	52.8	51.4	50.2
2000	68.8	63.2	62.8	62.4	62.0	61.1	60.1	57.3	55.9	54.4	53.2
2200	72.5	66.6	66.1	65.7	65.3	64.4	63.3	60.3	58.8	57.3	56.0
2400	75.9	69.7	69.3	68.8	68.4	67.4	66.3	63.2	61.6	60.0	58.6
2600	78.9	72.4	72.0	71.5	71.1	70.1	68.8	65.6	63.9	62.3	60.8
2800	81.8	75.0	74.5	74.1	73.6	72.5	71.3	67.9	66.2	64.5	62.9
3000	84.5	77.5	77.0	76.5	76.0	74.9	73.6	70.1	68.3	66.5	64.9
3200	86.1	79.7	79.2	78.7	78.1	77.0	75.7	72.1	70.2	68.4	66.7
3400	86.1	81.7	81.2	80.7	80.2	79.0	77.6	73.9	72.0	70.2	68.5
3600	86.1	83.7	83.2	82.6	82.1	80.9	79.5	75.7	73.8	71.9	70.1
3800	86.1	85.6	85.1	84.5	84.0	82.8	81.3	77.5	75.5	73.5	71.7
4000	86.1	86.1	86.1	86.1	85.8	84.6	83.1	79.1	77.1	75.1	73.3
4200	86.1	86.1	86.1	86.1	86.1	86.1	84.8	80.8	78.7	76.7	74.8
4400	86.1	86.1	86.1	86.1	86.1	86.1	86.1	82.4	80.3	78.2	76.3
4600	86.1	86.1	86.1	86.1	86.1	86.1	86.1	84.0	81.8	79.7	77.8
CLIMB LIMIT WT (1000 KG)	73.9	73.4	73.3	73.3	73.2	72.1	70.6	66.3	64.1	61.9	60.0

6000 FT Pressure Altitude

CORR'D FIELD LENGTH (M)	FIELD LIMIT WEIGHT (1000 KG)										
	OAT (°C)										
	-40	10	14	18	22	26	30	38	42	46	50
1200	47.7	43.8	43.6	43.3	42.8	42.2	41.5	39.6	38.6	37.8	36.9
1400	52.3	48.1	47.8	47.6	47.0	46.3	45.6	43.5	42.4	41.4	40.5
1600	56.5	52.1	51.7	51.4	50.8	50.1	49.3	47.0	45.8	44.8	43.8
1800	60.4	55.6	55.3	55.0	54.3	53.5	52.7	50.2	49.0	47.8	46.7
2000	64.0	58.9	58.6	58.2	57.5	56.7	55.7	53.1	51.8	50.6	49.4
2200	67.5	62.0	61.7	61.3	60.5	59.7	58.7	55.9	54.5	53.2	52.0
2400	70.6	64.9	64.6	64.2	63.3	62.5	61.4	58.5	57.0	55.7	54.4
2600	73.4	67.5	67.1	66.6	65.8	64.9	63.8	60.8	59.2	57.8	56.4
2800	76.1	69.9	69.4	69.0	68.1	67.2	66.0	62.9	61.3	59.8	58.4
3000	78.6	72.1	71.7	71.2	70.3	69.3	68.2	64.9	63.2	61.7	60.2
3200	80.8	74.1	73.7	73.2	72.3	71.3	70.1	66.7	65.0	63.4	61.9
3400	82.9	76.1	75.6	75.1	74.1	73.1	71.9	68.4	66.7	65.0	63.5
3600	84.9	77.9	77.4	77.0	76.0	74.9	73.6	70.1	68.3	66.6	65.0
3800	86.1	79.7	79.2	78.7	77.7	76.6	75.3	71.7	69.8	68.2	66.5
4000	86.1	81.4	80.9	80.4	79.4	78.3	76.9	73.3	71.4	69.6	68.0
4200	86.1	83.1	82.6	82.1	81.0	79.9	78.5	74.8	72.8	71.1	69.4
4400	86.1	84.8	84.2	83.7	82.6	81.5	80.1	76.3	74.3	72.5	70.8
4600	86.1	86.1	85.8	85.3	84.2	83.1	81.6	77.8	75.8	73.9	72.2
CLIMB LIMIT WT (1000 KG)	69.3	68.9	68.8	68.7	67.8	66.9	65.5	61.4	59.3	57.4	55.7

With engine bleed for packs off, increase field limit weight by 350 kg and climb limit weight by 1250 kg.
With engine anti-ice on, decrease field limit weight by 200 kg and climb limit weight by 250 kg.
With engine and wing anti-ice on (optional system), decrease field limit weight by 950 kg and climb limit weight by 1400 kg.

Takeoff Field & Climb Limit Weights - Dry Runway

Flaps 5

8000 FT Pressure Altitude

CORR'D FIELD LENGTH (M)	FIELD LIMIT WEIGHT (1000 KG)										
	OAT (°C)										
	-40	10	14	18	22	26	30	38	42	46	50
1200	44.4	40.9	40.7	40.2	39.7	39.0	38.2	36.4	35.6	34.7	33.9
1400	48.7	45.0	44.7	44.1	43.6	42.9	42.0	40.0	39.0	38.1	37.2
1600	52.7	48.6	48.3	47.7	47.1	46.4	45.5	43.2	42.2	41.2	40.3
1800	56.3	51.9	51.6	51.0	50.4	49.6	48.5	46.1	45.1	44.0	43.0
2000	59.6	55.0	54.6	54.0	53.3	52.4	51.3	48.8	47.6	46.5	45.4
2200	62.8	57.9	57.5	56.8	56.1	55.2	54.0	51.3	50.1	48.9	47.8
2400	65.8	60.6	60.2	59.5	58.7	57.8	56.5	53.7	52.4	51.2	49.9
2600	68.3	62.9	62.5	61.7	60.9	60.0	58.7	55.7	54.4	53.1	51.8
2800	70.7	65.1	64.7	63.9	63.1	62.1	60.7	57.6	56.2	54.9	53.6
3000	73.1	67.2	66.8	65.9	65.1	64.0	62.7	59.4	58.0	56.6	55.2
3200	75.1	69.1	68.6	67.8	66.9	65.8	64.4	61.1	59.6	58.2	56.7
3400	77.0	70.9	70.4	69.5	68.6	67.5	66.1	62.7	61.1	59.7	58.2
3600	78.9	72.6	72.1	71.2	70.3	69.2	67.7	64.2	62.6	61.1	59.6
3800	80.7	74.2	73.8	72.9	71.9	70.7	69.2	65.7	64.1	62.5	61.0
4000	82.4	75.9	75.4	74.4	73.5	72.3	70.7	67.1	65.5	63.9	62.3
4200	84.2	77.4	76.9	76.0	75.0	73.8	72.2	68.5	66.8	65.2	63.7
4400	85.8	79.0	78.5	77.5	76.5	75.3	73.7	69.9	68.2	66.6	64.9
4600	86.1	80.5	80.0	79.0	78.0	76.7	75.1	71.3	69.5	67.9	66.2
CLIMB LIMIT WT (1000 KG)	64.8	64.5	64.4	63.7	62.9	61.7	59.9	55.9	54.1	52.5	50.8

10000 FT Pressure Altitude

CORR'D FIELD LENGTH (M)	FIELD LIMIT WEIGHT (1000 KG)										
	OAT (°C)										
	-40	10	14	18	22	26	30	38	42	46	50
1200	41.5	38.2	37.8	37.3	36.8	36.2	35.4	33.6	32.7	31.9	31.0
1400	45.5	42.0	41.4	40.9	40.4	39.8	38.9	36.9	35.9	35.0	34.1
1600	49.3	45.4	44.8	44.3	43.7	43.0	42.1	39.9	38.9	37.9	36.8
1800	52.6	48.5	47.9	47.3	46.6	45.9	44.9	42.6	41.5	40.4	39.3
2000	55.7	51.3	50.6	50.0	49.3	48.5	47.4	45.0	43.8	42.6	41.4
2200	58.7	53.9	53.3	52.6	51.9	51.1	49.9	47.3	46.0	44.8	43.6
2400	61.4	56.5	55.7	55.0	54.3	53.4	52.2	49.5	48.2	46.9	45.5
2600	63.8	58.6	57.8	57.1	56.3	55.4	54.2	51.3	49.9	48.6	47.2
2800	66.0	60.6	59.8	59.1	58.3	57.3	56.0	53.1	51.6	50.2	48.8
3000	68.1	62.6	61.7	60.9	60.1	59.1	57.8	54.7	53.2	51.7	50.3
3200	70.0	64.3	63.4	62.6	61.8	60.8	59.4	56.2	54.7	53.2	51.6
3400	71.8	66.0	65.1	64.2	63.4	62.3	60.9	57.7	56.1	54.5	53.0
3600	73.6	67.6	66.7	65.8	64.9	63.9	62.4	59.1	57.5	55.9	54.3
3800	75.3	69.1	68.2	67.3	66.4	65.3	63.8	60.4	58.8	57.2	55.5
4000	76.9	70.6	69.7	68.8	67.8	66.8	65.2	61.8	60.1	58.4	56.7
4200	78.5	72.1	71.1	70.2	69.3	68.2	66.6	63.1	61.3	59.6	57.9
4400	80.1	73.5	72.6	71.6	70.7	69.5	67.9	64.3	62.6	60.9	59.1
4600	81.6	75.0	74.0	73.0	72.0	70.9	69.3	65.6	63.8	62.1	60.3
CLIMB LIMIT WT (1000 KG)	60.9	60.3	59.6	58.9	58.0	56.9	55.2	51.4	49.6	47.8	46.0

With engine bleed for packs off, increase field limit weight by 350 kg and climb limit weight by 1250 kg.
With engine anti-ice on, decrease field limit weight by 200 kg and climb limit weight by 250 kg.
With engine and wing anti-ice on (optional system), decrease field limit weight by 950 kg and climb limit weight by 1400 kg.

Takeoff Field Corrections - Wet Runway

Slope Corrections

FIELD LENGTH AVAILABLE (M)	SLOPE CORRECTED FIELD LENGTH (M)								
	RUNWAY SLOPE (%)								
	-2.0	-1.5	-1.0	-0.5	0.0	0.5	1.0	1.5	2.0
1200	1230	1220	1210	1210	1200	1190	1180	1170	1160
1400	1450	1440	1430	1410	1400	1380	1360	1340	1320
1600	1680	1660	1640	1620	1600	1570	1550	1520	1490
1800	1900	1880	1850	1830	1800	1760	1730	1690	1660
2000	2130	2100	2060	2030	2000	1960	1910	1870	1830
2200	2350	2310	2280	2240	2200	2150	2100	2050	1990
2400	2580	2530	2490	2440	2400	2340	2280	2220	2160
2600	2800	2750	2700	2650	2600	2530	2470	2400	2340
2800	3030	2970	2910	2860	2800	2730	2660	2580	2510
3000	3250	3190	3130	3060	3000	2920	2840	2760	2690
3200	3480	3410	3340	3270	3200	3120	3030	2950	2860
3400	3700	3630	3550	3480	3400	3310	3220	3130	3040
3600	3930	3850	3760	3680	3600	3500	3410	3310	3210
3800	4170	4080	3990	3890	3800	3690	3590	3480	3380
4000	4420	4320	4210	4110	4000	3880	3770	3650	3540
4200	4670	4550	4440	4320	4200	4080	3950	3830	3700
4400	4920	4790	4660	4530	4400	4270	4130	4000	3860
4600	5170	5030	4890	4740	4600	4460	4310	4170	4030
4800	5420	5270	5110	4960	4800	4650	4490	4340	4190
5000	5670	5500	5340	5170	5000	4840	4680	4510	4350

Wind Corrections

SLOPE CORR'D FIELD LENGTH (M)	SLOPE & WIND CORRECTED FIELD LENGTH (M)							
	WIND COMPONENT (KTS)							
	-15	-10	-5	0	10	20	30	40
1200	860	970	1090	1200	1280	1360	1440	1520
1400	1030	1150	1280	1400	1480	1570	1660	1750
1600	1200	1330	1470	1600	1690	1790	1880	1980
1800	1370	1510	1660	1800	1900	2000	2100	2210
2000	1540	1690	1850	2000	2110	2210	2320	2440
2200	1710	1870	2040	2200	2310	2430	2550	2670
2400	1880	2050	2230	2400	2520	2640	2770	2890
2600	2050	2230	2420	2600	2730	2860	2990	3120
2800	2220	2410	2610	2800	2930	3070	3210	3350
3000	2390	2590	2800	3000	3140	3280	3430	3580
3200	2560	2770	2990	3200	3350	3500	3650	3810
3400	2730	2950	3180	3400	3560	3710	3870	4040
3600	2900	3130	3370	3600	3760	3930	4090	4260
3800	3060	3310	3550	3800	3970	4140	4310	4490
4000	3230	3490	3740	4000	4180	4350	4540	4720
4200	3400	3670	3930	4200	4380	4570	4760	4950
4400	3570	3850	4120	4400	4590	4780	4980	5180
4600	3740	4030	4310	4600	4800	5000	5200	5400
4800	3910	4210	4500	4800	5000	5210	5420	5630
5000	4080	4390	4690	5000	5210	5430	5640	5860

Takeoff Field & Climb Limit Weights - Wet Runway

Flaps 5

Sea Level Pressure Altitude

CORR'D FIELD LENGTH (M)	FIELD LIMIT WEIGHT (1000 KG)										
	OAT (°C)										
	-40	10	14	18	22	26	30	38	42	46	50
1200	58.2	52.9	52.5	52.1	51.8	51.4	51.0	48.7	47.5	46.3	45.1
1400	63.7	58.0	57.5	57.1	56.7	56.3	55.9	53.2	51.9	50.6	49.3
1600	68.8	62.6	62.1	61.7	61.2	60.8	60.3	57.4	56.0	54.6	53.2
1800	73.5	66.8	66.3	65.8	65.3	64.9	64.4	61.3	59.8	58.3	56.8
2000	77.8	70.8	70.2	69.7	69.2	68.7	68.2	64.9	63.3	61.7	60.2
2200	82.0	74.5	74.0	73.4	72.9	72.3	71.8	68.4	66.6	65.0	63.3
2400	85.8	78.0	77.4	76.8	76.2	75.7	75.1	71.5	69.7	68.0	66.2
2600	86.1	81.0	80.4	79.8	79.2	78.6	78.0	74.3	72.4	70.6	68.8
2800	86.1	83.9	83.2	82.6	82.0	81.4	80.8	76.9	74.9	73.0	71.1
3000	86.1	86.1	85.9	85.2	84.6	83.9	83.3	79.3	77.2	75.3	73.3
3200	86.1	86.1	86.1	86.1	86.1	86.1	85.9	81.7	79.6	77.5	75.5
3400	86.1	86.1	86.1	86.1	86.1	86.1	86.1	84.0	81.8	79.8	77.6
3600	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	84.0	81.9	79.7
3800	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	83.9	81.6
4000	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	85.8	83.5
4200	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	85.3
4400	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1
4600	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1
CLIMB LIMIT WT (1000 KG)	82.4	81.9	81.8	81.7	81.6	81.5	81.3	76.0	73.5	71.0	68.4

2000 FT Pressure Altitude

CORR'D FIELD LENGTH (M)	FIELD LIMIT WEIGHT (1000 KG)										
	OAT (°C)										
	-40	10	14	18	22	26	30	38	42	46	50
1200	54.7	49.7	49.3	49.1	48.7	48.4	47.5	45.3	44.2	43.1	42.1
1400	59.9	54.5	54.1	53.7	53.3	52.9	51.9	49.5	48.3	47.2	46.0
1600	64.7	58.8	58.4	57.9	57.5	57.1	56.1	53.5	52.2	50.9	49.7
1800	69.1	62.7	62.3	61.8	61.4	60.9	59.8	57.0	55.7	54.3	53.0
2000	73.2	66.5	66.0	65.5	65.0	64.6	63.4	60.4	58.9	57.5	56.1
2200	77.0	70.0	69.4	68.9	68.4	67.9	66.7	63.6	62.0	60.5	59.1
2400	80.6	73.2	72.7	72.1	71.6	71.1	69.8	66.5	64.9	63.3	61.8
2600	83.8	76.0	75.5	74.9	74.4	73.8	72.5	69.0	67.3	65.7	64.1
2800	86.1	78.7	78.1	77.5	77.0	76.4	75.0	71.4	69.7	68.0	66.3
3000	86.1	81.2	80.5	79.9	79.4	78.8	77.3	73.6	71.8	70.0	68.3
3200	86.1	83.6	83.0	82.4	81.8	81.2	79.6	75.8	73.9	72.1	70.3
3400	86.1	86.0	85.4	84.7	84.1	83.5	81.9	78.0	76.0	74.1	72.3
3600	86.1	86.1	86.1	86.1	86.1	85.7	84.1	80.0	78.0	76.1	74.2
3800	86.1	86.1	86.1	86.1	86.1	86.1	86.1	82.0	79.9	77.9	76.0
4000	86.1	86.1	86.1	86.1	86.1	86.1	86.1	83.9	81.7	79.7	77.7
4200	86.1	86.1	86.1	86.1	86.1	86.1	86.1	85.7	83.5	81.4	79.4
4400	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	85.3	83.1	81.0
4600	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	84.8	82.6
CLIMB LIMIT WT (1000 KG)	78.5	78.1	78.0	77.9	77.8	77.7	75.9	71.1	68.7	66.4	64.0

With engine bleed for packs off, increase field limit weight by 350 kg and climb limit weight by 1250 kg.
With engine anti-ice on, decrease field limit weight by 200 kg and climb limit weight by 250 kg.
With engine and wing anti-ice on (optional system), decrease field limit weight by 800 kg and climb limit weight by 1400 kg.

Takeoff Field & Climb Limit Weights - Wet Runway

Flaps 5

4000 FT Pressure Altitude

CORR'D FIELD LENGTH (M)	FIELD LIMIT WEIGHT (1000 KG)										
	OAT (°C)										
	-40	10	14	18	22	26	30	38	42	46	50
1200	51.0	46.4	46.1	45.8	45.4	44.8	44.1	42.2	41.2	40.2	39.4
1400	55.9	50.8	50.4	50.1	49.7	49.0	48.2	46.1	45.1	44.0	43.0
1600	60.3	54.8	54.4	54.0	53.6	52.9	52.0	49.8	48.6	47.4	46.4
1800	64.4	58.5	58.1	57.6	57.2	56.4	55.5	53.1	51.8	50.6	49.5
2000	68.2	61.9	61.5	61.1	60.6	59.8	58.8	56.2	54.9	53.6	52.4
2200	71.8	65.2	64.7	64.3	63.8	62.9	61.9	59.2	57.8	56.4	55.1
2400	75.1	68.2	67.7	67.2	66.7	65.8	64.7	61.9	60.4	58.9	57.6
2600	78.1	70.8	70.3	69.8	69.3	68.3	67.2	64.2	62.7	61.2	59.8
2800	80.8	73.3	72.7	72.2	71.7	70.7	69.5	66.4	64.8	63.2	61.8
3000	83.3	75.5	75.0	74.4	73.9	72.8	71.6	68.4	66.7	65.1	63.6
3200	85.9	77.8	77.2	76.7	76.1	75.0	73.7	70.4	68.7	67.0	65.5
3400	86.1	80.0	79.4	78.8	78.3	77.1	75.8	72.4	70.6	68.9	67.3
3600	86.1	82.1	81.5	80.9	80.3	79.2	77.8	74.3	72.5	70.7	69.0
3800	86.1	84.1	83.5	82.9	82.3	81.1	79.7	76.1	74.2	72.4	70.7
4000	86.1	86.1	85.4	84.8	84.2	82.9	81.5	77.8	75.9	74.0	72.3
4200	86.1	86.1	86.1	86.1	86.0	84.8	83.3	79.5	77.6	75.6	73.9
4400	86.1	86.1	86.1	86.1	86.1	86.1	85.1	81.2	79.2	77.2	75.4
4600	86.1	86.1	86.1	86.1	86.1	86.1	86.1	82.8	80.8	78.7	76.9
CLIMB LIMIT WT (1000 KG)	73.9	73.4	73.3	73.3	73.2	72.1	70.6	66.3	64.1	61.9	60.0

6000 FT Pressure Altitude

CORR'D FIELD LENGTH (M)	FIELD LIMIT WEIGHT (1000 KG)										
	OAT (°C)										
	-40	10	14	18	22	26	30	38	42	46	50
1200	47.6	43.3	43.0	42.7	42.1	41.6	40.9	39.2	38.3	37.4	36.6
1400	52.0	47.4	47.0	46.7	46.1	45.5	44.8	42.8	41.8	40.9	40.0
1600	56.1	51.1	50.7	50.4	49.7	49.1	48.3	46.2	45.1	44.1	43.1
1800	59.9	54.5	54.1	53.8	53.1	52.4	51.5	49.2	48.1	47.0	45.9
2000	63.4	57.7	57.3	56.9	56.2	55.4	54.5	52.1	50.9	49.7	48.6
2200	66.8	60.7	60.3	59.9	59.1	58.3	57.4	54.9	53.5	52.3	51.2
2400	69.9	63.5	63.1	62.7	61.9	61.0	60.0	57.4	56.0	54.7	53.5
2600	72.6	65.9	65.5	65.0	64.2	63.3	62.3	59.5	58.1	56.7	55.5
2800	75.1	68.2	67.7	67.2	66.4	65.5	64.4	61.5	60.0	58.6	57.3
3000	77.4	70.3	69.8	69.3	68.4	67.4	66.3	63.3	61.7	60.3	59.0
3200	79.7	72.4	71.8	71.3	70.4	69.4	68.3	65.2	63.6	62.1	60.7
3400	82.0	74.4	73.9	73.3	72.4	71.4	70.2	67.0	65.3	63.8	62.3
3600	84.2	76.4	75.8	75.3	74.3	73.2	72.0	68.7	67.0	65.5	63.9
3800	86.1	78.2	77.6	77.1	76.1	75.0	73.7	70.4	68.6	67.0	65.5
4000	86.1	80.0	79.4	78.8	77.8	76.7	75.4	72.0	70.2	68.5	66.9
4200	86.1	81.7	81.1	80.6	79.5	78.4	77.1	73.5	71.7	70.0	68.4
4400	86.1	83.4	82.8	82.2	81.2	80.0	78.7	75.0	73.2	71.4	69.8
4600	86.1	85.1	84.5	83.9	82.8	81.6	80.2	76.5	74.6	72.9	71.2
CLIMB LIMIT WT (1000 KG)	69.3	68.9	68.8	68.7	67.8	66.9	65.5	61.4	59.3	57.4	55.7

With engine bleed for packs off, increase field limit weight by 350 kg and climb limit weight by 1250 kg.
With engine anti-ice on, decrease field limit weight by 200 kg and climb limit weight by 250 kg.
With engine and wing anti-ice on (optional system), decrease field limit weight by 800 kg and climb limit weight by 1400 kg.

Takeoff Field & Climb Limit Weights - Wet Runway

Flaps 5

8000 FT Pressure Altitude

CORR'D FIELD LENGTH (M)	FIELD LIMIT WEIGHT (1000 KG)										
	OAT (°C)										
	-40	10	14	18	22	26	30	38	42	46	50
1200	44.3	40.4	40.1	39.7	39.2	38.6	37.8	36.0	35.2	34.4	33.7
1400	48.4	44.2	43.9	43.3	42.8	42.1	41.3	39.4	38.5	37.6	36.8
1600	52.2	47.6	47.3	46.7	46.1	45.4	44.5	42.4	41.5	40.6	39.6
1800	55.7	50.8	50.5	49.8	49.2	48.4	47.5	45.2	44.2	43.2	42.3
2000	59.0	53.8	53.4	52.8	52.1	51.3	50.3	47.9	46.8	45.8	44.7
2200	62.1	56.6	56.2	55.5	54.8	54.0	52.9	50.4	49.2	48.1	47.1
2400	65.0	59.2	58.8	58.1	57.3	56.4	55.3	52.7	51.5	50.3	49.2
2600	67.5	61.4	61.0	60.2	59.5	58.5	57.3	54.6	53.4	52.1	51.0
2800	69.8	63.5	63.0	62.3	61.4	60.5	59.2	56.4	55.1	53.8	52.6
3000	71.9	65.4	64.9	64.1	63.3	62.2	61.0	58.0	56.7	55.4	54.1
3200	74.1	67.3	66.8	66.0	65.1	64.1	62.8	59.7	58.3	57.0	55.6
3400	76.1	69.2	68.7	67.8	66.9	65.9	64.5	61.3	59.9	58.5	57.1
3600	78.2	71.0	70.5	69.6	68.7	67.6	66.2	62.9	61.4	60.0	58.6
3800	80.0	72.7	72.2	71.3	70.3	69.2	67.7	64.4	62.9	61.4	60.0
4000	81.9	74.4	73.8	72.9	71.9	70.7	69.3	65.9	64.3	62.8	61.3
4200	83.7	76.0	75.4	74.5	73.5	72.3	70.8	67.3	65.7	64.1	62.6
4400	85.4	77.6	77.0	76.0	75.0	73.8	72.2	68.7	67.0	65.5	63.9
4600	86.1	79.1	78.5	77.5	76.5	75.2	73.7	70.0	68.4	66.7	65.2
CLIMB LIMIT WT (1000 KG)	64.8	64.5	64.4	63.7	62.9	61.7	59.9	55.9	54.1	52.5	50.8

10000 FT Pressure Altitude

CORR'D FIELD LENGTH (M)	FIELD LIMIT WEIGHT (1000 KG)										
	OAT (°C)										
	-40	10	14	18	22	26	30	38	42	46	50
1200	41.3	37.7	37.2	36.7	36.3	35.7	35.0	33.3	32.4	31.6	30.8
1400	45.2	41.2	40.6	40.1	39.6	39.0	38.2	36.3	35.4	34.5	33.6
1600	48.8	44.4	43.8	43.3	42.7	42.0	41.2	39.2	38.2	37.2	36.2
1800	52.0	47.3	46.7	46.1	45.5	44.8	43.9	41.7	40.7	39.7	38.6
2000	55.1	50.1	49.5	48.8	48.2	47.5	46.4	44.2	43.1	42.0	40.9
2200	58.0	52.7	52.1	51.4	50.7	49.9	48.9	46.5	45.3	44.1	43.0
2400	60.6	55.1	54.4	53.7	53.0	52.2	51.1	48.6	47.3	46.1	44.9
2600	62.9	57.2	56.4	55.7	54.9	54.1	52.9	50.3	49.0	47.8	46.5
2800	65.0	59.1	58.3	57.5	56.8	55.9	54.6	51.9	50.6	49.3	47.9
3000	67.0	60.8	60.0	59.2	58.4	57.5	56.2	53.4	52.0	50.6	49.3
3200	69.0	62.6	61.7	60.9	60.1	59.1	57.8	54.9	53.5	52.1	50.6
3400	70.9	64.3	63.4	62.6	61.7	60.8	59.4	56.4	54.9	53.5	52.0
3600	72.8	66.0	65.1	64.2	63.3	62.3	60.9	57.8	56.3	54.8	53.3
3800	74.5	67.5	66.6	65.7	64.8	63.8	62.4	59.2	57.6	56.1	54.5
4000	76.2	69.1	68.1	67.2	66.3	65.2	63.8	60.5	58.9	57.3	55.7
4200	77.9	70.6	69.6	68.7	67.7	66.6	65.1	61.8	60.2	58.5	56.9
4400	79.5	72.0	71.0	70.1	69.1	68.0	66.5	63.1	61.4	59.7	58.1
4600	81.1	73.4	72.4	71.5	70.5	69.3	67.8	64.3	62.6	60.9	59.2
CLIMB LIMIT WT (1000 KG)	60.9	60.3	59.6	58.9	58.0	56.9	55.2	51.4	49.6	47.8	46.0

With engine bleed for packs off, increase field limit weight by 350 kg and climb limit weight by 1250 kg.
With engine anti-ice on, decrease field limit weight by 200 kg and climb limit weight by 250 kg.
With engine and wing anti-ice on (optional system), decrease field limit weight by 800 kg and climb limit weight by 1400 kg.

Takeoff Obstacle Limit Weight

Flaps 5

Sea Level, 30°C & Below, Zero Wind

Based on engine bleed for packs on and anti-ice off

Reference Obstacle Limit Weight (1000 KG)

OBSTACLE HEIGHT (M)	REFERENCE OBSTACLE LIMIT WEIGHT (1000 KG) DISTANCE FROM BRAKE RELEASE (100 M)													
	25	30	35	40	45	50	55	60	65	70	75	80	85	90
5	73.4	79.2	83.0											
20	67.2	72.8	77.1	80.3	82.5	84.1								
40	62.2	67.4	71.6	75.0	77.7	79.8	81.4	82.7	83.7	84.6	85.3			
60	58.4	63.4	67.6	70.9	73.7	76.0	77.9	79.5	80.8	81.8	82.7	83.4	84.1	84.7
80	55.1	60.1	64.2	67.6	70.5	72.8	74.9	76.6	78.0	79.2	80.3	81.2	82.0	82.7
100	52.4	57.3	61.4	64.8	67.6	70.1	72.2	74.0	75.5	76.9	78.1	79.1	80.0	80.8
120	49.9	54.8	58.9	62.3	65.1	67.6	69.8	71.7	73.3	74.7	76.0	77.1	78.1	78.9
140	47.7	52.6	56.6	60.0	62.9	65.4	67.6	69.5	71.2	72.7	74.0	75.2	76.3	77.2
160	45.7	50.6	54.6	58.0	60.9	63.4	65.6	67.6	69.3	70.9	72.2	73.5	74.6	75.6
180	43.9	48.7	52.7	56.1	59.0	61.6	63.8	65.8	67.6	69.2	70.6	71.8	73.0	74.0
200	42.3	47.0	51.0	54.4	57.3	59.9	62.1	64.1	65.9	67.5	69.0	70.3	71.5	72.6
220		45.4	49.4	52.8	55.7	58.3	60.6	62.6	64.4	66.0	67.5	68.9	70.1	71.2
240		44.0	47.9	51.3	54.2	56.8	59.1	61.1	63.0	64.6	66.1	67.5	68.7	69.9
260		42.6	46.5	49.9	52.8	55.4	57.7	59.8	61.6	63.3	64.8	66.2	67.4	68.6
280			45.2	48.6	51.5	54.1	56.4	58.4	60.3	62.0	63.5	64.9	66.2	67.4
300			44.0	47.3	50.2	52.8	55.1	57.2	59.1	60.8	62.3	63.7	65.0	66.2

Obstacle height must be calculated from lowest point of the runway to conservatively account for runway slope.

OAT Adjustments

OAT (°C)	REFERENCE OBSTACLE LIMIT WEIGHT (1000 KG)										
	40	45	50	55	60	65	70	75	80	85	90
30 & BELOW	0	0	0	0	0	0	0	0	0	0	0
32	-0.6	-0.7	-0.7	-0.8	-0.9	-1.0	-1.1	-1.2	-1.3	-1.3	-1.4
34	-1.1	-1.3	-1.5	-1.6	-1.8	-2.0	-2.2	-2.3	-2.5	-2.7	-2.8
36	-1.7	-2.0	-2.2	-2.5	-2.7	-3.0	-3.2	-3.5	-3.8	-4.0	-4.3
38	-2.3	-2.6	-2.9	-3.3	-3.6	-4.0	-4.3	-4.7	-5.0	-5.3	-5.7
40	-2.8	-3.3	-3.7	-4.1	-4.5	-5.0	-5.4	-5.8	-6.3	-6.7	-7.1
42	-3.4	-3.9	-4.4	-4.9	-5.4	-5.9	-6.4	-6.9	-7.5	-8.0	-8.5
44	-3.9	-4.5	-5.1	-5.7	-6.3	-6.9	-7.5	-8.1	-8.7	-9.2	-9.8
46	-4.5	-5.1	-5.8	-6.5	-7.2	-7.8	-8.5	-9.2	-9.9	-10.5	-11.2
48	-5.0	-5.7	-6.5	-7.3	-8.0	-8.8	-9.5	-10.3	-11.0	-11.8	-12.6
50	-5.5	-6.4	-7.2	-8.1	-8.9	-9.7	-10.6	-11.4	-12.2	-13.1	-13.9

Pressure Altitude Adjustments

ALT (FT)	OAT ADJUSTED OBSTACLE LIMIT WEIGHT (1000 KG)										
	40	45	50	55	60	65	70	75	80	85	90
S.L. & BELOW	0	0	0	0	0	0	0	0	0	0	0
1000	-1.5	-1.6	-1.8	-2.0	-2.1	-2.3	-2.5	-2.6	-2.8	-3.0	-3.1
2000	-2.9	-3.3	-3.6	-3.9	-4.3	-4.6	-4.9	-5.3	-5.6	-5.9	-6.3
3000	-4.3	-4.8	-5.3	-5.8	-6.3	-6.8	-7.3	-7.8	-8.3	-8.8	-9.3
4000	-5.6	-6.3	-7.0	-7.6	-8.3	-9.0	-9.6	-10.3	-11.0	-11.6	-12.3
5000	-6.9	-7.7	-8.6	-9.4	-10.2	-11.0	-11.9	-12.7	-13.5	-14.3	-15.2
6000	-8.2	-9.2	-10.2	-11.1	-12.1	-13.1	-14.1	-15.1	-16.1	-17.0	-18.0
7000	-9.3	-10.5	-11.7	-12.8	-14.0	-15.1	-16.3	-17.5	-18.6	-19.8	-20.9
8000	-10.5	-11.8	-13.2	-14.5	-15.9	-17.2	-18.5	-19.9	-21.2	-22.5	-23.9
9000	-11.6	-13.1	-14.6	-16.1	-17.6	-19.0	-20.5	-22.0	-23.5	-25.0	-26.5
10000	-12.8	-14.4	-16.0	-17.7	-19.3	-20.9	-22.5	-24.2	-25.8	-27.4	-29.0

Takeoff Obstacle Limit Weight
Flaps 5
Sea Level, 30°C & Below, Zero Wind
Wind Adjustments

WIND (KTS)	OAT & ALT ADJUSTED OBSTACLE LIMIT WEIGHT (1000 KG)										
	40	45	50	55	60	65	70	75	80	85	90
15 TW	-9.8	-9.5	-9.3	-9.0	-8.7	-8.5	-8.2	-7.9	-7.7	-7.4	-7.1
10 TW	-6.5	-6.4	-6.2	-6.0	-5.8	-5.6	-5.5	-5.3	-5.1	-4.9	-4.8
5 TW	-3.3	-3.2	-3.1	-3.0	-2.9	-2.8	-2.7	-2.6	-2.6	-2.5	-2.4
0	0	0	0	0	0	0	0	0	0	0	0
10 HW	1.2	1.1	1.0	0.9	0.9	0.8	0.7	0.6	0.6	0.5	0.4
20 HW	2.3	2.2	2.0	1.9	1.7	1.6	1.4	1.3	1.1	1.0	0.8
30 HW	3.5	3.3	3.1	2.8	2.6	2.4	2.2	2.0	1.7	1.5	1.3
40 HW	4.7	4.4	4.1	3.8	3.5	3.2	2.9	2.6	2.3	2.0	1.7

With engine bleed for packs off, increase weight by 650 kg.
With engine anti-ice on, decrease weight by 250 kg.
With engine and wing anti-ice on (optional system), decrease weight by 1550 kg.

Performance Dispatch — Chapter PD
Enroute — Section 41

Long Range Cruise Maximum Operating Altitude
Max Cruise Thrust
ISA + 10°C and Below

WEIGHT (1000 KG)	OPTIMUM ALT (FT)	TAT (°C)	MARGIN TO INITIAL BUFFET 'G' (BANK ANGLE)				
			1.20 (33°)	1.25 (36°)	1.30 (39°)	1.40 (44°)	1.50 (48°)
85	30300	-5	32800*	32800*	32800*	32100	30700
80	31600	-8	34400*	34400*	34400*	33400	32000
75	33000	-11	35900*	35900*	35900*	34800	33400
70	34500	-15	37300*	37300*	37300*	36200	34900
65	36000	-18	38700*	38700*	38700*	37800	36400
60	37700	-18	40200*	40200*	40200*	39400	38100
55	39500	-18	41000	41000	41000	41000	39900
50	41000	-18	41000	41000	41000	41000	41000
45	41000	-18	41000	41000	41000	41000	41000
40	41000	-18	41000	41000	41000	41000	41000

ISA + 15°C

WEIGHT (1000 KG)	OPTIMUM ALT (FT)	TAT (°C)	MARGIN TO INITIAL BUFFET 'G' (BANK ANGLE)				
			1.20 (33°)	1.25 (36°)	1.30 (39°)	1.40 (44°)	1.50 (48°)
85	30300	0	30600*	30600*	30600*	30600*	30600*
80	31600	-3	32900*	32900*	32900*	32900*	32000
75	33000	-6	34800*	34800*	34800*	34800	33400
70	34500	-9	36300*	36300*	36300*	36200	34900
65	36000	-13	37800*	37800*	37800*	37800	36400
60	37700	-13	39200*	39200*	39200*	39200*	38100
55	39500	-13	40800*	40800*	40800*	40800*	39900
50	41000	-13	41000	41000	41000	41000	41000
45	41000	-13	41000	41000	41000	41000	41000
40	41000	-13	41000	41000	41000	41000	41000

ISA + 20°C

WEIGHT (1000 KG)	OPTIMUM ALT (FT)	TAT (°C)	MARGIN TO INITIAL BUFFET 'G' (BANK ANGLE)				
			1.20 (33°)	1.25 (36°)	1.30 (39°)	1.40 (44°)	1.50 (48°)
85	30300	6	27500*	27500*	27500*	27500*	27500*
80	31600	3	30000*	30000*	30000*	30000*	30000*
75	33000	0	32800*	32800*	32800*	32800*	32800*
70	34500	-3	34900*	34900*	34900*	34900*	34900
65	36000	-7	36500*	36500*	36500*	36500*	36400
60	37700	-7	38000*	38000*	38000*	38000*	38000*
55	39500	-7	39500*	39500*	39500*	39500*	39500*
50	41000	-7	41000	41000	41000	41000	41000
45	41000	-7	41000	41000	41000	41000	41000
40	41000	-7	41000	41000	41000	41000	41000

***Denotes altitude thrust limited in level flight, 100 fpm residual rate of climb.**

Long Range Cruise Trip Fuel and Time
Ground to Air Miles Conversion

AIR DISTANCE (NM)					GROUND DISTANCE (NM)	AIR DISTANCE (NM)				
HEADWIND COMPONENT (KTS)						TAILWIND COMPONENT (KTS)				
100	80	60	40	20		20	40	60	80	100
279	259	241	226	212	200	190	181	173	166	160
554	515	480	450	424	400	382	365	349	335	322
829	771	720	675	636	600	573	548	525	504	485
1103	1027	958	899	847	800	764	732	701	673	648
1376	1282	1197	1123	1059	1000	956	915	877	843	811
1649	1536	1435	1348	1270	1200	1147	1098	1053	1012	974
1921	1791	1673	1571	1482	1400	1339	1282	1229	1181	1138
2192	2044	1911	1795	1693	1600	1530	1465	1405	1351	1301
2463	2297	2148	2019	1904	1800	1721	1648	1581	1520	1465
2733	2550	2386	2242	2115	2000	1913	1832	1758	1690	1628
3003	2803	2622	2465	2326	2200	2105	2016	1934	1859	1791
3272	3054	2859	2688	2537	2400	2296	2200	2111	2029	1955
3540	3306	3095	2911	2748	2600	2488	2384	2287	2199	2119
3807	3556	3330	3133	2959	2800	2680	2568	2464	2369	2282
4074	3807	3566	3356	3169	3000	2871	2752	2641	2539	2446
4340	4057	3801	3578	3380	3200	3063	2935	2817	2709	2610
4606	4306	4036	3800	3590	3400	3255	3119	2994	2879	2774
4870	4555	4270	4021	3801	3600	3446	3303	3171	3049	2938
5134	4803	4504	4243	4011	3800	3638	3487	3347	3219	3102
5397	5051	4738	4464	4221	4000	3830	3671	3524	3389	3266
5659	5298	4971	4685	4431	4200	4021	3855	3701	3559	3430
5920	5544	5204	4906	4641	4400	4213	4038	3877	3729	3594
6181	5790	5437	5127	4851	4600	4404	4222	4054	3899	3758
6440	6035	5669	5347	5061	4800	4596	4406	4230	4069	3921
6699	6280	5901	5568	5271	5000	4787	4589	4406	4238	4085

Long Range Cruise Trip Fuel and Time

Reference Fuel and Time Required

AIR DIST (NM)	PRESSURE ALTITUDE (1000 FT)									
	29		31		33		35		37	
	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)
200	1.5	0:38	1.5	0:37	1.5	0:37	1.5	0:36	1.5	0:36
400	2.5	1:09	2.5	1:08	2.4	1:06	2.4	1:05	2.4	1:04
600	3.5	1:40	3.5	1:38	3.4	1:36	3.4	1:33	3.3	1:31
800	4.6	2:11	4.5	2:09	4.4	2:05	4.3	2:01	4.3	1:58
1000	5.7	2:42	5.5	2:39	5.4	2:34	5.3	2:29	5.2	2:25
1200	6.8	3:12	6.6	3:08	6.5	3:02	6.3	2:56	6.2	2:52
1400	7.9	3:42	7.7	3:37	7.5	3:30	7.3	3:23	7.2	3:19
1600	9.0	4:12	8.7	4:06	8.5	3:58	8.3	3:51	8.2	3:46
1800	10.1	4:42	9.8	4:35	9.6	4:26	9.3	4:18	9.1	4:13
2000	11.2	5:11	10.9	5:04	10.6	4:55	10.3	4:45	10.1	4:40
2200	12.3	5:40	12.0	5:32	11.7	5:22	11.4	5:12	11.2	5:07
2400	13.5	6:09	13.1	5:59	12.8	5:49	12.5	5:39	12.2	5:34
2600	14.7	6:38	14.3	6:27	13.9	6:17	13.5	6:06	13.3	6:00
2800	15.8	7:06	15.4	6:55	15.0	6:44	14.6	6:33	14.3	6:27
3000	17.0	7:35	16.5	7:23	16.1	7:11	15.6	7:00	15.4	6:54
3200	18.2	8:03	17.7	7:49	17.2	7:38	16.8	7:26	16.5	7:20
3400	19.4	8:30	18.9	8:16	18.4	8:05	17.9	7:53	17.6	7:47
3600	20.7	8:58	20.1	8:43	19.5	8:31	19.0	8:20	18.8	8:13
3800	21.9	9:26	21.3	9:10	20.7	8:58	20.2	8:46	19.9	8:39
4000	23.1	9:53	22.5	9:37	21.8	9:25	21.3	9:13	21.0	9:06
4200	24.4	10:20	23.7	10:03	23.0	9:51	22.5	9:39		
4400	25.7	10:47	25.0	10:30	24.3	10:18	23.7	10:05		
4600	27.0	11:14	26.2	10:56	25.5	10:44	24.9	10:32		
4800	28.3	11:41	27.5	11:23	26.7	11:10	26.2	10:58		
5000	29.5	12:08	28.7	11:49	27.9	11:37	27.4	11:24		

Fuel Required Adjustments (1000 KG)

REFERENCE FUEL REQUIRED (1000 KG)	LANDING WEIGHT (1000 KG)						
	40	45	50	55	60	65	70
2	-0.2	-0.1	0.0	0.1	0.2	0.4	0.5
4	-0.4	-0.2	0.0	0.2	0.5	0.8	1.2
6	-0.5	-0.3	0.0	0.3	0.8	1.4	2.0
8	-0.7	-0.4	0.0	0.5	1.1	2.0	3.0
10	-0.9	-0.5	0.0	0.6	1.5	2.6	4.0
12	-1.1	-0.5	0.0	0.7	1.8	3.3	5.2
14	-1.2	-0.6	0.0	0.8	2.2	4.1	6.5
16	-1.4	-0.7	0.0	1.0	2.6	4.9	7.9
18	-1.6	-0.8	0.0	1.1	3.1	5.9	9.5
20	-1.8	-0.9	0.0	1.3	3.5	6.8	11.1
22	-2.0	-1.0	0.0	1.4	4.0	7.9	12.9
24	-2.2	-1.1	0.0	1.6	4.5	9.0	14.8
26	-2.4	-1.2	0.0	1.7	5.1	10.1	16.8
28	-2.6	-1.3	0.0	1.9	5.7	11.3	18.9
30	-2.8	-1.4	0.0	2.0	6.3	12.6	21.2
32	-3.0	-1.5	0.0	2.2	6.9	14.0	23.5

Based on 280/.78 climb, Long Range Cruise and .78/280/250 descent.

Long Range Cruise Step Climb
Ground to Air Miles Conversion

AIR DISTANCE (NM)					GROUND DISTANCE (NM)	AIR DISTANCE (NM)				
HEADWIND COMPONENT (KTS)						TAILWIND COMPONENT (KTS)				
100	80	60	40	20		20	40	60	80	100
1316	1237	1168	1106	1050	1000	954	912	874	839	807
1830	1724	1630	1545	1469	1400	1337	1280	1227	1179	1134
2343	2210	2091	1984	1888	1800	1720	1647	1580	1518	1461
2856	2695	2552	2423	2306	2200	2103	2015	1933	1858	1789
3369	3181	3013	2861	2724	2600	2486	2382	2287	2198	2117
3882	3666	3474	3300	3143	3000	2870	2750	2640	2539	2445
4395	4152	3934	3738	3561	3400	3253	3118	2993	2879	2772
4907	4637	4395	4177	3980	3800	3636	3485	3347	3219	3100
5420	5123	4856	4616	4398	4200	4019	3853	3700	3559	3428
5933	5608	5317	5054	4816	4600	4402	4221	4054	3899	3756
6447	6094	5778	5493	5235	5000	4785	4588	4407	4239	4084

Trip Fuel and Time Required

AIR DIST (NM)	TRIP FUEL (1000 KG)							TIME (HRS:MIN)
	LANDING WEIGHT (1000 KG)							
	40	45	50	55	60	65	70	
1000	4.5	4.8	5.2	5.6	5.9	6.4	6.7	2:24
1400	6.2	6.5	7.1	7.7	8.2	8.8	9.2	3:17
1800	7.8	8.3	9.1	9.8	10.5	11.2	11.9	4:10
2200	9.5	10.2	11.1	12.0	12.8	13.7	14.6	5:03
2600	11.3	12.1	13.2	14.2	15.3	16.3	17.4	5:56
3000	13.0	14.1	15.3	16.6	17.8	19.0	20.2	6:49
3400	14.9	16.1	17.5	19.0	20.3	21.8	23.2	7:42
3800	16.8	18.2	19.8	21.4	23.0	24.6	26.2	8:34
4200	18.8	20.4	22.2	24.0	25.7	27.6		9:27
4600	20.8	22.6	24.6	26.6	28.6	30.6		10:20
5000	22.9	24.9	27.0	29.3	31.5	33.7		11:13

Based on 280/.78 climb, Long Range Cruise or .78 and .78/280/250 descent.
Valid for all pressure altitudes with 4000 ft step climb to 2000 ft above optimum altitude.

Short Trip Fuel and Time

Ground to Air Miles Conversion

AIR DISTANCE (NM)					GROUND DISTANCE (NM)	AIR DISTANCE (NM)				
HEADWIND COMPONENT (KTS)						TAILWIND COMPONENT (KTS)				
100	80	60	40	20		20	40	60	80	100
93	80	69	61	55	50	46	42	39	36	34
160	143	129	118	108	100	93	87	82	77	73
225	205	188	173	161	150	141	132	125	118	112
290	266	246	228	213	200	188	178	169	160	153
353	326	303	283	265	250	236	224	213	203	194
416	386	360	338	318	300	284	270	257	245	235
478	446	417	392	370	350	332	316	301	288	276
542	506	474	447	422	400	380	362	346	331	317
606	567	532	502	474	450	428	408	390	373	358
672	629	591	557	527	500	476	454	434	415	398

Trip Fuel and Time Required

AIR DIST (NM)		LANDING WEIGHT (1000 KG)							TIME (HRS:MIN)
		40	45	50	55	60	65	70	
50	FUEL (1000 KG)	0.5	0.5	0.6	0.6	0.7	0.7	0.7	0:14
	ALT (FT)	12000	12000	11000	11000	9000	9000	8000	
100	FUEL (1000 KG)	0.8	0.9	0.9	1.0	1.0	1.1	1.1	0:22
	ALT (FT)	19000	18000	18000	18000	17000	17000	17000	
150	FUEL (1000 KG)	1.1	1.1	1.2	1.3	1.3	1.4	1.5	0:30
	ALT (FT)	26000	25000	25000	24000	23000	22000	22000	
200	FUEL (1000 KG)	1.3	1.4	1.5	1.6	1.6	1.7	1.8	0:37
	ALT (FT)	35000	30000	28000	27000	26000	26000	26000	
250	FUEL (1000 KG)	1.5	1.6	1.7	1.8	1.9	2.0	2.1	0:44
	ALT (FT)	40000	37000	36000	35000	34000	31000	30000	
300	FUEL (1000 KG)	1.7	1.8	1.9	2.1	2.2	2.3	2.4	0:50
	ALT (FT)	41000	40000	39000	37000	35000	34000	32000	
350	FUEL (1000 KG)	1.9	2.0	2.2	2.3	2.4	2.6	2.7	0:56
	ALT (FT)	41000	40000	40000	38000	36000	35000	33000	
400	FUEL (1000 KG)	2.1	2.2	2.4	2.5	2.7	2.9	3.0	1:03
	ALT (FT)	41000	40000	40000	38000	36000	35000	33000	
450	FUEL (1000 KG)	2.3	2.5	2.6	2.8	3.0	3.1	3.3	1:10
	ALT (FT)	41000	41000	40000	38000	36000	35000	34000	
500	FUEL (1000 KG)	2.5	2.7	2.8	3.0	3.2	3.4	3.6	1:17
	ALT (FT)	41000	41000	40000	38000	36000	35000	34000	

Based on 280/.78 climb, Long Range Cruise and .78/280/250 descent.

Holding Planning
Flaps Up

WEIGHT (1000 KG)	TOTAL FUEL FLOW (KG/HR)								
	PRESSURE ALTITUDE (FT)								
	1500	5000	10000	15000	20000	25000	30000	35000	41000
85	3080	3030	3020	2990	2970	2980	3080		
80	2910	2870	2840	2830	2780	2790	2860	3130	
75	2750	2700	2670	2650	2600	2600	2660	2800	
70	2590	2540	2500	2480	2430	2420	2470	2550	
65	2420	2370	2340	2310	2270	2230	2280	2330	
60	2260	2210	2180	2140	2110	2050	2090	2130	
55	2100	2050	2010	1980	1940	1890	1910	1940	2110
50	1950	1890	1850	1810	1780	1730	1750	1770	1890
45	1790	1730	1690	1680	1640	1610	1590	1590	1670
40	1670	1620	1560	1520	1480	1450	1440	1420	1480

This table includes 5% additional fuel for holding in a racetrack pattern.

Flight Crew Requirements for Chemical Passenger Oxygen System

Required Pressure (PSI) for 76 Cu. Ft. Cylinder

BOTTLE TEMPERATURE		NUMBER OF CREW USING OXYGEN		
°C	°F	2	3	4
50	122	735	1055	1360
45	113	725	1040	1340
40	104	715	1020	1320
35	95	700	1005	1300
30	86	690	990	1280
25	77	680	975	1255
20	68	670	960	1240
15	59	655	940	1215
10	50	645	925	1195
5	41	635	910	1175
0	32	620	890	1150
-5	23	610	875	1130
-10	14	600	860	1110

Required Pressure (PSI) for 114/115 Cubic Ft. Cylinder

BOTTLE TEMPERATURE		NUMBER OF CREW USING OXYGEN		
°C	°F	2	3	4
50	122	530	735	945
45	113	520	725	930
40	104	510	715	915
35	95	505	700	900
30	86	495	690	885
25	77	485	680	870
20	68	480	670	860
15	59	470	655	840
10	50	460	645	830
5	41	455	635	815
0	32	445	620	800
-5	23	440	610	785
-10	14	430	600	770

Flight Crew and Supernumerary Requirements for Freighter Oxygen System

Table 1
Crew and Supernumerary Oxygen

NUMBER OF CREW AND SUPERNUMERARIES	LITERS OF UNDILUTED (100%) OXYGEN TIME (MINUTES)				
	30	60	90	120	180
2	1210	1740	2100	2450	3150
3	1560	2350	2880	3410	4470
4	1900	2960	3660	4370	5780
5	2240	3560	4440	5330	7090
6	2580	4170	5230	6280	8400
7	2920	4770	6010	7240	9710
8	3260	5380	6790	8200	11030

For more extensive than normal crew usage, add 2.05 liters/person/minute for each crew member at 8000 ft cabin altitude when regulator setting is NORMAL; or 13 liters/person/minute when regulator setting is 100%.

Table 2
Volume to Pressure Conversion for Two 115 Cubic Ft. Cylinders

OXYGEN VOLUME (1000 LITERS)	CYLINDER PRESSURE AT 21°C (PSI)
0.3	200
0.7	300
1.0	400
1.4	500
1.7	600
2.1	700
2.4	800
2.8	900
3.1	1000
3.5	1100
3.8	1200
4.2	1300
4.5	1400
4.9	1500
5.2	1600
5.5	1700
5.9	1800
6.2	1900
6.6	2000

Check maximum pressure in shaded area. Maximum cylinder pressure = 1850 PSI at 21°C. For maximum cylinder pressure at hotter or colder temperatures, add or subtract 32 PSI per 5°C, respectively.

Table 3
Temperature Corrections

CYLINDER PRESSURE AT 21°C (PSI)	PRESSURE CORRECTION FOR EACH 5°C ABOVE/BELOW 21°C (PSI)
400	+7/-7
600	+11/-11
800	+14/-14
1000	+17/-17
1200	+21/-21
1400	+24/-24
1600	+28/-28
1800	+31/-31
2000	+34/-34

ENGINE INOP

MAX CONTINUOUS THRUST

Net Level Off Weight

PRESSURE ALTITUDE (1000 FT)	LEVEL OFF WEIGHT (1000 KG)		
	ISA + 10°C & BELOW	ISA + 15°C	ISA + 20°C
30	43.0	41.7	
28	46.5	45.0	43.5
26	50.3	48.6	47.1
24	54.5	52.7	51.0
22	59.3	57.2	55.2
20	64.5	62.1	59.8
18	69.3	66.8	64.0
16	74.0	71.4	68.5
14	78.3	75.9	73.3
12	83.0	80.1	77.0

Anti-Ice Adjustments

ANTI-ICE CONFIGURATION	LEVEL OFF WEIGHT ADJUSTMENT (1000 KG)								
	PRESSURE ALTITUDE (1000 FT)								
	12	14	16	18	20	22	24	26	28
ENGINE ONLY	-1.9	-1.8	-1.7	-1.7	-1.6	-1.5	-1.4	-1.2	-1.1
ENGINE AND WING	-7.5	-6.9	-6.6	-6.5	-6.3	-5.8	-5.2	-4.8	

Intentionally
Blank

Performance Dispatch — Chapter PD
Landing — Section 42

Landing Field Limit Weight - Dry Runway
Flaps 40

Based on anti-skid operative and automatic speedbrakes

Wind Corrected Field Length (M)

FIELD LENGTH AVAILABLE (M)	WIND COMPONENT (KTS)							
	-15	-10	-5	0	10	20	30	40
1200			1090	1200	1270	1350	1420	1500
1400	1060	1160	1270	1400	1480	1560	1640	1720
1600	1240	1340	1460	1600	1680	1770	1850	1940
1800	1420	1520	1650	1800	1890	1980	2070	2170
2000	1600	1710	1840	2000	2090	2190	2290	2390
2200	1770	1890	2030	2200	2300	2400	2500	2610
2400	1950	2070	2220	2400	2500	2610	2720	2830
2600	2110	2250	2380	2600	2710	2820	2930	3050
2800	2210	2350	2530	2800	2910	3030	3150	3280
3000	2300	2450	2680	3000	3120	3240	3360	3500
3200	2390	2540	2840	3200	3320	3450	3580	
3400	2480	2630	2990	3400	3530			
3600	2570	2730	3140	3600				
3800	2660	2820	3290					
4000	2750	2910	3450					
4200	2850	3000	3600					
4400	2940	3100						
4600	3030	3190						
4800	3120	3280						
5000	3210	3380						

Field Limit Weight (1000 KG)

WIND CORR'D FIELD LENGTH (M)	AIRPORT PRESSURE ALTITUDE (FT)					
	0	2000	4000	6000	8000	10000
1200	46.2	43.6	41.1	38.7		
1400	56.0	53.2	50.2	47.3	44.5	41.8
1600	64.0	61.1	58.3	55.6	52.7	49.5
1800	72.7	69.0	65.5	62.5	59.5	56.7
2000	81.8	77.5	73.5	69.7	66.0	62.8
2200		85.6	81.6	77.3	73.2	69.2
2400			88.1	84.8	80.4	75.9
2600					85.9	81.9
2800						85.3

Decrease field limit weight by 4350 kg when using manual speedbrakes.

Landing Field Limit Weight - Dry Runway

Flaps 40

Based on anti-skid inoperative and manual speedbrakes

Wind Corrected Field Length (M)

FIELD LENGTH AVAILABLE (M)	WIND COMPONENT (KTS)							
	-15	-10	-5	0	10	20	30	40
1200				1200	1350	1470	1650	1770
1400			1170	1400	1560	1680	1860	1990
1600		1130	1370	1600	1760	1890	2070	2210
1800	1080	1320	1560	1800	1960	2100	2290	2430
2000	1260	1500	1750	2000	2170	2310	2500	2650
2200	1440	1690	1950	2200	2370	2520	2710	2870
2400	1620	1880	2140	2400	2570	2730	2920	3090
2600	1800	2060	2330	2600	2780	2940	3130	3310
2800	1980	2250	2520	2800	2980	3150	3340	3530
3000	2160	2440	2720	3000	3180	3360	3550	3750
3200	2340	2620	2910	3200	3390	3580	3760	3970
3400	2520	2810	3100	3400	3590	3790	3970	4190
3600	2700	3000	3300	3600	3790	4000	4180	4410
3800	2890	3180	3490	3800	4000	4210	4400	4630
4000	3070	3370	3680	4000	4200	4420	4610	4850
4200	3250	3560	3870	4200	4400	4630	4820	5070
4400	3430	3750	4070	4400	4610	4840	5030	5290
4600	3610	3930	4260	4600	4810	5050	5240	5510
4800	3790	4120	4450	4800	5020	5260	5450	5730
5000	3970	4310	4650	5000	5220	5470	5660	5950

Field Limit Weight (1000 KG)

WIND CORR'D FIELD LENGTH (M)	AIRPORT PRESSURE ALTITUDE (FT)					
	0	2000	4000	6000	8000	10000
2200	41.8	39.1				
2400	46.6	43.7	40.3			
2600	51.4	48.2	44.7	41.8	39.1	
2800	56.2	52.8	49.0	45.9	43.0	40.0
3000	60.9	57.3	53.3	50.0	46.8	43.7
3200	65.8	61.8	57.6	54.1	50.7	47.4
3400	71.2	66.5	61.9	58.2	54.6	51.1
3600	76.6	71.6	66.3	62.3	58.4	54.7
3800	82.2	76.8	71.2	66.5	62.3	58.4
4000	87.8	82.1	76.1	71.1	66.2	62.0
4200		87.4	81.1	75.7	70.6	65.7
4400			86.1	80.4	74.9	69.8
4600				85.1	79.4	73.9
4800					83.8	77.9
5000						82.0
5200						86.0

Landing Field Limit Weight - Wet Runway

Flaps 40

Based on anti-skid operative and automatic speedbrakes

Wind Corrected Field Length (M)

FIELD LENGTH AVAILABLE (M)	WIND COMPONENT (KTS)							
	-15	-10	-5	0	10	20	30	40
1200				1200	1280	1360	1440	1530
1400			1270	1400	1480	1570	1660	1750
1600	1220	1330	1460	1600	1690	1780	1870	1970
1800	1390	1510	1640	1800	1890	1990	2090	2190
2000	1570	1690	1830	2000	2100	2200	2300	2410
2200	1750	1870	2020	2200	2300	2410	2520	2630
2400	1920	2050	2210	2400	2510	2620	2740	2860
2600	2100	2230	2400	2600	2710	2830	2950	3080
2800	2280	2420	2590	2800	2920	3040	3170	3300
3000	2440	2600	2740	3000	3120	3250	3380	3520
3200	2530	2700	2900	3200	3330	3460	3600	
3400	2620	2790	3050	3400	3530			
3600	2710	2880	3200					
3800	2800	2980	3350					
4000	2890	3070	3510					
4200	2980	3160						
4400	3080	3250						
4600	3170	3350						
4800	3260	3440						
5000	3350							

Field Limit Weight (1000 KG)

WIND CORR'D FIELD LENGTH (M)	AIRPORT PRESSURE ALTITUDE (FT)					
	0	2000	4000	6000	8000	10000
1200	38.4					
1400	47.1	44.5	41.9	39.5		
1600	55.6	52.8	49.8	46.9	44.1	41.5
1800	62.6	59.8	57.1	54.4	51.2	48.2
2000	70.0	66.5	63.3	60.4	57.6	54.8
2200	77.8	73.8	70.0	66.4	63.2	60.1
2400	85.3	81.3	77.0	73.0	69.1	65.4
2600		87.5	84.0	79.6	75.4	71.3
2800				85.7	81.6	77.1
3000					86.0	82.1
3200						85.0
3400						88.0

Decrease field limit weight by 4350 kg when using manual speedbrakes.

Landing Field Limit Weight - Wet Runway

Flaps 40

Based on anti-skid inoperative and manual speedbrakes

Wind Corrected Field Length (M)

FIELD LENGTH AVAILABLE (M)	WIND COMPONENT (KTS)							
	-15	-10	-5	0	10	20	30	40
1200				1200	1370	1500	1710	1840
1400				1400	1580	1710	1920	2060
1600			1340	1600	1780	1920	2130	2280
1800		1260	1530	1800	1980	2130	2340	2500
2000	1180	1450	1730	2000	2190	2340	2550	2720
2200	1360	1640	1920	2200	2390	2550	2760	2940
2400	1540	1820	2110	2400	2590	2760	2980	3160
2600	1720	2010	2310	2600	2800	2970	3190	3380
2800	1900	2200	2500	2800	3000	3180	3400	3600
3000	2080	2380	2690	3000	3200	3390	3610	3820
3200	2260	2570	2880	3200	3410	3610	3820	4040
3400	2440	2760	3080	3400	3610	3820	4030	4260
3600	2620	2940	3270	3600	3810	4030	4240	4480
3800	2800	3130	3460	3800	4020	4240	4450	4700
4000	2980	3320	3660	4000	4220	4450	4660	4920
4200	3160	3500	3850	4200	4420	4660	4880	5140
4400	3350	3690	4040	4400	4630	4870	5090	5360
4600	3530	3880	4230	4600	4830	5080	5300	5580
4800	3710	4060	4430	4800	5040	5290	5510	5800
5000	3890	4250	4620	5000	5240	5500	5720	6020

Field Limit Weight (1000 KG)

WIND CORR'D FIELD LENGTH (M)	AIRPORT PRESSURE ALTITUDE (FT)					
	0	2000	4000	6000	8000	10000
2400	39.0					
2600	43.2	40.5				
2800	47.4	44.5	41.1	38.4		
3000	51.6	48.4	44.9	42.0	39.2	
3200	55.7	52.4	48.6	45.6	42.6	39.7
3400	59.9	56.3	52.4	49.2	46.0	42.9
3600	64.1	60.3	56.2	52.7	49.4	46.1
3800	68.6	64.2	59.9	56.3	52.7	49.3
4000	73.3	68.5	63.6	59.8	56.1	52.5
4200	78.1	73.0	67.6	63.3	59.4	55.7
4400	82.9	77.5	71.9	67.0	62.8	58.8
4600	87.8	82.1	76.1	71.1	66.2	62.0
4800		86.7	80.5	75.1	70.0	65.2
5000			84.8	79.2	73.8	68.7
5200				83.3	77.6	72.3
5400				87.4	81.5	75.8
5600					85.4	79.3
5800						82.8
6000						86.4

Landing Climb Limit Weight

Valid for approach with Flaps 15 and landing with Flaps 40

Based on engine bleed for packs on and anti-ice off

AIRPORT OAT		LANDING CLIMB LIMIT WEIGHT (1000 KG)					
		AIRPORT PRESSURE ALTITUDE (FT)					
°C	°F	0	2000	4000	6000	8000	10000
50	122	66.4	61.4				
48	118	67.8	62.9				
46	115	69.0	64.4	59.4			
44	111	70.2	65.6	60.8			
42	108	71.5	66.8	62.2	57.1		
40	104	72.7	68.0	63.4	58.4		
38	100	74.0	69.1	64.5	59.7	54.4	
36	97	75.3	70.4	65.7	60.8	55.3	
34	93	76.7	71.7	66.9	61.9	56.3	51.5
32	90	78.1	72.9	68.0	62.9	57.3	52.7
30	86	79.4	74.0	68.8	63.8	58.3	53.7
28	82	79.5	75.0	69.6	64.6	59.2	54.5
26	79	79.5	75.9	70.3	65.2	60.1	55.5
24	75	79.6	75.9	70.9	65.7	60.9	56.0
22	72	79.7	76.0	71.4	66.1	61.3	56.6
20	68	79.7	76.0	71.4	66.7	61.7	57.1
18	64	79.8	76.1	71.5	67.1	62.1	57.3
16	61	79.9	76.1	71.5	67.1	62.5	57.8
14	57	79.9	76.2	71.6	67.2	62.9	58.1
12	54	80.0	76.2	71.6	67.2	62.9	58.4
10	50	80.0	76.3	71.6	67.2	62.9	58.8
-40	-40	80.6	76.8	72.1	67.7	63.3	59.3

With engine bleeds for packs off, increase weight by 1200 kg.
With engine anti-ice on, decrease weight by 300 kg.
With engine and wing anti-ice on, decrease weight by 1400 kg.
When operating in icing conditions during any part of the flight with forecast landing temperature below 10°C, decrease weight by 5500 kg.

ENGINE INOP

ADVISORY INFORMATION

Go-Around Climb Gradient
Flaps 15
Based on engine bleed for packs on and anti-ice off

OAT (°C)	REFERENCE GO-AROUND GRADIENT (%)					
	PRESSURE ALTITUDE (FT)					
	0	2000	4000	6000	8000	10000
54	2.54					
50	3.21	2.15				
46	3.72	2.80	1.75			
42	4.23	3.27	2.35	1.29		
38	4.75	3.74	2.79	1.82	0.73	
34	5.27	4.25	3.26	2.25	1.11	0.19
30	5.82	4.71	3.65	2.62	1.52	0.60
26	5.85	5.07	3.94	2.90	1.87	0.94
22	5.88	5.09	4.16	3.09	2.11	1.16
18	5.90	5.11	4.17	3.27	2.27	1.33
14	5.92	5.12	4.18	3.28	2.41	1.47
10	5.95	5.14	4.20	3.29	2.42	1.61
6	5.97	5.16	4.21	3.30	2.44	1.62
2	5.99	5.17	4.22	3.31	2.45	1.63

Gradient Adjustment for Weight (%)

WEIGHT (1000 KG)	REFERENCE GO-AROUND GRADIENT (%)						
	0	1	2	3	4	5	6
80	-2.44	-2.78	-3.08	-3.35	-3.62	-3.88	-4.15
75	-1.98	-2.23	-2.47	-2.68	-2.90	-3.11	-3.32
70	-1.42	-1.60	-1.76	-1.92	-2.07	-2.23	-2.38
65	-0.76	-0.86	-0.95	-1.03	-1.12	-1.20	-1.28
60	0	0	0	0	0	0	0
55	0.90	1.00	1.10	1.21	1.31	1.41	1.52
50	2.01	2.23	2.45	2.67	2.90	3.13	3.37

Gradient Adjustment for Speed (%)

SPEED (KIAS)	WEIGHT ADJUSTED GO-AROUND GRADIENT (%)												
	0	1	2	3	4	5	6	7	8	9	10	11	12
VREF40	-0.25	-0.27	-0.29	-0.30	-0.31	-0.31	-0.30	-0.30	-0.30	-0.30	-0.29	-0.29	-0.27
VREF40+5	0	0	0	0	0	0	0	0	0	0	0	0	0
VREF40+10	0.15	0.14	0.14	0.14	0.13	0.12	0.12	0.12	0.12	0.13	0.13	0.13	0.11
VREF40+15	0.22	0.21	0.20	0.20	0.18	0.16	0.14	0.13	0.14	0.15	0.16	0.16	0.14
VREF40+20	0.24	0.22	0.21	0.19	0.17	0.13	0.10	0.09	0.09	0.10	0.11	0.09	0.05
VREF40+25	0.20	0.17	0.14	0.12	0.08	0.04	-0.01	-0.04	-0.04	-0.03	-0.03	-0.05	-0.11
VREF40+30	0.12	0.07	0.03	-0.02	-0.08	-0.14	-0.19	-0.22	-0.23	-0.23	-0.23	-0.25	-0.31

With engine bleed for packs off, increase gradient by 0.2%.
With engine anti-ice on, decrease gradient by 0.1%.
With engine and wing anti-ice on, decrease gradient by 0.3%.
When operating in icing conditions during any part of the flight with forecast landing temperatures below 10°C decrease gradient by 0.6%.

Quick Turnaround Limit Weight - Category C Steel Brakes

Flaps 40

AIRPORT OAT (°C)	LIMIT WEIGHT (1000 KG)					
	AIRPORT PRESSURE ALTITUDE (FT)					
	0	2000	4000	6000	8000	10000
54	79.6					
50	80.2	77.2				
45	80.9	77.8	74.8			
40	81.6	78.5	75.4	72.4		
35	82.3	79.2	76.1	73.1	70.1	
30	83.0	79.9	76.7	73.7	70.8	67.9
25	83.8	80.6	77.4	74.4	71.4	68.5
20	84.6	81.3	78.1	75.1	72.1	69.1
15	85.4	82.1	78.9	75.8	72.7	69.8
10	86.1	82.9	79.6	76.5	73.4	70.4
5	86.1	83.7	80.4	77.2	74.1	71.1
0	86.1	84.5	81.2	78.0	74.9	71.8
-5	86.1	85.4	82.0	78.8	75.6	72.5
-10	86.1	86.1	82.8	79.6	76.4	73.3
-15	86.1	86.1	83.7	80.4	77.2	74.0
-20	86.1	86.1	84.6	81.2	78.0	74.8
-30	86.1	86.1	86.1	83.0	79.7	76.4
-40	86.1	86.1	86.1	84.9	81.5	78.1
-50	86.1	86.1	86.1	86.1	83.4	79.9
-54	86.1	86.1	86.1	86.1	84.1	80.7

**Increase weight by 700 kg per 1% uphill slope. Decrease weight by 1200 kg per 1% downhill slope.
Increase weight by 1850 kg per 10 knots headwind. Decrease weight by 7750 kg per 10 knots tailwind.
After landing at weights exceeding those shown above, adjusted for slope and wind, wait at least 67 minutes and check that wheel thermal plugs have not melted before executing a subsequent takeoff.**

As an alternate procedure, ensure that each brake pressure plate surface temperature, without artificial cooling, is less than 218°C as follows: No sooner than 10 and no later than 15 minutes after parking, measure each brake pressure plate surface temperature at a minimum of two points per brake by an accurate method (using a Doric Microtemp 450 hand held thermometer or equivalent, hold temperature probe in place for 20 seconds or until reading stabilizes). If each measured temperature is less than 218°C, immediate dispatch is allowed; otherwise the required minimum ground wait period of 67 minutes applies.

If a Brake Temperature Monitoring System (BTMS) is installed:

**No sooner than 10 and no later than 15 minutes after parking, check the BRAKE TEMP light. If the BRAKE TEMP light is not on, no ground waiting period is required. If the BRAKE TEMP light is on, do not dispatch until at least 67 minutes after landing, or until all the BTMS readings on the systems Display are below 3.5 and the BRAKE TEMP light is off. Check that wheel thermal plugs have not melted before making a subsequent takeoff.
Note: If any brake temperature display digit is blank or indicates 0.0 or 0.1, then this method cannot be used.**

Quick Turnaround Limit Weight - Category N Carbon Brakes

Flaps 40

OAT		LIMIT WEIGHT (1000 KG)					
		AIRPORT PRESSURE ALTITUDE (FT)					
°C	°F	0	2000	4000	6000	8000	10000
54	129	73.5					
50	122	74.0	71.2				
45	113	74.6	71.8	69.0			
40	104	75.2	72.4	69.6	66.9		
35	95	75.9	73.0	70.2	67.4	64.8	
30	86	76.6	73.7	70.8	68.0	65.3	62.8
25	77	77.3	74.3	71.4	68.6	65.9	63.3
20	68	78.0	75.0	72.1	69.3	66.5	63.9
15	59	78.7	75.7	72.8	69.9	67.1	64.4
10	50	79.4	76.4	73.5	70.6	67.8	65.0
5	41	80.2	77.2	74.2	71.3	68.4	65.6
0	32	81.0	77.9	74.9	72.0	69.1	66.3
-5	23	81.8	78.7	75.6	72.7	69.8	66.9
-10	14	82.6	79.5	76.4	73.4	70.5	67.6
-15	5	83.4	80.3	77.2	74.2	71.2	68.3
-20	-4	84.3	81.1	78.0	74.9	71.9	69.0
-30	-22	86.1	82.9	79.7	76.6	73.5	70.5
-40	-40	86.1	84.7	81.5	78.3	75.2	72.1
-50	-58	86.1	86.1	83.4	80.1	77.0	73.8
-54	-65	86.1	86.1	84.1	80.9	77.7	74.5

**Increase weight by 650 kg per 1% uphill slope. Decrease weight by 1200 kg per 1% downhill slope.
Increase weight by 1550 kg per 10 knots headwind. Decrease weight by 8350 kg per 10 knots tailwind.
After landing at weights exceeding those shown above, adjusted for slope and wind, wait at least 48 minutes and check that wheel thermal plugs have not melted before executing a takeoff.**

If a Brake Temperature Monitoring System (BTMS) is installed:

**No sooner than 10 and no later than 15 minutes after parking, check the BRAKE TEMP light. If the BRAKE TEMP light is not on, no ground waiting period is required. If the BRAKE TEMP light is on, do not dispatch until at least 48 minutes after landing, or until all the BTMS readings on the systems Display are below 3.0 and the BRAKE TEMP light is off. Check that wheel thermal plugs have not melted before making a subsequent takeoff.
Note: If any brake temperature display digit is blank or indicates 0.0 or 0.1, then this method cannot be used.**

GEAR DOWN

Takeoff Climb Limit Weight
Flaps 5
Based on engine bleed for packs on and anti-ice off

AIRPORT OAT		TAKEOFF CLIMB WEIGHT (1000 KG)					
		AIRPORT PRESSURE ALTITUDE (FT)					
°C	°F	0	2000	4000	6000	8000	10000
54	129	59.3	55.7	52.1	48.4	44.1	
52	126	60.4	56.3	53.0	49.2	44.9	
50	122	61.5	56.6	53.1	50.0	45.7	41.3
48	118	62.6	57.9	53.1	49.9	46.4	42.1
46	115	63.8	59.2	53.4	49.9	46.5	42.9
44	111	64.9	60.5	54.7	49.9	46.5	43.7
42	108	66.0	61.7	56.0	50.2	46.5	43.8
40	104	67.2	62.8	57.2	51.5	46.5	43.8
38	100	68.3	63.8	58.4	52.7	46.8	43.7
36	97	69.5	64.9	59.6	53.9	48.0	43.7
34	93	70.7	66.1	60.8	55.1	49.2	44.1
32	90	72.0	67.2	62.0	56.3	50.4	45.3
30	86	73.2	68.2	63.2	57.4	51.6	46.4
28	82	73.3	69.1	64.1	58.6	52.8	47.6
26	79	73.3	69.8	64.7	59.8	54.0	48.8
24	75	73.4	69.9	65.2	60.5	55.2	50.0
22	72	73.4	69.9	65.7	60.9	56.4	51.2
20	68	73.5	70.0	65.7	61.3	56.8	52.3
18	64	73.6	70.0	65.8	61.7	57.2	52.9
16	61	73.6	70.1	65.8	61.7	57.5	53.2
14	57	73.7	70.1	65.8	61.7	57.8	53.5
12	54	73.7	70.1	65.9	61.8	57.9	53.8
10	50	73.8	70.2	65.9	61.8	57.9	54.1

With engine bleeds for packs off, increase weight by 300 kg.
With engine anti-ice on, decrease weight by 250 kg.
With engine and wing anti-ice on, decrease weight by 1600 kg (optional system).

GEAR DOWN

Landing Climb Limit Weight

Valid for approach with Flaps 15 and landing with Flaps 30 or 40

Based on engine bleed for packs on and anti-ice off

AIRPORT OAT		LANDING CLIMB LIMIT WEIGHT (1000 KG)						
		AIRPORT PRESSURE ALTITUDE (FT)						
°C	°F	-2000	0	2000	4000	6000	8000	10000
54	129	58.8	55.4					
52	126	59.9	56.8					
50	122	60.9	58.3	53.8				
48	118	62.1	59.4	55.2				
46	115	63.3	60.5	56.5	52.1			
44	111	64.4	61.5	57.5	53.3			
42	108	65.5	62.6	58.5	54.6	50.1		
40	104	66.6	63.7	59.5	55.6	51.2		
38	100	67.7	64.8	60.6	56.5	52.3	47.7	
36	97	68.8	65.9	61.6	57.5	53.3	48.5	
34	93	69.8	67.0	62.7	58.6	54.2	49.3	45.3
32	90	70.0	68.3	63.8	59.5	55.0	50.3	46.2
30	86	70.0	69.4	64.7	60.2	55.8	51.1	47.1
28	82	70.1	69.5	65.5	60.9	56.6	51.9	47.8
26	79	70.2	69.6	66.3	61.5	57.0	52.6	48.6
24	75	70.2	69.6	66.3	62.0	57.4	53.3	49.1
22	72	70.3	69.7	66.4	62.4	57.9	53.7	49.5
20	68	70.4	69.7	66.4	62.4	58.3	54.0	49.9
18	64	70.4	69.8	66.5	62.5	58.6	54.3	50.2
16	61	70.5	69.8	66.5	62.5	58.7	54.7	50.6
14	57	70.5	69.9	66.5	62.5	58.7	55.0	50.9
12	54	70.6	69.9	66.6	62.6	58.7	55.0	51.2
10	50	70.7	70.0	66.6	62.6	58.7	55.0	51.4
-40	-40	71.2	70.5	67.1	63.1	59.1	55.4	51.9

With engine bleed for packs off, increase weight by 1150 kg.
With engine anti-ice on, decrease weight by 200 kg.
With engine and wing anti-ice on, decrease weight by 1200 kg.
When operating in icing conditions during any part of the flight with forecast landing temperature below 10°C, decrease weight by 6200 kg.

GEAR DOWN

Takeoff Obstacle Limit Weight

Flaps 5

Sea Level, 30°C & Below, Zero Wind

Based on engine bleed for packs on and anti-ice off

Reference Obstacle Limit Weight (1000 KG)

OBSTACLE HEIGHT (M)	REFERENCE OBSTACLE LIMIT WEIGHT (1000 KG)										
	DISTANCE FROM BRAKE RELEASE (100 M)										
	25	30	35	40	45	50	55	60	65	70	75
5	72.2	76.1									
20	65.7	70.0	73.0	75.0							
40	60.4	64.7	67.9	70.4	72.3	73.7	74.8	75.7	76.4	77.1	
60	56.6	60.8	64.1	66.7	68.8	70.5	71.9	73.0	73.9	74.7	75.3
80	53.4	57.6	61.0	63.7	65.9	67.8	69.3	70.6	71.6	72.6	73.3
100	50.7	54.9	58.3	61.1	63.4	65.3	67.0	68.3	69.5	70.6	71.4
120	48.4	52.6	56.0	58.8	61.2	63.2	64.9	66.3	67.6	68.7	69.7
140	46.3	50.5	53.9	56.8	59.2	61.2	63.0	64.5	65.8	67.0	68.0
160	44.4	48.6	52.0	54.9	57.4	59.5	61.3	62.8	64.2	65.4	66.5
180	42.6	46.8	50.3	53.2	55.7	57.8	59.7	61.3	62.7	64.0	65.1
200		45.2	48.7	51.6	54.1	56.3	58.2	59.8	61.3	62.6	63.7
220		43.7	47.2	50.1	52.7	54.9	56.8	58.4	59.9	61.3	62.5
240		42.4	45.8	48.8	51.3	53.5	55.4	57.1	58.7	60.0	61.3
260			44.5	47.5	50.0	52.2	54.2	55.9	57.5	58.9	60.1
280			43.3	46.2	48.8	51.0	53.0	54.8	56.3	57.7	59.0
300			42.1	45.1	47.6	49.9	51.9	53.6	55.2	56.7	58.0

Obstacle height must be calculated from lowest point of the runway to conservatively account for runway slope.

OAT Adjustments

OAT (°C)	REFERENCE OBSTACLE LIMIT WEIGHT (1000 KG)					
	30	40	50	60	70	80
30 & BELOW	0	0	0	0	0	0
32	-0.5	-0.7	-0.9	-1.1	-1.2	-1.4
34	-1.0	-1.4	-1.7	-2.1	-2.5	-2.9
36	-1.5	-2.1	-2.6	-3.2	-3.7	-4.3
38	-2.0	-2.7	-3.5	-4.2	-5.0	-5.7
40	-2.5	-3.4	-4.4	-5.3	-6.2	-7.2
42	-2.9	-4.1	-5.2	-6.3	-7.5	-8.6
44	-3.4	-4.7	-6.1	-7.4	-8.7	-10.0
46	-3.8	-5.4	-6.9	-8.4	-9.9	-11.5
48	-4.3	-6.0	-7.7	-9.5	-11.2	-12.9
50	-4.7	-6.7	-8.6	-10.5	-12.4	-14.4

GEAR DOWN

Takeoff Obstacle Limit Weight
Flaps 5
Sea Level, 30°C & Below, Zero Wind
Pressure Altitude Adjustments

ALT (FT)	OAT ADJUSTED OBSTACLE LIMIT WEIGHT (1000 KG)					
	30	40	50	60	70	80
S.L. & BELOW	0	0	0	0	0	0
1000	-1.5	-1.9	-2.2	-2.6	-3.0	-3.4
2000	-2.9	-3.7	-4.5	-5.2	-6.0	-6.7
3000	-4.0	-5.2	-6.4	-7.6	-8.8	-9.9
4000	-5.1	-6.7	-8.3	-9.9	-11.5	-13.2
5000	-5.6	-7.7	-9.8	-11.9	-14.0	-16.1
6000	-6.2	-8.8	-11.4	-13.9	-16.5	-19.1
7000	-6.8	-10.0	-13.1	-16.3	-19.4	-22.6
8000	-7.5	-11.2	-14.9	-18.6	-22.3	-26.0
9000	-7.8	-11.9	-16.1	-20.4	-24.6	-28.8
10000	-8.0	-12.7	-17.4	-22.1	-26.8	-31.5

Wind Adjustments

WIND (KTS)	OAT & ALT ADJUSTED OBSTACLE LIMIT WEIGHT (1000 KG)					
	30	40	50	60	70	80
15 TW	-10.1	-9.4	-8.8	-8.1	-7.5	-6.8
10 TW	-6.7	-6.3	-5.9	-5.4	-5.0	-4.6
5 TW	-3.4	-3.1	-2.9	-2.7	-2.5	-2.3
0	0	0	0	0	0	0
10 HW	1.0	0.8	0.7	0.6	0.4	0.2
20 HW	2.0	1.7	1.4	1.1	0.8	0.5
30 HW	3.0	2.6	2.2	1.8	1.4	1.0
40 HW	4.0	3.5	3.0	2.5	2.0	1.5

With engine bleed for packs off, increase weight by 200 kg.
With engine anti-ice on, decrease weight by 250 kg.
With engine and wing anti-ice on, decrease weight by 4300 kg (optional system).

GEAR DOWN

Long Range Cruise Altitude Capability

Max Cruise Thrust, 100 ft/min residual rate of climb

WEIGHT (1000 KG)	PRESSURE ALTITUDE (FT)		
	ISA + 10°C & BELOW	ISA + 15°C	ISA + 20°C
85	14600	11500	8500
80	17400	14600	11700
75	20300	17600	14900
70	22800	20500	17800
65	25400	23500	20900
60	27800	26300	24400
55	30200	29000	27300
50	32300	31300	30100
45	34500	33500	32400
40	36900	36000	34900

GEAR DOWN

Long Range Cruise Trip Fuel and Time

Ground to Air Miles Conversion

AIR DISTANCE (NM) HEADWIND COMPONENT (KTS)					GROUND DISTANCE (NM)	AIR DISTANCE (NM) TAILWIND COMPONENT (KTS)				
100	80	60	40	20		20	40	60	80	100
340	300	266	239	218	200	186	174	163	153	145
509	449	399	359	327	300	279	260	244	229	217
676	598	531	479	437	400	372	347	325	306	289
842	745	663	598	546	500	465	434	407	383	362
1007	892	794	717	654	600	559	521	488	460	435
1170	1038	925	836	763	700	652	609	570	537	508
1333	1183	1055	954	872	800	745	696	652	614	581
1494	1328	1185	1072	980	900	839	784	734	691	654
1655	1472	1315	1190	1089	1000	932	871	817	769	728
1815	1615	1444	1308	1197	1100	1025	958	899	847	802
1973	1758	1573	1426	1305	1200	1119	1046	981	925	876
2131	1900	1701	1543	1413	1300	1212	1134	1064	1003	950
2288	2041	1829	1660	1521	1400	1306	1221	1146	1081	1025
2444	2182	1957	1777	1629	1500	1400	1309	1229	1159	1099
2599	2323	2084	1894	1737	1600	1493	1397	1312	1238	1174
2753	2462	2211	2011	1845	1700	1587	1486	1395	1316	1248
2907	2602	2338	2127	1953	1800	1681	1574	1479	1395	1323
3059	2740	2465	2243	2060	1900	1775	1663	1562	1474	1398
3211	2878	2591	2359	2168	2000	1869	1751	1646	1553	1473

Reference Fuel and Time Required

AIR DIST (NM)	PRESSURE ALTITUDE (1000 FT)									
	10		14		20		24		28	
	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)
200	2.6	0:53	2.5	0:51	2.3	0:49	2.3	0:48	2.3	0:47
300	3.9	1:18	3.7	1:14	3.4	1:10	3.3	1:07	3.2	1:05
400	5.1	1:42	4.8	1:37	4.4	1:31	4.2	1:27	4.1	1:24
500	6.4	2:06	6.0	2:00	5.5	1:52	5.2	1:47	5.1	1:43
600	7.7	2:29	7.2	2:22	6.6	2:12	6.3	2:06	6.0	2:01
700	9.0	2:52	8.5	2:44	7.7	2:32	7.3	2:25	7.0	2:19
800	10.3	3:15	9.7	3:06	8.8	2:53	8.3	2:44	8.0	2:37
900	11.7	3:39	10.9	3:28	9.9	3:13	9.4	3:03	9.0	2:55
1000	13.0	4:02	12.1	3:50	11.0	3:33	10.4	3:22	10.0	3:14
1100	14.4	4:24	13.4	4:11	12.2	3:52	11.5	3:41		
1200	15.8	4:46	14.7	4:32	13.3	4:12	12.6	3:59		
1300	17.2	5:08	16.0	4:53	14.5	4:31	13.7	4:18		
1400	18.6	5:30	17.3	5:14	15.7	4:51	14.8	4:36		
1500	20.0	5:52	18.6	5:35	16.8	5:10	15.8	4:54		
1600	21.4	6:13	20.0	5:55	18.1	5:29	17.0	5:12		
1700	22.9	6:34	21.4	6:15	19.3	5:47	18.2	5:30		
1800	24.4	6:55	22.8	6:35	20.5	6:06	19.3	5:48		
1900	25.9	7:16	24.2	6:55	21.8	6:25	20.5	6:06		
2000	27.3	7:37	25.5	7:15	23.0	6:43	21.7	6:24		

GEAR DOWN

Long Range Cruise Trip Fuel and Time

Fuel Required Adjustments (1000 KG)

REFERENCE FUEL REQUIRED (1000 KG)	LANDING WEIGHT (1000 KG)						
	40	45	50	55	60	65	70
2	-0.2	-0.1	0.0	0.1	0.3	0.4	0.5
4	-0.4	-0.2	0.0	0.2	0.5	0.7	1.0
6	-0.6	-0.3	0.0	0.4	0.7	1.1	1.4
8	-0.8	-0.4	0.0	0.5	0.9	1.4	1.9
10	-1.0	-0.5	0.0	0.6	1.2	1.8	2.3
12	-1.2	-0.6	0.0	0.7	1.4	2.1	2.8
14	-1.4	-0.7	0.0	0.8	1.6	2.4	3.3
16	-1.5	-0.8	0.0	0.9	1.8	2.8	3.7
18	-1.7	-0.9	0.0	1.0	2.1	3.1	4.2
20	-1.9	-1.0	0.0	1.1	2.3	3.5	4.6
22	-2.1	-1.1	0.0	1.3	2.5	3.8	5.1
24	-2.3	-1.2	0.0	1.4	2.7	4.1	5.6
26	-2.5	-1.2	0.0	1.5	3.0	4.5	6.0
28	-2.7	-1.3	0.0	1.6	3.2	4.8	6.5

Based on VREF40 + 70 climb, Long Range Cruise and VREF40 + 70 descent.

GEAR DOWN

Holding Planning

Flaps Up

WEIGHT (1000 KG)	TOTAL FUEL FLOW (KG/HR)							
	PRESSURE ALTITUDE (FT)							
	1500	5000	10000	15000	20000	25000	30000	35000
85	4580	4560	4550	4590	4670			
80	4330	4300	4290	4310	4350			
75	4080	4050	4030	4040	4060			
70	3840	3800	3770	3770	3780	3880		
65	3610	3560	3530	3520	3510	3560		
60	3370	3320	3280	3260	3240	3260	3490	
55	3130	3080	3040	3010	2980	2990	3090	
50	2900	2850	2800	2760	2720	2720	2780	
45	2670	2620	2570	2530	2480	2460	2500	2640
40	2440	2390	2350	2300	2250	2220	2250	2290

This table includes 5% additional fuel for holding in a racetrack pattern.

GEAR DOWN

ENGINE INOP

MAX CONTINUOUS THRUST

Net Level Off Weight

PRESSURE ALTITUDE (1000 FT)	LEVEL OFF WEIGHT (1000 KG)		
	ISA + 10°C & BELOW	ISA + 15°C	ISA + 20°C
20	43.4	42.2	40.9
18	46.8	45.2	43.6
16	50.1	48.3	46.5
14	53.1	51.5	49.8
12	56.5	54.6	52.5
10	59.9	57.9	55.2
8	63.6	61.3	58.5
6	67.4	64.7	61.6
4	70.9	68.0	64.7
2	74.3	71.1	67.8
0	77.5	74.2	70.9

Anti-Ice Adjustments

ANTI-ICE CONFIGURATION	LEVEL OFF WEIGHT ADJUSTMENT (1000 KG)									
	PRESSURE ALTITUDE (1000 FT)									
	0	2	4	6	8	10	12	14	16	18
ENGINE ONLY	-1.2	-1.2	-1.3	-1.3	-1.3	-1.3	-1.3	-1.2	-1.2	-1.1
ENGINE AND WING	-6.0	-5.9	-5.8	-5.6	-5.4	-5.2	-5.0	-4.9	-4.8	

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Introduction

This chapter contains self dispatch performance data intended primarily for use by flight crews in the event that information cannot be obtained from the airline dispatch office. The takeoff data provided is for a single takeoff flap at max takeoff thrust. The range of conditions covered is limited to those normally encountered in airline operation. In the event of conflict between the data presented in this chapter and that contained in the approved Airplane Flight Manual, the Flight Manual shall always take precedence.

Takeoff

The maximum allowable takeoff weight will be the least of the Field, Climb, Obstacle, Brake Energy and Tire Speed Limit Weights as determined from the tables shown.

Brake Energy or Tire Speed Limit Weight tables are only provided if they are limiting for the range of conditions covered in the FCOM Section PD.

Field Limit Weight - Slope and Wind Corrections

These tables for dry and wet runways provide corrections to the field length available for the effects of runway slope and wind component along the runway. Enter the appropriate table with the available field length and runway slope to determine the slope corrected field length. Next enter the appropriate table with slope corrected field length and wind component to determine the slope and wind corrected field length.

Field and Climb Limit Weight

Tables are presented for selected airport pressure altitudes and runway conditions and show both Field and Climb Limit Weights. Enter the appropriate table for pressure altitude and runway condition with “Slope and Wind Corrected Field Length” determined above and airport OAT to obtain Field Limit Weight. Also read Climb Limit Weight for the same OAT. Intermediate altitudes may be interpolated or use next higher altitude. When finding a maximum weight for a wet runway, the dry runway limit weight must also be determined and the lower of the two weights used.

Obstacle Limit Weight

The Reference Obstacle Limit Weight table provides obstacle limit weights for reference airport conditions based on obstacle height above the runway surface and distance from brake release. Enter the adjustment tables to adjust the reference Obstacle Limit Weight for the effects of OAT, pressure altitude and wind as indicated. In the case of multiple obstacles, enter the tables successively with each obstacle and determine the most limiting weight.

Tire Speed Limit

Tire Speed Limit Weight tables are only provided if they are limiting for the range of conditions covered in the FCOM Section PD.

Maximum tire speed limited weights are presented for 225 MPH tires. To determine the tire speed limit weight, enter the table with OAT and airport pressure altitude. Adjust the tire speed limit weight according to the notes below the table to account for wind.

Brake Energy Limit VMBE

Brake Energy Limit Weight tables are only provided if they are limiting for the range of conditions covered in the FCOM Section PD.

The Maximum Brake Energy Speed table provides the Reference VMBE for a variety of airport pressure altitudes and temperatures. Enter the Weight Adjusted VMBE table to adjust the Reference VMBE for the actual brake release gross weight. Correct VMBE for slope and wind. If V1 exceeds VMBE, decrease brake release weight as indicated for each knot that V1 exceeds VMBE and determine V1, VR, and V2 for the lower brake release weight.

Enroute

Long Range Cruise Maximum Operating Altitude

These tables provide the maximum operating altitude in the same manner as the FMC. Maximum altitudes are shown for a given cruise weight and maneuver capability. Note that this table considers both thrust and buffet limits, providing the more limiting of the two. Any data that is thrust limited is denoted by an asterisk and represents only a thrust limited condition in level flight with 100 ft/min residual rate of climb. Flying above these altitudes with sustained banks in excess of approximately 15° may cause the airplane to lose speed and/or altitude. The altitudes shown in the table are limited to the maximum certified altitude of 41000 ft.

Long Range Cruise Trip Fuel and Time

Long Range Cruise Trip Fuel and Time tables are provided to determine trip time and fuel required to destination.

To determine trip fuel and time for a constant altitude cruise, first enter the Ground to Air Miles Conversion table to convert ground distance and enroute wind to an equivalent still air distance for use with the Reference Fuel and Time tables. Next, enter the Reference Fuel and Time table with air distance from the Ground to Air Miles Conversion table and the desired altitude and read Reference Fuel and Time Required. Lastly, enter the Fuel Required Adjustment table with the Reference Fuel and the planned landing weight to obtain the adjustment to the fuel required at the planned landing weight.

Long Range Cruise Step Climb Trip Fuel and Time

The Long Range Cruise Step Climb Trip Fuel and Time tables are provided to determine trip time and fuel required to destination when flying a step climb profile. Step climb profiles are based on 4000 ft step climbs to keep the flight within 2000 ft of the optimum altitude for the current cruise weight. To determine trip fuel and time, enter the Ground to Air Miles Conversion table and determine air distance as discussed above. Then enter the Trip Fuel and Time Required table with air distance and planned landing weight to read trip fuel. Continue across the table to read trip time.

Short Trip Fuel and Time

These tables are provided to determine trip fuel and time for short distances or alternates. Obtain air distance from the table using the ground distance and wind component to the alternate. Enter the Trip Fuel and Time Required table with air distance and read trip fuel required for the expected landing weight, together with time to alternate at right. For distances greater than shown or other altitudes, use the Long Range Cruise Trip Fuel and Time tables.

Holding Planning

This table provides total fuel flow information necessary for planning flaps up holding and reserve fuel requirements. Data is based on the FMC holding speed schedule which is the higher of the maximum endurance and flaps up maneuver speeds. As noted, the fuel flow is based on flight in a racetrack holding pattern. For holding in straight and level flight, reduce table values by 5%.

Flight Crew Requirements for Chemical Passenger Oxygen System

The flight crew oxygen system is a gaseous system. Flight crew oxygen tables are provided for both the chemical passenger oxygen system and the freighter oxygen system. Use the tables corresponding to the appropriate oxygen system installed.

Regulations require that sufficient oxygen be provided to the flight crew to account for the greater of supplemental breathing oxygen in the event of a cabin depressurization or protective breathing in the event of smoke or harmful fumes in the flight deck. The oxygen quantity associated with the above requirements is achieved for the flight crew with the minimum dispatch oxygen cylinder pressure.

Tables are provided to determine the flight crew oxygen dispatch requirements for a chemical passenger oxygen system. To determine the minimum dispatch oxygen cylinder pressure enter the appropriate flight crew oxygen table with the number of crew plus observers using oxygen and read the minimum cylinder pressure required for the appropriate cylinder temperature.

Flight Crew and Supernumerary Requirements for Freighter Oxygen System

The flight crew oxygen system is a gaseous system.

Regulations require that sufficient oxygen be provided to the flight crew to account for the greater of supplemental breathing oxygen in the event of a cabin depressurization or protective breathing in the event of smoke or harmful fumes in the flight deck. Sufficient oxygen must be provided to the supernumeraries for supplemental breathing in the event of a cabin depressurization or a main deck cargo fire.

Data are provided to determine the total oxygen dispatch requirement. Table 1 shows the quantity of oxygen required to complete an emergency descent to 25000 ft, level off for the diversion time, and continue descent below 10000 ft with the regulator set to "100%" for the flight crew protective breathing requirement. Table 1 includes values for up to eight people to account for up to four crew members and up to four supernumeraries.

Both the crew oxygen and supernumerary oxygen draw from the same set of oxygen cylinders. To determine the total oxygen required for dispatch, enter the table for the total number of crew plus supernumeraries and read required liters of 100% oxygen for the maximum diversion time.

Additional adjustments for more extensive than normal crew usage can be made by adding 2.05 liters/person/minute (0.6 psi/person/minute for the dual cylinder system) or 13 liters/person/minute (4 psi/person/minute) if 100% oxygen is selected during normal usage.

After determining the total volume (liters) required for the flight crew plus supernumeraries, obtain the dispatch pressure required from the Cylinder Volume to Pressure Conversion table (Table 2). Adjust this reading for cylinder temperature as required, using the adjustments given (Table 3).

Net Level Off Weight

The Net Level Off Weight table is provided to determine terrain clearance capability in straight and level flight following an engine failure. Regulations require terrain clearance planning based on net performance which is the gross (or actual) gradient performance degraded by 1.1%. In addition, the net level off pressure altitude must clear the terrain by 1000 ft.

To determine the maximum weight for terrain clearance, enter the table with required net level off pressure altitude and expected ISA deviation to obtain weight. Adjust weight for anti-ice operation as noted below the table.

Landing

Tables are provided for determining the maximum landing weight as limited by field length or climb requirements for a single landing flap.

Maximum landing weight is the lowest of the field length limit weight, climb limit weight, or maximum certified landing weight.

Landing Field Limit Weight

For the expected runway condition and anti-skid system configuration, obtain wind corrected field length by entering the Wind Corrected Field Length table with field length available and wind component along the runway. Now enter the Field Limit Weight table with wind corrected field length and pressure altitude to read field limit weight.

Landing Climb Limit Weight

Enter the table with airport OAT and pressure altitude to read landing climb limit weight. Apply the noted adjustments as required.

Go-Around Climb Gradient

Enter the Reference Go-Around Gradient table with airport OAT and pressure altitude to determine the reference go-around gradient. Then adjust the reference gradient for airplane weight and speed using the tables provided to determine the weight and speed adjusted go-around gradient. Apply the necessary corrections for engine bleed configuration and icing conditions as noted.

Quick Turnaround Limit Weight

Enter the appropriate table (Steel or Carbon Brakes) with airport pressure altitude and OAT to read maximum quick turnaround weight. Apply the noted adjustments as required.

If the landing weight exceeds the maximum quick turnaround weight, wait the specified time and then check that the wheel thermal plugs have not melted before executing a subsequent takeoff. For Steel Brakes, the alternate procedures on the charts can be used to ensure the brake temperature is within limits. These procedures cannot be used for carbon brakes.

Gear Down

This section provides flight planning data for revenue operation with gear down. Unless otherwise noted, the gear down tables in this section are identical in format and usage to the corresponding gear up tables previously described.

To eliminate erroneous displays the flight crew should enter only gross weight data on the PERF INIT page of the Control Display Unit (CDU). Omission of the cost index and cruise altitude entries on the PERF INIT page will render the VNAV function unavailable during flight. As a result, the following information will not be provided: VNAV guidance and speed schedules, trip fuel and ETA predictions, optimum and maximum altitude data, step climb and top of descent predictions, and the VNAV descent guidance path.

The gross weight entry allows the FMCS takeoff and approach speed schedules to be generated. In addition, the flap maneuver speed and VREF speed bugs will be available for display on the primary flight display speed tape. Except for VNAV, normal autopilot and autothrottle modes will remain available for use during the flight, as will the LNAV mode.

Takeoff/Landing Climb Limit Weight

Enter the appropriate table with airport OAT and pressure altitude to determine Takeoff/Landing Climb Limit Weight with gear down. Correct the weight obtained for engine bleed configuration as required.

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Performance Dispatch — Chapter PD
Table of Contents — Section 50

737-800W CFM56-7B26 C M KG FAA CATC/N

General

The table below shows the airplanes that have been identified with the following performance package. Note, some airplanes may be identified with more than one performance package. This configuration table information reflects the Boeing delivered configuration updated for service bulletin incorporations in conformance with the policy stated in the introduction section of the FCOM. The performance data is prepared for the owner/operator named on the title page. The intent of this information is to assist flight crews and airlines in knowing which performance package is applicable to a given airplane. The performance package model identification information is based on Boeing's knowledge of the airline's fleet at a point in time approximately three months prior to the page date. Notice of Errata (NOE) will not be provided to airlines to identify airplanes that are moved between performance packages within this manual or airplanes added to the airline's fleet whose performance packages are already represented in this manual. These types of changes will be updated in the next block revision. Owners/operators are responsible for ensuring the operational documentation they are using is complete and matches the current configuration of their airplanes, and the accuracy and validity of all information furnished by the owner/operator or any other party. Owners/operators receiving active revision service are responsible to ensure that any modifications to the listed airplanes are properly reflected in this manual.

Serial and tabulation number are supplied by Boeing.

Registry Number	Serial Number	Tabulation Number
YX802	YX802	YX802

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Performance Dispatch — Chapter PD
Takeoff — Section 50

Takeoff Field Corrections - Dry Runway
Slope Corrections

FIELD LENGTH AVAILABLE (M)	SLOPE CORRECTED FIELD LENGTH (M)								
	RUNWAY SLOPE (%)								
	-2.0	-1.5	-1.0	-0.5	0.0	0.5	1.0	1.5	2.0
1200	1240	1230	1220	1210	1200	1190	1180	1170	1150
1400	1460	1450	1430	1420	1400	1380	1350	1330	1310
1600	1680	1660	1640	1620	1600	1570	1530	1500	1460
1800	1900	1870	1850	1820	1800	1750	1710	1660	1610
2000	2110	2090	2060	2030	2000	1940	1880	1820	1770
2200	2330	2300	2270	2230	2200	2130	2060	1990	1920
2400	2550	2510	2470	2440	2400	2320	2240	2150	2070
2600	2770	2730	2690	2640	2600	2510	2410	2320	2220
2800	3000	2950	2900	2850	2800	2690	2590	2480	2380
3000	3220	3170	3110	3060	3000	2880	2770	2650	2530
3200	3450	3390	3320	3260	3200	3070	2940	2810	2680
3400	3670	3600	3540	3470	3400	3260	3120	2980	2840
3600	3900	3820	3750	3670	3600	3450	3290	3140	2990
3800	4130	4050	3970	3880	3800	3640	3470	3310	3140
4000	4370	4280	4190	4090	4000	3820	3650	3470	3290
4200	4610	4510	4410	4300	4200	4010	3820	3640	3450
4400	4850	4740	4630	4510	4400	4200	4000	3800	3600
4600	5090	4970	4850	4720	4600	4390	4180	3960	3750
4800	5330	5200	5070	4930	4800	4580	4350	4130	3910
5000	5570	5430	5290	5140	5000	4760	4530	4290	4060

Wind Corrections

SLOPE CORR'D FIELD LENGTH (M)	SLOPE & WIND CORRECTED FIELD LENGTH (M)							
	WIND COMPONENT (KTS)							
	-15	-10	-5	0	10	20	30	40
1200	880	990	1090	1200	1270	1340	1410	1490
1400	1050	1170	1280	1400	1480	1550	1630	1710
1600	1220	1350	1470	1600	1680	1760	1850	1930
1800	1390	1530	1660	1800	1890	1980	2070	2160
2000	1560	1700	1850	2000	2090	2190	2280	2380
2200	1720	1880	2040	2200	2300	2400	2500	2600
2400	1890	2060	2230	2400	2500	2610	2720	2830
2600	2060	2240	2420	2600	2710	2820	2930	3050
2800	2230	2420	2610	2800	2910	3030	3150	3270
3000	2400	2600	2800	3000	3120	3240	3370	3500
3200	2570	2780	2990	3200	3330	3450	3590	3720
3400	2730	2960	3180	3400	3530	3660	3800	3940
3600	2900	3140	3370	3600	3740	3880	4020	4170
3800	3070	3310	3560	3800	3940	4090	4240	4390
4000	3240	3490	3750	4000	4150	4300	4450	4610
4200	3410	3670	3940	4200	4350	4510	4670	4840
4400	3580	3850	4130	4400	4560	4720	4890	5060
4600	3740	4030	4310	4600	4760	4930	5110	5280
4800	3910	4210	4500	4800	4970	5140	5320	5510
5000	4080	4390	4690	5000	5170	5350	5540	5730

Takeoff Field & Climb Limit Weights - Dry Runway

Flaps 5

Sea Level Pressure Altitude

CORR'D FIELD LENGTH (M)	FIELD LIMIT WEIGHT (1000 KG)										
	OAT (°C)										
	-40	10	14	18	22	26	30	38	42	46	50
1220	58.6	53.8	53.4	53.1	52.7	52.4	52.0	49.6	48.3	47.1	45.8
1400	63.7	58.5	58.1	57.7	57.3	57.0	56.6	53.9	52.5	51.2	49.8
1600	68.9	63.3	62.8	62.4	62.0	61.6	61.2	58.3	56.8	55.4	53.9
1800	73.7	67.6	67.2	66.7	66.3	65.9	65.4	62.4	60.7	59.2	57.6
2000	78.2	71.8	71.3	70.8	70.3	69.9	69.4	66.1	64.4	62.7	61.0
2200	82.5	75.6	75.1	74.6	74.1	73.6	73.1	69.7	67.8	66.0	64.3
2400	86.1	79.2	78.7	78.2	77.6	77.1	76.6	73.0	71.0	69.2	67.3
2600	86.1	82.4	81.8	81.3	80.7	80.2	79.6	75.8	73.8	71.9	69.9
2800	86.1	85.4	84.8	84.2	83.6	83.1	82.5	78.6	76.5	74.4	72.4
3000	86.1	86.1	86.1	86.1	86.1	85.9	85.3	81.2	79.0	76.9	74.8
3200	86.1	86.1	86.1	86.1	86.1	86.1	86.1	83.4	81.2	79.0	76.9
3400	86.1	86.1	86.1	86.1	86.1	86.1	86.1	85.6	83.3	81.1	78.8
3600	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	85.3	83.1	80.8
3800	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	84.9	82.6
4000	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	84.4
4200	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1
4400	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1
4600	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1
CLIMB LIMIT WT (1000 KG)	86.1	86.0	85.9	85.8	85.7	85.6	85.4	79.8	77.2	74.6	71.9

2000 FT Pressure Altitude

CORR'D FIELD LENGTH (M)	FIELD LIMIT WEIGHT (1000 KG)										
	OAT (°C)										
	-40	10	14	18	22	26	30	38	42	46	50
1220	55.2	50.8	50.5	50.1	49.8	49.5	48.6	46.2	45.0	43.9	42.8
1400	60.1	55.2	54.9	54.5	54.2	53.8	52.8	50.3	49.0	47.7	46.5
1600	65.0	59.7	59.3	59.0	58.6	58.2	57.2	54.4	53.0	51.6	50.3
1800	69.5	63.9	63.5	63.1	62.7	62.3	61.1	58.1	56.6	55.2	53.8
2000	73.7	67.7	67.3	66.8	66.4	66.0	64.8	61.6	60.0	58.4	56.9
2200	77.7	71.3	70.9	70.4	70.0	69.5	68.2	64.8	63.2	61.5	59.9
2400	81.4	74.7	74.2	73.8	73.3	72.8	71.4	67.9	66.1	64.4	62.7
2600	84.6	77.7	77.2	76.7	76.2	75.7	74.3	70.5	68.7	66.9	65.2
2800	86.1	80.5	80.0	79.4	78.9	78.4	76.9	73.1	71.1	69.3	67.5
3000	86.1	83.1	82.6	82.1	81.5	81.0	79.5	75.5	73.5	71.5	69.6
3200	86.1	85.5	84.9	84.4	83.8	83.3	81.7	77.6	75.5	73.5	71.6
3400	86.1	86.1	86.1	86.1	86.0	85.5	83.8	79.6	77.5	75.4	73.4
3600	86.1	86.1	86.1	86.1	86.1	86.1	85.8	81.5	79.4	77.3	75.2
3800	86.1	86.1	86.1	86.1	86.1	86.1	86.1	83.4	81.2	79.0	76.9
4000	86.1	86.1	86.1	86.1	86.1	86.1	86.1	85.2	82.9	80.7	78.6
4200	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	84.6	82.4	80.2
4400	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	84.0	81.8
4600	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	85.7	83.4
CLIMB LIMIT WT (1000 KG)	82.5	82.0	81.9	81.8	81.7	81.6	79.7	74.7	72.2	69.7	67.3

With engine bleed for packs off, increase field limit weight by 350 kg and climb limit weight by 1350 kg.
With engine anti-ice on, decrease field limit weight by 200 kg and climb limit weight by 250 kg.
With engine and wing anti-ice on (optional system), decrease field limit weight by 950 kg and climb limit weight by 1500 kg.

Takeoff Field & Climb Limit Weights - Dry Runway

Flaps 5

4000 FT Pressure Altitude

CORR'D FIELD LENGTH (M)	FIELD LIMIT WEIGHT (1000 KG)										
	OAT (°C)										
	-40	10	14	18	22	26	30	38	42	46	50
1220	51.6	47.4	47.1	46.8	46.5	45.9	45.1	43.1	42.0	40.9	40.0
1400	56.1	51.6	51.3	50.9	50.6	49.9	49.1	46.8	45.7	44.5	43.5
1600	60.7	55.8	55.4	55.1	54.8	54.0	53.1	50.6	49.4	48.2	47.0
1800	64.9	59.6	59.3	58.9	58.5	57.7	56.7	54.1	52.8	51.4	50.2
2000	68.8	63.2	62.8	62.4	62.0	61.1	60.1	57.3	55.9	54.4	53.2
2200	72.5	66.6	66.1	65.7	65.3	64.4	63.3	60.3	58.8	57.3	56.0
2400	75.9	69.7	69.3	68.8	68.4	67.4	66.3	63.2	61.6	60.0	58.6
2600	78.9	72.4	72.0	71.5	71.1	70.1	68.8	65.6	63.9	62.3	60.8
2800	81.8	75.0	74.5	74.1	73.6	72.5	71.3	67.9	66.2	64.5	62.9
3000	84.5	77.5	77.0	76.5	76.0	74.9	73.6	70.1	68.3	66.5	64.9
3200	86.1	79.7	79.2	78.7	78.1	77.0	75.7	72.1	70.2	68.4	66.7
3400	86.1	81.7	81.2	80.7	80.2	79.0	77.6	73.9	72.0	70.2	68.5
3600	86.1	83.7	83.2	82.6	82.1	80.9	79.5	75.7	73.8	71.9	70.1
3800	86.1	85.6	85.1	84.5	84.0	82.8	81.3	77.5	75.5	73.5	71.7
4000	86.1	86.1	86.1	86.1	85.8	84.6	83.1	79.1	77.1	75.1	73.3
4200	86.1	86.1	86.1	86.1	86.1	86.1	84.8	80.8	78.7	76.7	74.8
4400	86.1	86.1	86.1	86.1	86.1	86.1	86.1	82.4	80.3	78.2	76.3
4600	86.1	86.1	86.1	86.1	86.1	86.1	86.1	84.0	81.8	79.7	77.8
CLIMB LIMIT WT (1000 KG)	77.7	77.1	77.1	77.0	76.9	75.8	74.2	69.7	67.3	65.1	63.0

6000 FT Pressure Altitude

CORR'D FIELD LENGTH (M)	FIELD LIMIT WEIGHT (1000 KG)										
	OAT (°C)										
	-40	10	14	18	22	26	30	38	42	46	50
1220	48.1	44.2	44.0	43.7	43.2	42.6	41.9	40.0	39.0	38.1	37.2
1400	52.3	48.1	47.8	47.6	47.0	46.3	45.6	43.5	42.4	41.4	40.5
1600	56.5	52.1	51.7	51.4	50.8	50.1	49.3	47.0	45.8	44.8	43.8
1800	60.4	55.6	55.3	55.0	54.3	53.5	52.7	50.2	49.0	47.8	46.7
2000	64.0	58.9	58.6	58.2	57.5	56.7	55.7	53.1	51.8	50.6	49.4
2200	67.5	62.0	61.7	61.3	60.5	59.7	58.7	55.9	54.5	53.2	52.0
2400	70.6	64.9	64.6	64.2	63.3	62.5	61.4	58.5	57.0	55.7	54.4
2600	73.4	67.5	67.1	66.6	65.8	64.9	63.8	60.8	59.2	57.8	56.4
2800	76.1	69.9	69.4	69.0	68.1	67.2	66.0	62.9	61.3	59.8	58.4
3000	78.6	72.1	71.7	71.2	70.3	69.3	68.2	64.9	63.2	61.7	60.2
3200	80.8	74.1	73.7	73.2	72.3	71.3	70.1	66.7	65.0	63.4	61.9
3400	82.9	76.1	75.6	75.1	74.1	73.1	71.9	68.4	66.7	65.0	63.5
3600	84.9	77.9	77.4	77.0	76.0	74.9	73.6	70.1	68.3	66.6	65.0
3800	86.1	79.7	79.2	78.7	77.7	76.6	75.3	71.7	69.8	68.2	66.5
4000	86.1	81.4	80.9	80.4	79.4	78.3	76.9	73.3	71.4	69.6	68.0
4200	86.1	83.1	82.6	82.1	81.0	79.9	78.5	74.8	72.8	71.1	69.4
4400	86.1	84.8	84.2	83.7	82.6	81.5	80.1	76.3	74.3	72.5	70.8
4600	86.1	86.1	85.8	85.3	84.2	83.1	81.6	77.8	75.8	73.9	72.2
CLIMB LIMIT WT (1000 KG)	72.8	72.4	72.3	72.3	71.3	70.3	68.8	64.5	62.3	60.4	58.5

With engine bleed for packs off, increase field limit weight by 350 kg and climb limit weight by 1350 kg.
With engine anti-ice on, decrease field limit weight by 200 kg and climb limit weight by 250 kg.
With engine and wing anti-ice on (optional system), decrease field limit weight by 950 kg and climb limit weight by 1500 kg.

Takeoff Field & Climb Limit Weights - Dry Runway

Flaps 5

8000 FT Pressure Altitude

CORR'D FIELD LENGTH (M)	FIELD LIMIT WEIGHT (1000 KG)										
	OAT (°C)										
	-40	10	14	18	22	26	30	38	42	46	50
1220	44.8	41.3	41.1	40.6	40.1	39.4	38.6	36.7	35.9	35.0	34.2
1400	48.7	45.0	44.7	44.1	43.6	42.9	42.0	40.0	39.0	38.1	37.2
1600	52.7	48.6	48.3	47.7	47.1	46.4	45.5	43.2	42.2	41.2	40.3
1800	56.3	51.9	51.6	51.0	50.4	49.6	48.5	46.1	45.1	44.0	43.0
2000	59.6	55.0	54.6	54.0	53.3	52.4	51.3	48.8	47.6	46.5	45.4
2200	62.8	57.9	57.5	56.8	56.1	55.2	54.0	51.3	50.1	48.9	47.8
2400	65.8	60.6	60.2	59.5	58.7	57.8	56.5	53.7	52.4	51.2	49.9
2600	68.3	62.9	62.5	61.7	60.9	60.0	58.7	55.7	54.4	53.1	51.8
2800	70.7	65.1	64.7	63.9	63.1	62.1	60.7	57.6	56.2	54.9	53.6
3000	73.1	67.2	66.8	65.9	65.1	64.0	62.7	59.4	58.0	56.6	55.2
3200	75.1	69.1	68.6	67.8	66.9	65.8	64.4	61.1	59.6	58.2	56.7
3400	77.0	70.9	70.4	69.5	68.6	67.5	66.1	62.7	61.1	59.7	58.2
3600	78.9	72.6	72.1	71.2	70.3	69.2	67.7	64.2	62.6	61.1	59.6
3800	80.7	74.2	73.8	72.9	71.9	70.7	69.2	65.7	64.1	62.5	61.0
4000	82.4	75.9	75.4	74.4	73.5	72.3	70.7	67.1	65.5	63.9	62.3
4200	84.2	77.4	76.9	76.0	75.0	73.8	72.2	68.5	66.8	65.2	63.7
4400	85.8	79.0	78.5	77.5	76.5	75.3	73.7	69.9	68.2	66.6	64.9
4600	86.1	80.5	80.0	79.0	78.0	76.7	75.1	71.3	69.5	67.9	66.2
CLIMB LIMIT WT (1000 KG)	68.2	67.8	67.8	67.0	66.1	64.9	63.0	58.7	56.9	55.2	53.4

10000 FT Pressure Altitude

CORR'D FIELD LENGTH (M)	FIELD LIMIT WEIGHT (1000 KG)										
	OAT (°C)										
	-40	10	14	18	22	26	30	38	42	46	50
1220	41.9	38.6	38.1	37.6	37.1	36.5	35.7	33.9	33.0	32.2	31.3
1400	45.5	42.0	41.4	40.9	40.4	39.8	38.9	36.9	35.9	35.0	34.1
1600	49.3	45.4	44.8	44.3	43.7	43.0	42.1	39.9	38.9	37.9	36.8
1800	52.6	48.5	47.9	47.3	46.6	45.9	44.9	42.6	41.5	40.4	39.3
2000	55.7	51.3	50.6	50.0	49.3	48.5	47.4	45.0	43.8	42.6	41.4
2200	58.7	53.9	53.3	52.6	51.9	51.1	49.9	47.3	46.0	44.8	43.6
2400	61.4	56.5	55.7	55.0	54.3	53.4	52.2	49.5	48.2	46.9	45.5
2600	63.8	58.6	57.8	57.1	56.3	55.4	54.2	51.3	49.9	48.6	47.2
2800	66.0	60.6	59.8	59.1	58.3	57.3	56.0	53.1	51.6	50.2	48.8
3000	68.1	62.6	61.7	60.9	60.1	59.1	57.8	54.7	53.2	51.7	50.3
3200	70.0	64.3	63.4	62.6	61.8	60.8	59.4	56.2	54.7	53.2	51.6
3400	71.8	66.0	65.1	64.2	63.4	62.3	60.9	57.7	56.1	54.5	53.0
3600	73.6	67.6	66.7	65.8	64.9	63.9	62.4	59.1	57.5	55.9	54.3
3800	75.3	69.1	68.2	67.3	66.4	65.3	63.8	60.4	58.8	57.2	55.5
4000	76.9	70.6	69.7	68.8	67.8	66.8	65.2	61.8	60.1	58.4	56.7
4200	78.5	72.1	71.1	70.2	69.3	68.2	66.6	63.1	61.3	59.6	57.9
4400	80.1	73.5	72.6	71.6	70.7	69.5	67.9	64.3	62.6	60.9	59.1
4600	81.6	75.0	74.0	73.0	72.0	70.9	69.3	65.6	63.8	62.1	60.3
CLIMB LIMIT WT (1000 KG)	64.0	63.4	62.7	61.9	61.0	59.8	58.0	54.0	52.1	50.3	48.4

With engine bleed for packs off, increase field limit weight by 350 kg and climb limit weight by 1350 kg.
With engine anti-ice on, decrease field limit weight by 200 kg and climb limit weight by 250 kg.
With engine and wing anti-ice on (optional system), decrease field limit weight by 950 kg and climb limit weight by 1500 kg.

Takeoff Field Corrections - Wet Runway

Slope Corrections

FIELD LENGTH AVAILABLE (M)	SLOPE CORRECTED FIELD LENGTH (M)								
	RUNWAY SLOPE (%)								
	-2.0	-1.5	-1.0	-0.5	0.0	0.5	1.0	1.5	2.0
1200	1230	1220	1210	1210	1200	1190	1180	1170	1160
1400	1450	1440	1430	1410	1400	1380	1360	1340	1320
1600	1680	1660	1640	1620	1600	1570	1550	1520	1490
1800	1900	1880	1850	1830	1800	1760	1730	1690	1660
2000	2130	2100	2060	2030	2000	1960	1910	1870	1830
2200	2350	2310	2280	2240	2200	2150	2100	2050	1990
2400	2580	2530	2490	2440	2400	2340	2280	2220	2160
2600	2800	2750	2700	2650	2600	2530	2470	2400	2340
2800	3030	2970	2910	2860	2800	2730	2660	2580	2510
3000	3250	3190	3130	3060	3000	2920	2840	2760	2690
3200	3480	3410	3340	3270	3200	3120	3030	2950	2860
3400	3700	3630	3550	3480	3400	3310	3220	3130	3040
3600	3930	3850	3760	3680	3600	3500	3410	3310	3210
3800	4170	4080	3990	3890	3800	3690	3590	3480	3380
4000	4420	4320	4210	4110	4000	3880	3770	3650	3540
4200	4670	4550	4440	4320	4200	4080	3950	3830	3700
4400	4920	4790	4660	4530	4400	4270	4130	4000	3860
4600	5170	5030	4890	4740	4600	4460	4310	4170	4030
4800	5420	5270	5110	4960	4800	4650	4490	4340	4190
5000	5670	5500	5340	5170	5000	4840	4680	4510	4350

Wind Corrections

SLOPE CORR'D FIELD LENGTH (M)	SLOPE & WIND CORRECTED FIELD LENGTH (M)							
	WIND COMPONENT (KTS)							
	-15	-10	-5	0	10	20	30	40
1200	860	970	1090	1200	1280	1360	1440	1520
1400	1030	1150	1280	1400	1480	1570	1660	1750
1600	1200	1330	1470	1600	1690	1790	1880	1980
1800	1370	1510	1660	1800	1900	2000	2100	2210
2000	1540	1690	1850	2000	2110	2210	2320	2440
2200	1710	1870	2040	2200	2310	2430	2550	2670
2400	1880	2050	2230	2400	2520	2640	2770	2890
2600	2050	2230	2420	2600	2730	2860	2990	3120
2800	2220	2410	2610	2800	2930	3070	3210	3350
3000	2390	2590	2800	3000	3140	3280	3430	3580
3200	2560	2770	2990	3200	3350	3500	3650	3810
3400	2730	2950	3180	3400	3560	3710	3870	4040
3600	2900	3130	3370	3600	3760	3930	4090	4260
3800	3060	3310	3550	3800	3970	4140	4310	4490
4000	3230	3490	3740	4000	4180	4350	4540	4720
4200	3400	3670	3930	4200	4380	4570	4760	4950
4400	3570	3850	4120	4400	4590	4780	4980	5180
4600	3740	4030	4310	4600	4800	5000	5200	5400
4800	3910	4210	4500	4800	5000	5210	5420	5630
5000	4080	4390	4690	5000	5210	5430	5640	5860

Takeoff Field & Climb Limit Weights - Wet Runway

Flaps 5

Sea Level Pressure Altitude

CORR'D FIELD LENGTH (M)	FIELD LIMIT WEIGHT (1000 KG)										
	OAT (°C)										
	-40	10	14	18	22	26	30	38	42	46	50
1220	58.7	53.4	53.0	52.6	52.3	51.9	51.5	49.1	47.9	46.7	45.5
1400	63.7	58.0	57.5	57.1	56.7	56.3	55.9	53.2	51.9	50.6	49.3
1600	68.8	62.6	62.1	61.7	61.2	60.8	60.3	57.4	56.0	54.6	53.2
1800	73.5	66.8	66.3	65.8	65.3	64.9	64.4	61.3	59.8	58.3	56.8
2000	77.8	70.8	70.2	69.7	69.2	68.7	68.2	64.9	63.3	61.7	60.2
2200	82.0	74.5	74.0	73.4	72.9	72.3	71.8	68.4	66.6	65.0	63.3
2400	85.8	78.0	77.4	76.8	76.2	75.7	75.1	71.5	69.7	68.0	66.2
2600	86.1	81.0	80.4	79.8	79.2	78.6	78.0	74.3	72.4	70.6	68.8
2800	86.1	83.9	83.2	82.6	82.0	81.4	80.8	76.9	74.9	73.0	71.1
3000	86.1	86.1	85.9	85.2	84.6	83.9	83.3	79.3	77.2	75.3	73.3
3200	86.1	86.1	86.1	86.1	86.1	86.1	85.9	81.7	79.6	77.5	75.5
3400	86.1	86.1	86.1	86.1	86.1	86.1	86.1	84.0	81.8	79.8	77.6
3600	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	84.0	81.9	79.7
3800	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	83.9	81.6
4000	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	85.8	83.5
4200	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	85.3
4400	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1
4600	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1
CLIMB LIMIT WT (1000 KG)	86.1	86.0	85.9	85.8	85.7	85.6	85.4	79.8	77.2	74.6	71.9

2000 FT Pressure Altitude

CORR'D FIELD LENGTH (M)	FIELD LIMIT WEIGHT (1000 KG)										
	OAT (°C)										
	-40	10	14	18	22	26	30	38	42	46	50
1220	55.2	50.2	49.8	49.5	49.1	48.8	47.9	45.7	44.6	43.5	42.5
1400	59.9	54.5	54.1	53.7	53.3	52.9	51.9	49.5	48.3	47.2	46.0
1600	64.7	58.8	58.4	57.9	57.5	57.1	56.1	53.5	52.2	50.9	49.7
1800	69.1	62.7	62.3	61.8	61.4	60.9	59.8	57.0	55.7	54.3	53.0
2000	73.2	66.5	66.0	65.5	65.0	64.6	63.4	60.4	58.9	57.5	56.1
2200	77.0	70.0	69.4	68.9	68.4	67.9	66.7	63.6	62.0	60.5	59.1
2400	80.6	73.2	72.7	72.1	71.6	71.1	69.8	66.5	64.9	63.3	61.8
2600	83.8	76.0	75.5	74.9	74.4	73.8	72.5	69.0	67.3	65.7	64.1
2800	86.1	78.7	78.1	77.5	77.0	76.4	75.0	71.4	69.7	68.0	66.3
3000	86.1	81.2	80.5	79.9	79.4	78.8	77.3	73.6	71.8	70.0	68.3
3200	86.1	83.6	83.0	82.4	81.8	81.2	79.6	75.8	73.9	72.1	70.3
3400	86.1	86.0	85.4	84.7	84.1	83.5	81.9	78.0	76.0	74.1	72.3
3600	86.1	86.1	86.1	86.1	86.1	85.7	84.1	80.0	78.0	76.1	74.2
3800	86.1	86.1	86.1	86.1	86.1	86.1	86.1	82.0	79.9	77.9	76.0
4000	86.1	86.1	86.1	86.1	86.1	86.1	86.1	83.9	81.7	79.7	77.7
4200	86.1	86.1	86.1	86.1	86.1	86.1	86.1	85.7	83.5	81.4	79.4
4400	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	85.3	83.1	81.0
4600	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	84.8	82.6
CLIMB LIMIT WT (1000 KG)	82.5	82.0	81.9	81.8	81.7	81.6	79.7	74.7	72.2	69.7	67.3

With engine bleed for packs off, increase field limit weight by 350 kg and climb limit weight by 1350 kg.
With engine anti-ice on, decrease field limit weight by 200 kg and climb limit weight by 250 kg.
With engine and wing anti-ice on (optional system), decrease field limit weight by 800 kg and climb limit weight by 1500 kg.

Takeoff Field & Climb Limit Weights - Wet Runway
Flaps 5
4000 FT Pressure Altitude

CORR'D FIELD LENGTH (M)	FIELD LIMIT WEIGHT (1000 KG)										
	OAT (°C)										
	-40	10	14	18	22	26	30	38	42	46	50
1220	51.5	46.8	46.5	46.2	45.8	45.2	44.5	42.6	41.6	40.6	39.7
1400	55.9	50.8	50.4	50.1	49.7	49.0	48.2	46.1	45.1	44.0	43.0
1600	60.3	54.8	54.4	54.0	53.6	52.9	52.0	49.8	48.6	47.4	46.4
1800	64.4	58.5	58.1	57.6	57.2	56.4	55.5	53.1	51.8	50.6	49.5
2000	68.2	61.9	61.5	61.1	60.6	59.8	58.8	56.2	54.9	53.6	52.4
2200	71.8	65.2	64.7	64.3	63.8	62.9	61.9	59.2	57.8	56.4	55.1
2400	75.1	68.2	67.7	67.2	66.7	65.8	64.7	61.9	60.4	58.9	57.6
2600	78.1	70.8	70.3	69.8	69.3	68.3	67.2	64.2	62.7	61.2	59.8
2800	80.8	73.3	72.7	72.2	71.7	70.7	69.5	66.4	64.8	63.2	61.8
3000	83.3	75.5	75.0	74.4	73.9	72.8	71.6	68.4	66.7	65.1	63.6
3200	85.9	77.8	77.2	76.7	76.1	75.0	73.7	70.4	68.7	67.0	65.5
3400	86.1	80.0	79.4	78.8	78.3	77.1	75.8	72.4	70.6	68.9	67.3
3600	86.1	82.1	81.5	80.9	80.3	79.2	77.8	74.3	72.5	70.7	69.0
3800	86.1	84.1	83.5	82.9	82.3	81.1	79.7	76.1	74.2	72.4	70.7
4000	86.1	86.1	85.4	84.8	84.2	82.9	81.5	77.8	75.9	74.0	72.3
4200	86.1	86.1	86.1	86.1	86.0	84.8	83.3	79.5	77.6	75.6	73.9
4400	86.1	86.1	86.1	86.1	86.1	86.1	85.1	81.2	79.2	77.2	75.4
4600	86.1	86.1	86.1	86.1	86.1	86.1	86.1	82.8	80.8	78.7	76.9
CLIMB LIMIT WT (1000 KG)	77.7	77.1	77.1	77.0	76.9	75.8	74.2	69.7	67.3	65.1	63.0

6000 FT Pressure Altitude

CORR'D FIELD LENGTH (M)	FIELD LIMIT WEIGHT (1000 KG)										
	OAT (°C)										
	-40	10	14	18	22	26	30	38	42	46	50
1220	48.0	43.7	43.4	43.1	42.5	42.0	41.3	39.5	38.6	37.7	36.9
1400	52.0	47.4	47.0	46.7	46.1	45.5	44.8	42.8	41.8	40.9	40.0
1600	56.1	51.1	50.7	50.4	49.7	49.1	48.3	46.2	45.1	44.1	43.1
1800	59.9	54.5	54.1	53.8	53.1	52.4	51.5	49.2	48.1	47.0	45.9
2000	63.4	57.7	57.3	56.9	56.2	55.4	54.5	52.1	50.9	49.7	48.6
2200	66.8	60.7	60.3	59.9	59.1	58.3	57.4	54.9	53.5	52.3	51.2
2400	69.9	63.5	63.1	62.7	61.9	61.0	60.0	57.4	56.0	54.7	53.5
2600	72.6	65.9	65.5	65.0	64.2	63.3	62.3	59.5	58.1	56.7	55.5
2800	75.1	68.2	67.7	67.2	66.4	65.5	64.4	61.5	60.0	58.6	57.3
3000	77.4	70.3	69.8	69.3	68.4	67.4	66.3	63.3	61.7	60.3	59.0
3200	79.7	72.4	71.8	71.3	70.4	69.4	68.3	65.2	63.6	62.1	60.7
3400	82.0	74.4	73.9	73.3	72.4	71.4	70.2	67.0	65.3	63.8	62.3
3600	84.2	76.4	75.8	75.3	74.3	73.2	72.0	68.7	67.0	65.5	63.9
3800	86.1	78.2	77.6	77.1	76.1	75.0	73.7	70.4	68.6	67.0	65.5
4000	86.1	80.0	79.4	78.8	77.8	76.7	75.4	72.0	70.2	68.5	66.9
4200	86.1	81.7	81.1	80.6	79.5	78.4	77.1	73.5	71.7	70.0	68.4
4400	86.1	83.4	82.8	82.2	81.2	80.0	78.7	75.0	73.2	71.4	69.8
4600	86.1	85.1	84.5	83.9	82.8	81.6	80.2	76.5	74.6	72.9	71.2
CLIMB LIMIT WT (1000 KG)	72.8	72.4	72.3	72.3	71.3	70.3	68.8	64.5	62.3	60.4	58.5

With engine bleed for packs off, increase field limit weight by 350 kg and climb limit weight by 1350 kg.
With engine anti-ice on, decrease field limit weight by 200 kg and climb limit weight by 250 kg.
With engine and wing anti-ice on (optional system), decrease field limit weight by 800 kg and climb limit weight by 1500 kg.

Takeoff Field & Climb Limit Weights - Wet Runway

Flaps 5

8000 FT Pressure Altitude

CORR'D FIELD LENGTH (M)	FIELD LIMIT WEIGHT (1000 KG) OAT (°C)										
	-40	10	14	18	22	26	30	38	42	46	50
1220	44.7	40.8	40.5	40.0	39.5	38.9	38.1	36.3	35.5	34.7	34.0
1400	48.4	44.2	43.9	43.3	42.8	42.1	41.3	39.4	38.5	37.6	36.8
1600	52.2	47.6	47.3	46.7	46.1	45.4	44.5	42.4	41.5	40.6	39.6
1800	55.7	50.8	50.5	49.8	49.2	48.4	47.5	45.2	44.2	43.2	42.3
2000	59.0	53.8	53.4	52.8	52.1	51.3	50.3	47.9	46.8	45.8	44.7
2200	62.1	56.6	56.2	55.5	54.8	54.0	52.9	50.4	49.2	48.1	47.1
2400	65.0	59.2	58.8	58.1	57.3	56.4	55.3	52.7	51.5	50.3	49.2
2600	67.5	61.4	61.0	60.2	59.5	58.5	57.3	54.6	53.4	52.1	51.0
2800	69.8	63.5	63.0	62.3	61.4	60.5	59.2	56.4	55.1	53.8	52.6
3000	71.9	65.4	64.9	64.1	63.3	62.2	61.0	58.0	56.7	55.4	54.1
3200	74.1	67.3	66.8	66.0	65.1	64.1	62.8	59.7	58.3	57.0	55.6
3400	76.1	69.2	68.7	67.8	66.9	65.9	64.5	61.3	59.9	58.5	57.1
3600	78.2	71.0	70.5	69.6	68.7	67.6	66.2	62.9	61.4	60.0	58.6
3800	80.0	72.7	72.2	71.3	70.3	69.2	67.7	64.4	62.9	61.4	60.0
4000	81.9	74.4	73.8	72.9	71.9	70.7	69.3	65.9	64.3	62.8	61.3
4200	83.7	76.0	75.4	74.5	73.5	72.3	70.8	67.3	65.7	64.1	62.6
4400	85.4	77.6	77.0	76.0	75.0	73.8	72.2	68.7	67.0	65.5	63.9
4600	86.1	79.1	78.5	77.5	76.5	75.2	73.7	70.0	68.4	66.7	65.2
CLIMB LIMIT WT (1000 KG)	68.2	67.8	67.8	67.0	66.1	64.9	63.0	58.7	56.9	55.2	53.4

10000 FT Pressure Altitude

CORR'D FIELD LENGTH (M)	FIELD LIMIT WEIGHT (1000 KG) OAT (°C)										
	-40	10	14	18	22	26	30	38	42	46	50
1220	41.7	38.0	37.5	37.0	36.6	36.0	35.3	33.6	32.7	31.9	31.1
1400	45.2	41.2	40.6	40.1	39.6	39.0	38.2	36.3	35.4	34.5	33.6
1600	48.8	44.4	43.8	43.3	42.7	42.0	41.2	39.2	38.2	37.2	36.2
1800	52.0	47.3	46.7	46.1	45.5	44.8	43.9	41.7	40.7	39.7	38.6
2000	55.1	50.1	49.5	48.8	48.2	47.5	46.4	44.2	43.1	42.0	40.9
2200	58.0	52.7	52.1	51.4	50.7	49.9	48.9	46.5	45.3	44.1	43.0
2400	60.6	55.1	54.4	53.7	53.0	52.2	51.1	48.6	47.3	46.1	44.9
2600	62.9	57.2	56.4	55.7	54.9	54.1	52.9	50.3	49.0	47.8	46.5
2800	65.0	59.1	58.3	57.5	56.8	55.9	54.6	51.9	50.6	49.3	47.9
3000	67.0	60.8	60.0	59.2	58.4	57.5	56.2	53.4	52.0	50.6	49.3
3200	69.0	62.6	61.7	60.9	60.1	59.1	57.8	54.9	53.5	52.1	50.6
3400	70.9	64.3	63.4	62.6	61.7	60.8	59.4	56.4	54.9	53.5	52.0
3600	72.8	66.0	65.1	64.2	63.3	62.3	60.9	57.8	56.3	54.8	53.3
3800	74.5	67.5	66.6	65.7	64.8	63.8	62.4	59.2	57.6	56.1	54.5
4000	76.2	69.1	68.1	67.2	66.3	65.2	63.8	60.5	58.9	57.3	55.7
4200	77.9	70.6	69.6	68.7	67.7	66.6	65.1	61.8	60.2	58.5	56.9
4400	79.5	72.0	71.0	70.1	69.1	68.0	66.5	63.1	61.4	59.7	58.1
4600	81.1	73.4	72.4	71.5	70.5	69.3	67.8	64.3	62.6	60.9	59.2
CLIMB LIMIT WT (1000 KG)	64.0	63.4	62.7	61.9	61.0	59.8	58.0	54.0	52.1	50.3	48.4

With engine bleed for packs off, increase field limit weight by 350 kg and climb limit weight by 1350 kg.
With engine anti-ice on, decrease field limit weight by 200 kg and climb limit weight by 250 kg.
With engine and wing anti-ice on (optional system), decrease field limit weight by 800 kg and climb limit weight by 1500 kg.

Takeoff Obstacle Limit Weight

Flaps 5

Sea Level, 30°C & Below, Zero Wind

Based on engine bleed for packs on and anti-ice off

Reference Obstacle Limit Weight (1000 KG)

OBSTACLE HEIGHT (M)	DISTANCE FROM BRAKE RELEASE (100 M)										
	25	30	35	40	45	50	55	60	65	70	75
5	74.0	80.3									
20	68.2	74.1	78.9	82.6							
40	63.2	68.8	73.4	77.1	80.1	82.6	84.6				
60	59.4	64.7	69.2	72.9	76.0	78.6	80.7	82.5	84.0		
80	56.1	61.4	65.8	69.5	72.6	75.3	77.5	79.4	81.1	82.5	83.7
100	53.3	58.5	62.8	66.5	69.6	72.3	74.7	76.7	78.4	79.9	81.2
120	50.9	56.0	60.3	63.9	67.0	69.7	72.1	74.2	76.0	77.6	79.0
140	48.6	53.7	58.0	61.6	64.7	67.4	69.8	71.9	73.8	75.5	76.9
160	46.6	51.6	55.8	59.5	62.6	65.3	67.7	69.9	71.8	73.5	75.0
180	44.7	49.7	53.9	57.5	60.6	63.4	65.8	68.0	69.9	71.6	73.2
200	43.0	48.0	52.1	55.7	58.8	61.6	64.0	66.2	68.1	69.9	71.5
220	41.5	46.4	50.5	54.1	57.2	59.9	62.4	64.5	66.5	68.3	69.9
240		44.8	49.0	52.5	55.6	58.4	60.8	63.0	65.0	66.8	68.4
260		43.4	47.5	51.0	54.2	56.9	59.3	61.5	63.5	65.3	67.0
280		42.1	46.2	49.7	52.8	55.5	58.0	60.2	62.2	64.0	65.6
300			44.9	48.4	51.5	54.2	56.6	58.9	60.9	62.7	64.4

Obstacle height must be calculated from lowest point of the runway to conservatively account for runway slope.

OAT Adjustments

OAT (°C)	REFERENCE OBSTACLE LIMIT WEIGHT (1000 KG)					
	40	50	60	70	80	90
30 & BELOW	0	0	0	0	0	0
32	-0.6	-0.7	-0.9	-1.1	-1.2	-1.4
34	-1.2	-1.5	-1.8	-2.1	-2.5	-2.8
36	-1.7	-2.2	-2.7	-3.2	-3.7	-4.2
38	-2.3	-3.0	-3.6	-4.3	-5.0	-5.6
40	-2.9	-3.7	-4.5	-5.4	-6.2	-7.0
42	-3.4	-4.4	-5.4	-6.4	-7.4	-8.4
44	-4.0	-5.1	-6.3	-7.4	-8.6	-9.7
46	-4.5	-5.8	-7.1	-8.4	-9.8	-11.1
48	-5.1	-6.6	-8.0	-9.5	-10.9	-12.4
50	-5.7	-7.3	-8.9	-10.5	-12.1	-13.8

Pressure Altitude Adjustments

ALT (FT)	OAT ADJUSTED OBSTACLE LIMIT WEIGHT (1000 KG)					
	40	50	60	70	80	90
S.L. & BELOW	0	0	0	0	0	0
1000	-1.5	-1.8	-2.1	-2.5	-2.8	-3.2
2000	-2.9	-3.6	-4.3	-5.0	-5.6	-6.3
3000	-4.3	-5.3	-6.3	-7.3	-8.3	-9.3
4000	-5.6	-7.0	-8.3	-9.7	-11.0	-12.4
5000	-6.9	-8.6	-10.2	-11.9	-13.6	-15.2
6000	-8.2	-10.2	-12.2	-14.2	-16.1	-18.1
7000	-9.3	-11.7	-14.0	-16.3	-18.7	-21.0
8000	-10.5	-13.2	-15.9	-18.5	-21.2	-23.9
9000	-11.6	-14.6	-17.6	-20.5	-23.5	-26.5
10000	-12.8	-16.0	-19.3	-22.5	-25.8	-29.1

Takeoff Obstacle Limit Weight
Flaps 5
Sea Level, 30°C & Below, Zero Wind
Wind Adjustments

WIND (KTS)	OAT & ALT ADJUSTED OBSTACLE LIMIT WEIGHT (1000 KG)					
	40	50	60	70	80	90
15 TW	-9.4	-9.0	-8.7	-8.3	-8.0	-7.7
10 TW	-6.2	-6.0	-5.8	-5.6	-5.3	-5.1
5 TW	-3.1	-3.0	-2.9	-2.8	-2.7	-2.6
0	0	0	0	0	0	0
10 HW	1.1	1.0	0.9	0.8	0.7	0.6
20 HW	2.3	2.1	1.9	1.7	1.5	1.3
30 HW	3.5	3.2	2.9	2.6	2.3	1.9
40 HW	4.7	4.3	3.9	3.5	3.0	2.6

With engine bleed for packs off, increase weight by 550 kg.
With engine anti-ice on, decrease weight by 250 kg.
With engine and wing anti-ice on, decrease weight by 1300 kg (optional system).

Tire Speed Limit Weight

Flaps 5 Limit Weight (1000 KG)

OAT (°C)	AIRPORT PRESSURE ALTITUDE (FT)					
	0	2000	4000	6000	8000	10000
54	86.2	86.2	82.9	76.4	70.4	
52	86.2	86.2	83.5	77.0	70.9	
50	86.2	86.2	84.1	77.5	71.4	65.7
48	86.2	86.2	84.7	78.0	71.9	66.2
46	86.2	86.2	85.3	78.6	72.4	66.6
44	86.2	86.2	85.7	79.2	72.9	67.1
42	86.2	86.2	85.9	79.7	73.4	67.6
40	86.2	86.2	86.2	80.3	73.9	68.1
38	86.2	86.2	86.2	80.9	74.5	68.6
36	86.2	86.2	86.2	81.5	75.0	69.1
34	86.2	86.2	86.2	82.1	75.6	69.6
32	86.2	86.2	86.2	82.7	76.2	70.1
30	86.2	86.2	86.2	83.4	76.7	70.6
28	86.2	86.2	86.2	84.0	77.3	71.1
26	86.2	86.2	86.2	84.6	77.9	71.7
24	86.2	86.2	86.2	85.2	78.5	72.2
22	86.2	86.2	86.2	85.8	79.1	72.7
20	86.2	86.2	86.2	86.2	79.6	73.3
18	86.2	86.2	86.2	86.2	80.2	73.8
16	86.2	86.2	86.2	86.2	80.8	74.4
14	86.2	86.2	86.2	86.2	81.4	74.9
12	86.2	86.2	86.2	86.2	82.0	75.5
10	86.2	86.2	86.2	86.2	82.7	76.1
-40	86.2	86.2	86.2	86.2	86.2	86.2

Increase tire speed limit weight by 600 kg per knot headwind.
Decrease tire speed limit weight by 1100 kg per knot tailwind.

Brake Energy Limits VMBE

Maximum Brake Energy Speed

OAT (°C)	REFERENCE VMBE (KIAS)						
	PRESSURE ALTITUDE (FT)						
	-2000	0	2000	4000	6000	8000	10000
54	195	188					
50	195	189	182				
46	196	189	183	176			
42	197	190	184	177	171		
38	198	191	184	178	172	166	
34	199	192	185	179	173	167	161
30	200	192	186	180	174	168	162
26	202	194	187	181	175	169	163
22	203	195	189	182	176	170	163
18	205	197	190	183	177	171	164
14	207	198	191	185	178	172	166
10	208	200	193	186	180	173	167
6	210	202	194	188	181	174	168
2	210	203	196	189	182	176	169
-2	210	205	198	191	184	177	171
-6	210	207	199	192	185	179	172
-10	210	209	201	194	187	180	174

Weight Adjusted VMBE

WEIGHT (1000 KG)	REFERENCE VMBE (KIAS)														
	140	145	150	155	160	165	170	175	180	185	190	195	200	205	210
42	167	174	180	186	192	198	204	210	210	210	210	210	210	210	210
46	159	165	170	176	182	188	194	200	205	210	210	210	210	210	210
50	152	157	163	168	174	179	185	190	196	201	207	210	210	210	210
54	145	151	156	161	166	172	177	182	187	193	198	203	208	210	210
58	140	145	150	155	160	165	170	175	180	185	190	195	200	205	210
62	135	140	144	149	154	159	164	168	173	178	183	188	193	197	202
66	130	135	139	144	149	153	158	163	167	172	177	181	186	191	195
70	126	131	135	140	144	149	153	158	162	167	171	176	180	185	189
74	123	127	131	136	140	144	149	153	157	162	166	170	175	179	183
78	120	124	128	132	136	141	145	149	153	157	162	166	170	174	178
82	117	121	125	129	133	137	141	145	149	153	157	161	166	170	174
86	115	119	122	126	130	134	138	142	146	150	154	158	161	165	169

Increase VMBE by 1 knot per 1% uphill runway slope. Decrease VMBE by 4 knots per 1% downhill runway slope.
Increase VMBE by 3 knots per 10 knots headwind. Decrease VMBE by 19 knots per 10 knots tailwind.
Decrease brake release weight by 500 kg for each knot V1 exceeds VMBE.
Determine normal V1, VR, V2 speeds for lower brake release weight.

Performance Dispatch — Chapter PD
Enroute — Section 51

Long Range Cruise Maximum Operating Altitude
Max Cruise Thrust
ISA + 10°C and Below

WEIGHT (1000 KG)	OPTIMUM ALT (FT)	TAT (°C)	MARGIN TO INITIAL BUFFET 'G' (BANK ANGLE)				
			1.20 (33°)	1.25 (36°)	1.30 (39°)	1.40 (44°)	1.50 (48°)
85	32300	-10	34300*	34300*	33800	32200	30800
80	33600	-13	35800*	35800*	35100	33500	32100
75	35000	-16	37100*	37100*	36400	34900	33500
70	36400	-18	38400*	38400*	37900	36300	35000
65	38000	-18	39800*	39800*	39400	37800	36500
60	39600	-18	41000	41000	41000	39500	38200
55	41000	-18	41000	41000	41000	41000	40000
50	41000	-18	41000	41000	41000	41000	41000
45	41000	-18	41000	41000	41000	41000	41000
40	41000	-18	41000	41000	41000	41000	41000

ISA + 15°C

WEIGHT (1000 KG)	OPTIMUM ALT (FT)	TAT (°C)	MARGIN TO INITIAL BUFFET 'G' (BANK ANGLE)				
			1.20 (33°)	1.25 (36°)	1.30 (39°)	1.40 (44°)	1.50 (48°)
85	32300	-4	33000*	33000*	33000*	32200	30800
80	33600	-7	34700*	34700*	34700*	33500	32100
75	35000	-10	36200*	36200*	36200*	34900	33500
70	36400	-12	37600*	37600*	37600*	36300	35000
65	38000	-12	38900*	38900*	38900*	37800	36500
60	39600	-12	40400*	40400*	40400*	39500	38200
55	41000	-12	41000	41000	41000	41000	40000
50	41000	-12	41000	41000	41000	41000	41000
45	41000	-12	41000	41000	41000	41000	41000
40	41000	-12	41000	41000	41000	41000	41000

ISA + 20°C

WEIGHT (1000 KG)	OPTIMUM ALT (FT)	TAT (°C)	MARGIN TO INITIAL BUFFET 'G' (BANK ANGLE)				
			1.20 (33°)	1.25 (36°)	1.30 (39°)	1.40 (44°)	1.50 (48°)
85	32300	2	29400*	29400*	29400*	29400*	29400*
80	33600	-1	32200*	32200*	32200*	32200*	32100
75	35000	-4	34700*	34700*	34700*	34700*	33500
70	36400	-7	36200*	36200*	36200*	36200*	35000
65	38000	-7	37700*	37700*	37700*	37700*	36500
60	39600	-7	39100*	39100*	39100*	39100*	38200
55	41000	-7	40500*	40500*	40500*	40500*	40000
50	41000	-7	41000	41000	41000	41000	41000
45	41000	-7	41000	41000	41000	41000	41000
40	41000	-7	41000	41000	41000	41000	41000

***Denotes altitude thrust limited in level flight, 100 fpm residual rate of climb.**

Long Range Cruise Trip Fuel and Time

Ground to Air Miles Conversion

AIR DISTANCE (NM)					GROUND DISTANCE (NM)	AIR DISTANCE (NM)				
HEADWIND COMPONENT (KTS)						TAILWIND COMPONENT (KTS)				
100	80	60	40	20		20	40	60	80	100
279	259	241	226	212	200	190	181	173	166	159
556	516	481	451	424	400	382	364	349	334	321
832	774	721	676	636	600	573	547	524	503	484
1108	1030	960	900	848	800	764	730	700	672	646
1383	1286	1200	1125	1059	1000	955	914	875	840	809
1657	1542	1439	1349	1271	1200	1146	1097	1051	1009	971
1931	1797	1677	1574	1483	1400	1338	1280	1227	1178	1134
2204	2052	1916	1798	1694	1600	1529	1464	1403	1347	1297
2477	2307	2154	2022	1905	1800	1721	1647	1579	1517	1460
2749	2561	2392	2246	2117	2000	1912	1830	1755	1686	1623
3021	2815	2630	2470	2328	2200	2104	2014	1932	1856	1787
3292	3069	2868	2694	2540	2400	2295	2198	2108	2025	1950
3563	3322	3105	2917	2751	2600	2487	2382	2284	2195	2114
3832	3574	3342	3140	2962	2800	2678	2565	2461	2365	2277
4101	3826	3579	3363	3173	3000	2870	2749	2637	2535	2441
4369	4077	3814	3586	3384	3200	3061	2933	2814	2704	2605
4636	4328	4050	3808	3594	3400	3253	3116	2990	2874	2769
4902	4578	4285	4030	3805	3600	3445	3300	3166	3044	2932
5168	4827	4520	4252	4015	3800	3636	3484	3343	3214	3096
5433	5076	4755	4474	4226	4000	3828	3668	3520	3384	3260
5697	5325	4989	4696	4436	4200	4019	3851	3696	3554	3424
5961	5573	5223	4917	4647	4400	4211	4035	3873	3724	3588
6224	5820	5457	5139	4857	4600	4403	4219	4050	3894	3751
6486	6068	5690	5360	5067	4800	4594	4403	4226	4064	3915
6747	6314	5923	5581	5277	5000	4786	4587	4403	4233	4079

Long Range Cruise Trip Fuel and Time

Reference Fuel and Time Required

AIR DIST (NM)	PRESSURE ALTITUDE (1000 FT)									
	29		31		33		35		37	
	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)
200	1.5	0:38	1.5	0:37	1.5	0:37	1.5	0:36	1.5	0:36
400	2.5	1:10	2.4	1:09	2.4	1:07	2.4	1:06	2.4	1:04
600	3.5	1:42	3.4	1:40	3.4	1:37	3.3	1:34	3.3	1:32
800	4.5	2:14	4.4	2:11	4.3	2:07	4.3	2:03	4.2	2:00
1000	5.5	2:45	5.4	2:41	5.3	2:36	5.2	2:32	5.1	2:28
1200	6.6	3:16	6.5	3:11	6.3	3:05	6.2	2:59	6.1	2:55
1400	7.7	3:47	7.5	3:41	7.3	3:34	7.2	3:27	7.0	3:22
1600	8.7	4:18	8.5	4:11	8.3	4:02	8.1	3:55	8.0	3:50
1800	9.8	4:49	9.6	4:40	9.3	4:31	9.1	4:23	8.9	4:17
2000	10.9	5:19	10.6	5:10	10.3	5:00	10.1	4:51	9.8	4:44
2200	12.0	5:49	11.7	5:38	11.4	5:27	11.1	5:18	10.9	5:11
2400	13.1	6:18	12.8	6:07	12.5	5:55	12.1	5:45	11.9	5:38
2600	14.3	6:48	13.9	6:35	13.5	6:23	13.1	6:13	12.9	6:05
2800	15.4	7:17	15.0	7:04	14.6	6:51	14.2	6:40	13.9	6:32
3000	16.5	7:47	16.1	7:32	15.6	7:18	15.2	7:07	14.9	6:58
3200	17.7	8:15	17.2	8:00	16.7	7:45	16.3	7:34	15.9	7:25
3400	18.9	8:43	18.4	8:27	17.8	8:12	17.3	8:01	17.0	7:52
3600	20.0	9:11	19.5	8:55	18.9	8:39	18.4	8:27	18.0	8:18
3800	21.2	9:39	20.6	9:22	20.0	9:06	19.5	8:54	19.1	8:45
4000	22.4	10:08	21.8	9:50	21.2	9:33	20.6	9:21	20.2	9:11
4200	23.6	10:35	23.0	10:16	22.3	10:00	21.7	9:47	21.3	9:38
4400	24.9	11:02	24.2	10:43	23.5	10:26	22.8	10:14	22.4	10:04
4600	26.1	11:29	25.4	11:10	24.6	10:53	24.0	10:40	23.6	10:31
4800	27.4	11:56	26.6	11:37	25.8	11:20	25.1	11:07	24.7	10:57
5000	28.6	12:24	27.8	12:04	27.0	11:46	26.3	11:33	25.9	11:24

Fuel Required Adjustments (1000 KG)

REFERENCE FUEL REQUIRED (1000 KG)	LANDING WEIGHT (1000 KG)						
	40	45	50	55	60	65	70
2	-0.2	-0.1	0.0	0.1	0.3	0.4	0.5
4	-0.3	-0.2	0.0	0.2	0.5	0.7	1.0
6	-0.5	-0.2	0.0	0.3	0.7	1.1	1.7
8	-0.6	-0.3	0.0	0.5	1.0	1.6	2.4
10	-0.8	-0.4	0.0	0.6	1.3	2.1	3.2
12	-1.0	-0.5	0.0	0.7	1.6	2.6	4.0
14	-1.1	-0.6	0.0	0.9	1.9	3.1	4.9
16	-1.3	-0.7	0.0	1.0	2.2	3.8	5.9
18	-1.5	-0.8	0.0	1.2	2.6	4.4	7.0
20	-1.7	-0.9	0.0	1.4	3.0	5.1	8.1
22	-1.8	-1.0	0.0	1.6	3.4	5.8	9.3
24	-2.0	-1.0	0.0	1.8	3.8	6.6	10.6
26	-2.2	-1.1	0.0	2.0	4.3	7.4	11.9
28	-2.4	-1.2	0.0	2.2	4.8	8.3	13.3
30	-2.6	-1.3	0.0	2.4	5.3	9.2	14.8
32	-2.8	-1.4	0.0	2.7	5.8	10.1	16.4

Based on 280/.78 climb, Long Range Cruise and .78/280/250 descent.

Long Range Cruise Step Climb

Ground to Air Miles Conversion

AIR DISTANCE (NM)					GROUND DISTANCE (NM)	AIR DISTANCE (NM)				
HEADWIND COMPONENT (KTS)						TAILWIND COMPONENT (KTS)				
100	80	60	40	20		20	40	60	80	100
1321	1241	1171	1108	1051	1000	954	911	873	837	804
1839	1730	1634	1548	1470	1400	1336	1278	1225	1176	1130
2354	2218	2096	1987	1889	1800	1719	1645	1577	1515	1457
2869	2704	2558	2426	2308	2200	2102	2012	1930	1854	1784
3383	3190	3019	2865	2726	2600	2485	2380	2283	2194	2112
3895	3676	3480	3304	3145	3000	2868	2747	2636	2534	2439
4407	4161	3940	3742	3563	3400	3251	3115	2990	2874	2768
4919	4645	4401	4180	3981	3800	3635	3483	3344	3215	3096
5430	5130	4861	4619	4399	4200	4018	3851	3697	3556	3424
5942	5614	5321	5057	4818	4600	4401	4219	4051	3896	3753
6453	6099	5781	5495	5236	5000	4785	4587	4405	4237	4081

Trip Fuel and Time Required

AIR DIST (NM)	TRIP FUEL (1000 KG)							TIME (HRS:MIN)
	LANDING WEIGHT (1000 KG)							
	40	45	50	55	60	65	70	
1000	4.5	4.8	5.1	5.4	5.7	6.2	6.5	2:26
1400	6.1	6.5	6.9	7.3	7.9	8.4	8.9	3:20
1800	7.8	8.3	8.8	9.4	10.1	10.8	11.3	4:14
2200	9.5	10.0	10.7	11.4	12.3	13.1	13.9	5:08
2600	11.2	11.9	12.6	13.6	14.6	15.6	16.5	6:01
3000	12.9	13.7	14.7	15.8	16.9	18.1	19.2	6:54
3400	14.7	15.7	16.8	18.0	19.4	20.7	22.0	7:46
3800	16.5	17.6	19.0	20.4	21.9	23.4	24.8	8:39
4200	18.4	19.7	21.2	22.7	24.4	26.2	27.8	9:31
4600	20.3	21.7	23.4	25.2	27.1	29.0	30.8	10:23
5000	22.2	23.9	25.7	27.7	29.8	31.9	33.9	11:16

Based on 280/.78 climb, Long Range Cruise and .78/280/250 descent.
Valid for all pressure altitudes with 4000 ft step climb to 2000 ft above optimum altitude.

Short Trip Fuel and Time

Ground to Air Miles Conversion

AIR DISTANCE (NM) HEADWIND COMPONENT (KTS)					GROUND DISTANCE (NM)	AIR DISTANCE (NM) TAILWIND COMPONENT (KTS)				
100	80	60	40	20		20	40	60	80	100
93	80	69	61	55	50	46	42	39	36	34
161	143	129	118	108	100	93	87	81	77	73
227	206	188	174	161	150	140	132	125	118	112
291	267	246	229	213	200	188	178	168	160	152
355	327	304	283	266	250	236	224	212	202	193
417	387	361	338	318	300	284	270	257	245	234
480	447	418	392	370	350	332	316	301	288	276
543	507	475	447	422	400	380	362	345	330	317
607	567	533	502	475	450	428	408	390	373	358
673	629	591	557	527	500	476	453	433	415	398

Trip Fuel and Time Required

AIR DIST (NM)		LANDING WEIGHT (1000 KG)							TIME (HRS:MIN)
		40	45	50	55	60	65	70	
50	FUEL (1000 KG)	0.5	0.6	0.6	0.6	0.7	0.7	0.7	0:14
	ALT (FT)	12000	12000	11000	8000	8000	10000	8000	
100	FUEL (1000 KG)	0.8	0.9	0.9	1.0	1.0	1.1	1.1	0:23
	ALT (FT)	18000	17000	16000	15000	15000	15000	16000	
150	FUEL (1000 KG)	1.1	1.2	1.2	1.3	1.3	1.4	1.5	0:31
	ALT (FT)	25000	24000	24000	23000	23000	22000	21000	
200	FUEL (1000 KG)	1.3	1.4	1.5	1.6	1.6	1.7	1.8	0:38
	ALT (FT)	31000	29000	27000	26000	26000	25000	24000	
250	FUEL (1000 KG)	1.5	1.6	1.7	1.8	1.9	2.0	2.1	0:44
	ALT (FT)	39000	37000	35000	31000	31000	31000	29000	
300	FUEL (1000 KG)	1.7	1.8	2.0	2.1	2.2	2.3	2.4	0:51
	ALT (FT)	41000	41000	39000	37000	35000	35000	33000	
350	FUEL (1000 KG)	1.9	2.0	2.2	2.3	2.4	2.6	2.7	0:57
	ALT (FT)	41000	41000	39000	39000	37000	35000	35000	
400	FUEL (1000 KG)	2.1	2.2	2.4	2.5	2.7	2.8	3.0	1:03
	ALT (FT)	41000	41000	41000	39000	39000	37000	35000	
450	FUEL (1000 KG)	2.3	2.5	2.6	2.8	2.9	3.1	3.3	1:10
	ALT (FT)	41000	41000	41000	41000	39000	37000	35000	
500	FUEL (1000 KG)	2.5	2.7	2.8	3.0	3.2	3.4	3.5	1:17
	ALT (FT)	41000	41000	41000	41000	39000	37000	35000	

Based on 280/.78 climb, Long Range Cruise and .78/280/250 descent.

Holding Planning

Flaps Up

WEIGHT (1000 KG)	TOTAL FUEL FLOW (KG/HR)								
	PRESSURE ALTITUDE (FT)								
	1500	5000	10000	15000	20000	25000	30000	35000	41000
85	3000	2950	2920	2900	2850	2860	2910		
80	2840	2790	2760	2740	2680	2680	2720		
75	2680	2630	2600	2570	2520	2500	2540	2600	
70	2520	2470	2440	2410	2360	2320	2360	2400	
65	2370	2320	2280	2240	2210	2150	2190	2220	
60	2210	2160	2120	2080	2050	1990	2010	2030	
55	2060	2000	1960	1920	1890	1840	1840	1860	1970
50	1910	1850	1800	1770	1730	1720	1700	1710	1790
45	1750	1700	1680	1640	1600	1570	1540	1540	1600
40	1640	1580	1530	1480	1450	1420	1400	1370	1420

This table includes 5% additional fuel for holding in a racetrack pattern.

Flight Crew Requirements for Chemical Passenger Oxygen System

Required Pressure (PSI) for 76 Cu. Ft. Cylinder

BOTTLE TEMPERATURE		NUMBER OF CREW USING OXYGEN		
°C	°F	2	3	4
50	122	735	1055	1360
45	113	725	1040	1340
40	104	715	1020	1320
35	95	700	1005	1300
30	86	690	990	1280
25	77	680	975	1255
20	68	670	960	1240
15	59	655	940	1215
10	50	645	925	1195
5	41	635	910	1175
0	32	620	890	1150
-5	23	610	875	1130
-10	14	600	860	1110

Required Pressure (PSI) for 114/115 Cubic Ft. Cylinder

BOTTLE TEMPERATURE		NUMBER OF CREW USING OXYGEN		
°C	°F	2	3	4
50	122	530	735	945
45	113	520	725	930
40	104	510	715	915
35	95	505	700	900
30	86	495	690	885
25	77	485	680	870
20	68	480	670	860
15	59	470	655	840
10	50	460	645	830
5	41	455	635	815
0	32	445	620	800
-5	23	440	610	785
-10	14	430	600	770

Flight Crew and Supernumerary Requirements for Freighter Oxygen System

Table 1
Crew and Supernumerary Oxygen

NUMBER OF CREW AND SUPERNUMERARIES	LITERS OF UNDILUTED (100%) OXYGEN TIME (MINUTES)				
	30	60	90	120	180
2	1210	1740	2100	2450	3150
3	1560	2350	2880	3410	4470
4	1900	2960	3660	4370	5780
5	2240	3560	4440	5330	7090
6	2580	4170	5230	6280	8400
7	2920	4770	6010	7240	9710
8	3260	5380	6790	8200	11030

For more extensive than normal crew usage, add 2.05 liters/person/minute for each crew member at 8000 ft cabin altitude when regulator setting is NORMAL; or 13 liters/person/minute when regulator setting is 100%.

Table 2
Volume to Pressure Conversion for Two 115 Cubic Ft. Cylinders

OXYGEN VOLUME (1000 LITERS)	CYLINDER PRESSURE AT 21°C (PSI)
0.3	200
0.7	300
1.0	400
1.4	500
1.7	600
2.1	700
2.4	800
2.8	900
3.1	1000
3.5	1100
3.8	1200
4.2	1300
4.5	1400
4.9	1500
5.2	1600
5.5	1700
5.9	1800
6.2	1900
6.6	2000

Check maximum pressure in shaded area. Maximum cylinder pressure = 1850 PSI at 21°C. For maximum cylinder pressure at hotter or colder temperatures, add or subtract 32 PSI per 5°C, respectively.

Table 3
Temperature Corrections

CYLINDER PRESSURE AT 21°C (PSI)	PRESSURE CORRECTION FOR EACH 5°C ABOVE/BELOW 21°C (PSI)
400	+7/-7
600	+11/-11
800	+14/-14
1000	+17/-17
1200	+21/-21
1400	+24/-24
1600	+28/-28
1800	+31/-31
2000	+34/-34

ENGINE INOP

MAX CONTINUOUS THRUST

Net Level Off Weight

PRESSURE ALTITUDE (1000 FT)	LEVEL OFF WEIGHT (1000 KG)		
	ISA + 10°C & BELOW	ISA + 15°C	ISA + 20°C
30	44.3	42.9	41.4
28	47.9	46.3	44.7
26	51.7	49.9	48.3
24	56.0	54.1	52.2
22	61.0	58.8	56.7
20	66.3	63.9	61.4
18	71.2	68.5	65.6
16	76.0	73.3	70.3
14	80.4	77.7	75.1
12	85.1	82.1	78.9

Anti-Ice Adjustments

ANTI-ICE CONFIGURATION	LEVEL OFF WEIGHT ADJUSTMENT (1000 KG)								
	PRESSURE ALTITUDE (1000 FT)								
	12	14	16	18	20	22	24	26	28
ENGINE ONLY	-2.0	-1.9	-1.8	-1.8	-1.6	-1.5	-1.4	-1.3	-1.2
ENGINE & WING	-7.8	-7.3	-6.8	-6.8	-6.6	-6.0	-5.4	-5.0	

Intentionally
Blank

Performance Dispatch — Chapter PD
Landing — Section 52

Landing Field Limit Weight - Dry Runway
Flaps 40
Based on anti-skid operative and automatic speedbrakes
Wind Corrected Field Length (M)

FIELD LENGTH AVAILABLE (M)	WIND COMPONENT (KTS)							
	-15	-10	-5	0	10	20	30	40
1200			1090	1200	1270	1350	1420	1500
1400	1060	1160	1270	1400	1480	1560	1640	1720
1600	1240	1340	1460	1600	1680	1770	1850	1940
1800	1420	1520	1650	1800	1890	1980	2070	2170
2000	1600	1710	1840	2000	2090	2190	2290	2390
2200	1770	1890	2030	2200	2300	2400	2500	2610
2400	1950	2070	2220	2400	2500	2610	2720	2830
2600	2110	2250	2380	2600	2710	2820	2930	3050
2800	2210	2350	2530	2800	2910	3030	3150	3280
3000	2300	2450	2680	3000	3120	3240	3360	3500
3200	2390	2540	2840	3200	3320	3450	3580	
3400	2480	2630	2990	3400	3530			
3600	2570	2730	3140	3600				
3800	2660	2820	3290					
4000	2750	2910	3450					
4200	2850	3000	3600					
4400	2940	3100						
4600	3030	3190						
4800	3120	3280						
5000	3210	3380						

Field Limit Weight (1000 KG)

WIND CORR'D FIELD LENGTH (M)	AIRPORT PRESSURE ALTITUDE (FT)					
	0	2000	4000	6000	8000	10000
1200	46.2	43.6	41.1	38.7		
1400	56.0	53.2	50.2	47.3	44.5	41.8
1600	64.0	61.1	58.3	55.6	52.7	49.5
1800	72.7	69.0	65.5	62.5	59.5	56.7
2000	81.8	77.5	73.5	69.7	66.0	62.8
2200		85.6	81.6	77.3	73.2	69.2
2400			88.1	84.8	80.4	75.9
2600					85.9	81.9
2800						85.3

Decrease field limit weight by 4350 kg when using manual speedbrakes.

Landing Field Limit Weight - Dry Runway

Flaps 40

Based on anti-skid inoperative and manual speedbrakes

Wind Corrected Field Length (M)

FIELD LENGTH AVAILABLE (M)	WIND COMPONENT (KTS)							
	-15	-10	-5	0	10	20	30	40
1200				1200	1350	1470	1650	1770
1400			1170	1400	1560	1680	1860	1990
1600		1130	1370	1600	1760	1890	2070	2210
1800	1080	1320	1560	1800	1960	2100	2290	2430
2000	1260	1500	1750	2000	2170	2310	2500	2650
2200	1440	1690	1950	2200	2370	2520	2710	2870
2400	1620	1880	2140	2400	2570	2730	2920	3090
2600	1800	2060	2330	2600	2780	2940	3130	3310
2800	1980	2250	2520	2800	2980	3150	3340	3530
3000	2160	2440	2720	3000	3180	3360	3550	3750
3200	2340	2620	2910	3200	3390	3580	3760	3970
3400	2520	2810	3100	3400	3590	3790	3970	4190
3600	2700	3000	3300	3600	3790	4000	4180	4410
3800	2890	3180	3490	3800	4000	4210	4400	4630
4000	3070	3370	3680	4000	4200	4420	4610	4850
4200	3250	3560	3870	4200	4400	4630	4820	5070
4400	3430	3750	4070	4400	4610	4840	5030	5290
4600	3610	3930	4260	4600	4810	5050	5240	5510
4800	3790	4120	4450	4800	5020	5260	5450	5730
5000	3970	4310	4650	5000	5220	5470	5660	5950

Field Limit Weight (1000 KG)

WIND CORR'D FIELD LENGTH (M)	AIRPORT PRESSURE ALTITUDE (FT)					
	0	2000	4000	6000	8000	10000
2200	41.8	39.1				
2400	46.6	43.7	40.3			
2600	51.4	48.2	44.7	41.8	39.1	
2800	56.2	52.8	49.0	45.9	43.0	40.0
3000	60.9	57.3	53.3	50.0	46.8	43.7
3200	65.8	61.8	57.6	54.1	50.7	47.4
3400	71.2	66.5	61.9	58.2	54.6	51.1
3600	76.6	71.6	66.3	62.3	58.4	54.7
3800	82.2	76.8	71.2	66.5	62.3	58.4
4000	87.8	82.1	76.1	71.1	66.2	62.0
4200		87.4	81.1	75.7	70.6	65.7
4400			86.1	80.4	74.9	69.8
4600				85.1	79.4	73.9
4800					83.8	77.9
5000						82.0
5200						86.0

Landing Field Limit Weight - Wet Runway

Flaps 40

Based on anti-skid operative and automatic speedbrakes

Wind Corrected Field Length (M)

FIELD LENGTH AVAILABLE (M)	WIND COMPONENT (KTS)							
	-15	-10	-5	0	10	20	30	40
1200				1200	1280	1360	1440	1530
1400			1270	1400	1480	1570	1660	1750
1600	1220	1330	1460	1600	1690	1780	1870	1970
1800	1390	1510	1640	1800	1890	1990	2090	2190
2000	1570	1690	1830	2000	2100	2200	2300	2410
2200	1750	1870	2020	2200	2300	2410	2520	2630
2400	1920	2050	2210	2400	2510	2620	2740	2860
2600	2100	2230	2400	2600	2710	2830	2950	3080
2800	2280	2420	2590	2800	2920	3040	3170	3300
3000	2440	2600	2740	3000	3120	3250	3380	3520
3200	2530	2700	2900	3200	3330	3460	3600	3740
3400	2620	2790	3050	3400	3530	3670	3820	3970
3600	2710	2880	3200	3600	3740	3880	4030	
3800	2800	2980	3350	3800	3940	4090		
4000	2890	3070	3510	4000				
4200	2980	3160	3660					
4400	3080	3250	3810					
4600	3170	3350	3960					
4800	3260	3440	4120					
5000	3350	3530						

Field Limit Weight (1000 KG)

WIND CORR'D FIELD LENGTH (M)	AIRPORT PRESSURE ALTITUDE (FT)					
	0	2000	4000	6000	8000	10000
1200	38.4					
1400	47.1	44.5	41.9	39.5		
1600	55.6	52.8	49.8	46.9	44.1	41.5
1800	62.6	59.8	57.1	54.4	51.2	48.2
2000	70.0	66.5	63.3	60.4	57.6	54.8
2200	77.8	73.8	70.0	66.4	63.2	60.1
2400	85.3	81.3	77.0	73.0	69.1	65.4
2600		87.5	84.0	79.6	75.4	71.3
2800				85.7	81.6	77.1
3000					86.0	82.1
3200						85.0
3400						88.0

Decrease field limit weight by 4350 kg when using manual speedbrakes.

Landing Field Limit Weight - Wet Runway

Flaps 40

Based on anti-skid inoperative and manual speedbrakes

Wind Corrected Field Length (M)

FIELD LENGTH AVAILABLE (M)	WIND COMPONENT (KTS)							
	-15	-10	-5	0	10	20	30	40
1200				1200	1370	1500	1710	1840
1400				1400	1580	1710	1920	2060
1600			1340	1600	1780	1920	2130	2280
1800		1260	1530	1800	1980	2130	2340	2500
2000	1180	1450	1730	2000	2190	2340	2550	2720
2200	1360	1640	1920	2200	2390	2550	2760	2940
2400	1540	1820	2110	2400	2590	2760	2980	3160
2600	1720	2010	2310	2600	2800	2970	3190	3380
2800	1900	2200	2500	2800	3000	3180	3400	3600
3000	2080	2380	2690	3000	3200	3390	3610	3820
3200	2260	2570	2880	3200	3410	3610	3820	4040
3400	2440	2760	3080	3400	3610	3820	4030	4260
3600	2620	2940	3270	3600	3810	4030	4240	4480
3800	2800	3130	3460	3800	4020	4240	4450	4700
4000	2980	3320	3660	4000	4220	4450	4660	4920
4200	3160	3500	3850	4200	4420	4660	4880	5140
4400	3350	3690	4040	4400	4630	4870	5090	5360
4600	3530	3880	4230	4600	4830	5080	5300	5580
4800	3710	4060	4430	4800	5040	5290	5510	5800
5000	3890	4250	4620	5000	5240	5500	5720	6020

Field Limit Weight (1000 KG)

WIND CORR'D FIELD LENGTH (M)	AIRPORT PRESSURE ALTITUDE (FT)					
	0	2000	4000	6000	8000	10000
2400	39.0					
2600	43.2	40.5				
2800	47.4	44.5	41.1	38.4		
3000	51.6	48.4	44.9	42.0	39.2	
3200	55.7	52.4	48.6	45.6	42.6	39.7
3400	59.9	56.3	52.4	49.2	46.0	42.9
3600	64.1	60.3	56.2	52.7	49.4	46.1
3800	68.6	64.2	59.9	56.3	52.7	49.3
4000	73.3	68.5	63.6	59.8	56.1	52.5
4200	78.1	73.0	67.6	63.3	59.4	55.7
4400	82.9	77.5	71.9	67.0	62.8	58.8
4600	87.8	82.1	76.1	71.1	66.2	62.0
4800		86.7	80.5	75.1	70.0	65.2
5000			84.8	79.2	73.8	68.7
5200				83.3	77.6	72.3
5400				87.4	81.5	75.8
5600					85.4	79.3
5800						82.8
6000						86.4

Landing Climb Limit Weight

Valid for approach with flaps 15 and landing with flaps 40

Based on engine bleed for packs on and anti-ice off

AIRPORT OAT		LANDING CLIMB LIMIT WEIGHT (1000 KG)												
		AIRPORT PRESSURE ALTITUDE (FT)												
°C	°F	-2000	-1000	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
54	129	68.6	66.6	64.5										
52	126	69.8	68.3	66.2	63.6									
50	122	71.1	69.6	67.9	65.2	62.6								
48	118	72.4	70.9	69.2	66.9	64.2	61.6							
46	115	73.9	72.3	70.5	68.1	65.8	63.2	60.6						
44	111	75.2	73.6	71.7	69.3	67.0	64.7	62.1	59.6					
42	108	76.5	74.9	73.0	70.5	68.2	65.8	63.6	61.0	58.3				
40	104	77.8	76.2	74.3	71.8	69.4	67.0	64.7	62.5	59.6	56.9			
38	100	79.1	77.5	75.6	73.1	70.6	68.2	65.8	63.6	60.9	58.0	55.5		
36	97	80.4	78.8	76.9	74.5	71.8	69.5	67.1	64.7	62.1	59.2	56.5	54.1	
34	93	81.6	80.1	78.3	75.8	73.2	70.7	68.3	65.8	63.1	60.3	57.4	55.2	52.7
32	90	81.7	81.4	79.7	77.0	74.5	71.8	69.4	66.8	64.1	61.3	58.5	56.2	53.8
30	86	81.8	81.5	81.1	78.2	75.6	72.8	70.2	67.8	65.1	62.3	59.5	57.1	54.8
28	82	81.9	81.6	81.2	79.3	76.6	73.7	71.1	68.4	66.0	63.2	60.4	58.1	55.7
26	79	82.0	81.7	81.2	79.4	77.5	74.5	71.8	69.1	66.5	64.1	61.3	58.8	56.6
24	75	82.1	81.7	81.3	79.5	77.6	75.2	72.4	69.6	67.0	64.5	62.1	59.6	57.2
22	72	82.1	81.8	81.4	79.5	77.6	75.3	72.9	70.2	67.5	65.0	62.6	60.2	57.7
20	68	82.2	81.9	81.4	79.6	77.7	75.3	72.9	70.7	68.0	65.4	63.0	60.6	58.2
18	64	82.3	81.9	81.5	79.6	77.7	75.4	73.0	70.7	68.5	65.9	63.4	61.0	58.6
16	61	82.3	82.0	81.6	79.7	77.8	75.4	73.0	70.8	68.5	66.3	63.8	61.4	59.0
14	57	82.4	82.1	81.6	79.7	77.8	75.4	73.1	70.8	68.6	66.3	64.2	61.7	59.4
12	54	82.5	82.1	81.7	79.8	77.9	75.5	73.1	70.8	68.6	66.4	64.2	62.1	59.7
10	50	82.5	82.2	81.7	79.8	77.9	75.5	73.1	70.9	68.6	66.4	64.2	62.1	60.0
-40	-40	83.2	82.9	82.3	80.4	78.5	76.0	73.7	71.4	69.1	65.9	64.6	62.6	60.6

With engine bleeds for packs off, increase weight by 1250 kg.
With engine anti-ice on, decrease weight by 250 kg.
With engine and wing anti-ice on, decrease weight by 1400 kg.
When operating in icing conditions during any part of the flight with forecast landing temperature below 10°C, decrease weight by 7350 kg.

ENGINE INOP

ADVISORY INFORMATION

Go-Around Climb Gradient

Flaps 15

Based on engine bleed for packs on and anti-ice off

OAT (°C)	REFERENCE GO-AROUND GRADIENT (%)					
	PRESSURE ALTITUDE (FT)					
	0	2000	4000	6000	8000	10000
54	2.91					
50	3.58	2.52				
46	4.09	3.17	2.12			
42	4.60	3.64	2.72	1.66		
38	5.12	4.11	3.16	2.18	1.09	
34	5.64	4.62	3.63	2.62	1.48	0.55
30	6.19	5.08	4.02	2.99	1.89	0.97
26	6.22	5.44	4.31	3.27	2.24	1.30
22	6.25	5.46	4.53	3.46	2.48	1.53
18	6.27	5.48	4.54	3.63	2.64	1.70
14	6.30	5.50	4.55	3.65	2.78	1.84
10	6.32	5.51	4.57	3.66	2.79	1.97
6	6.34	5.53	4.58	3.67	2.80	1.99
2	6.36	5.54	4.59	3.68	2.81	2.00

Gradient Adjustment for Weight (%)

WEIGHT (1000 KG)	REFERENCE GO-AROUND GRADIENT (%)							
	0	1	2	3	4	5	6	7
85	-2.90	-3.11	-3.43	-3.78	-4.09	-4.40	-4.72	-5.04
80	-2.43	-2.67	-2.95	-3.24	-3.51	-3.77	-4.05	-4.32
75	-1.93	-2.14	-2.37	-2.60	-2.81	-3.03	-3.25	-3.47
70	-1.38	-1.54	-1.70	-1.86	-2.02	-2.17	-2.33	-2.49
65	-0.75	-0.83	-0.92	-1.01	-1.09	-1.18	-1.26	-1.34
60	0	0	0	0	0	0	0	0
55	0.88	0.98	1.08	1.18	1.29	1.39	1.49	1.59
50	1.96	2.16	2.37	2.60	2.82	3.05	3.29	3.54
45	3.22	3.53	3.86	4.23	4.59	4.98	5.41	5.88
40	4.67	5.09	5.55	6.09	6.60	7.18	7.85	8.59

Gradient Adjustment for Speed (%)

SPEED (KIAS)	WEIGHT ADJUSTED GO-AROUND GRADIENT (%)													
	0	1	2	3	4	5	6	7	8	9	10	11	12	13
VREF40	-0.17	-0.16	-0.17	-0.17	-0.18	-0.18	-0.19	-0.19	-0.19	-0.19	-0.19	-0.19	-0.19	-0.18
VREF40+5	0	0	0	0	0	0	0	0	0	0	0	0	0	0
VREF40+10	0.11	0.10	0.10	0.10	0.10	0.10	0.09	0.09	0.09	0.08	0.08	0.07	0.07	0.08
VREF40+15	0.18	0.16	0.14	0.13	0.12	0.12	0.11	0.10	0.09	0.08	0.07	0.06	0.06	0.05
VREF40+20	0.20	0.16	0.13	0.11	0.09	0.07	0.06	0.04	0.03	0.01	-0.01	-0.03	-0.04	-0.05
VREF40+25	0.17	0.12	0.08	0.04	0.00	-0.03	-0.06	-0.08	-0.10	-0.13	-0.16	-0.19	-0.21	-0.23
VREF40+30	0.10	0.04	-0.02	-0.08	-0.13	-0.18	-0.22	-0.26	-0.29	-0.33	-0.36	-0.40	-0.44	-0.48

With engine bleed for packs off, increase gradient by 0.2%.
With engine anti-ice on, decrease gradient by 0.1%.
With engine and wing anti-ice on, decrease gradient by 0.3%.
When operating in icing conditions during any part of the flight with forecast landing temperatures below 10°C decrease gradient by 1.0%.

Quick Turnaround Limit Weight - Category C Steel Brakes

Flaps 40

AIRPORT OAT (°C)	LIMIT WEIGHT (1000 KG)					
	AIRPORT PRESSURE ALTITUDE (FT)					
	0	2000	4000	6000	8000	10000
54	79.6					
50	80.2	77.2				
45	80.9	77.8	74.8			
40	81.6	78.5	75.4	72.4		
35	82.3	79.2	76.1	73.1	70.1	
30	83.0	79.9	76.7	73.7	70.8	67.9
25	83.8	80.6	77.4	74.4	71.4	68.5
20	84.6	81.3	78.1	75.1	72.1	69.1
15	85.4	82.1	78.9	75.8	72.7	69.8
10	86.1	82.9	79.6	76.5	73.4	70.4
5	86.1	83.7	80.4	77.2	74.1	71.1
0	86.1	84.5	81.2	78.0	74.9	71.8
-5	86.1	85.4	82.0	78.8	75.6	72.5
-10	86.1	86.1	82.8	79.6	76.4	73.3
-15	86.1	86.1	83.7	80.4	77.2	74.0
-20	86.1	86.1	84.6	81.2	78.0	74.8
-30	86.1	86.1	86.1	83.0	79.7	76.4
-40	86.1	86.1	86.1	84.9	81.5	78.1
-50	86.1	86.1	86.1	86.1	83.4	79.9
-54	86.1	86.1	86.1	86.1	84.1	80.7

Increase weight by 700 kg per 1% uphill slope. Decrease weight by 1200 kg per 1% downhill slope. Increase weight by 1850 kg per 10 knots headwind. Decrease weight by 7750 kg per 10 knots tailwind. After landing at weights exceeding those shown above, adjusted for slope and wind, wait at least 67 minutes and check that wheel thermal plugs have not melted before executing a subsequent takeoff.

As an alternate procedure, ensure that each brake pressure plate surface temperature, without artificial cooling, is less than 218°C as follows: No sooner than 10 and no later than 15 minutes after parking, measure each brake pressure plate surface temperature at a minimum of two points per brake by an accurate method (using a Doric Microtemp 450 hand held thermometer or equivalent, hold temperature probe in place for 20 seconds or until reading stabilizes). If each measured temperature is less than 218°C, immediate dispatch is allowed; otherwise the required minimum ground wait period of 67 minutes applies.

If a Brake Temperature Monitoring System (BTMS) is installed:

No sooner than 10 and no later than 15 minutes after parking, check the BRAKE TEMP light. If the BRAKE TEMP light is not on, no ground waiting period is required. If the BRAKE TEMP light is on, do not dispatch until at least 67 minutes after landing, or until all the BTMS readings on the systems Display are below 3.5 and the BRAKE TEMP light is off. Check that wheel thermal plugs have not melted before making a subsequent takeoff.
Note: If any brake temperature display digit is blank or indicates 0.0 or 0.1, then this method cannot be used.

Quick Turnaround Limit Weight - Category N Carbon Brakes

Flaps 40

OAT		LIMIT WEIGHT (1000 KG)					
		AIRPORT PRESSURE ALTITUDE (FT)					
°C	°F	0	2000	4000	6000	8000	10000
54	129	73.5					
50	122	74.0	71.2				
45	113	74.6	71.8	69.0			
40	104	75.2	72.4	69.6	66.9		
35	95	75.9	73.0	70.2	67.4	64.8	
30	86	76.6	73.7	70.8	68.0	65.3	62.8
25	77	77.3	74.3	71.4	68.6	65.9	63.3
20	68	78.0	75.0	72.1	69.3	66.5	63.9
15	59	78.7	75.7	72.8	69.9	67.1	64.4
10	50	79.4	76.4	73.5	70.6	67.8	65.0
5	41	80.2	77.2	74.2	71.3	68.4	65.6
0	32	81.0	77.9	74.9	72.0	69.1	66.3
-5	23	81.8	78.7	75.6	72.7	69.8	66.9
-10	14	82.6	79.5	76.4	73.4	70.5	67.6
-15	5	83.4	80.3	77.2	74.2	71.2	68.3
-20	-4	84.3	81.1	78.0	74.9	71.9	69.0
-30	-22	86.1	82.9	79.7	76.6	73.5	70.5
-40	-40	86.1	84.7	81.5	78.3	75.2	72.1
-50	-58	86.1	86.1	83.4	80.1	77.0	73.8
-54	-65	86.1	86.1	84.1	80.9	77.7	74.5

Increase weight by 650 kg per 1% uphill slope. Decrease weight by 1200 kg per 1% downhill slope. Increase weight by 1550 kg per 10 knots headwind. Decrease weight by 8350 kg per 10 knots tailwind. After landing at weights exceeding those shown above, adjusted for slope and wind, wait at least 48 minutes and check that wheel thermal plugs have not melted before executing a takeoff.

If a Brake Temperature Monitoring System (BTMS) is installed:

No sooner than 10 and no later than 15 minutes after parking, check the BRAKE TEMP light. If the BRAKE TEMP light is not on, no ground waiting period is required. If the BRAKE TEMP light is on, do not dispatch until at least 48 minutes after landing, or until all the BTMS readings on the systems Display are below 3.0 and the BRAKE TEMP light is off. Check that wheel thermal plugs have not melted before making a subsequent takeoff.
Note: If any brake temperature display digit is blank or indicates 0.0 or 0.1, then this method cannot be used.

Performance Dispatch — Chapter PD
Gear Down — Section 53

GEAR DOWN

Takeoff Climb Limit Weight
Flaps 5
Based on engine bleed for packs on and anti-ice off

AIRPORT OAT		TAKEOFF CLIMB WEIGHT (1000 KG)					
		AIRPORT PRESSURE ALTITUDE (FT)					
°C	°F	0	2000	4000	6000	8000	10000
54	129	60.9	57.5	54.3	50.7	46.2	
52	126	62.2	57.5	54.3	51.1	47.0	
50	122	63.5	57.8	54.3	51.1	47.6	43.3
48	118	64.9	59.1	54.2	51.0	47.6	44.1
46	115	66.3	60.4	54.6	51.0	47.6	44.8
44	111	67.7	61.7	55.9	51.0	47.6	44.8
42	108	69.0	63.0	57.2	51.3	47.5	44.8
40	104	70.4	64.3	58.4	52.6	47.5	44.8
38	100	71.6	65.5	59.7	53.9	47.9	44.8
36	97	72.8	66.8	60.9	55.1	49.1	44.7
34	93	74.1	68.0	62.1	56.3	50.3	45.1
32	90	75.5	69.3	63.3	57.5	51.5	46.3
30	86	76.7	70.7	64.5	58.7	52.8	47.5
28	82	76.8	72.3	65.7	59.9	54.0	48.7
26	79	76.9	73.2	67.1	61.1	55.2	49.9
24	75	76.9	73.3	68.4	62.3	56.5	51.1
22	72	77.0	73.3	68.9	63.6	57.7	52.4
20	68	77.1	73.4	68.9	64.3	58.8	53.5
18	64	77.1	73.4	68.9	64.6	59.9	54.7
16	61	77.2	73.5	69.0	64.7	60.3	55.7
14	57	77.2	73.5	69.0	64.7	60.6	56.1
12	54	77.3	73.5	69.0	64.7	60.6	56.4
10	50	77.3	73.6	69.1	64.7	60.6	56.7

With engine bleeds for packs off, increase weight by 300 kg.
With engine anti-ice on, decrease weight by 250 kg.
With engine and wing anti-ice on, decrease weight by 4250 kg (optional system).

GEAR DOWN

Landing Climb Limit Weight

Valid for approach with Flaps 15 and Landing with Flaps 40

Based on engine bleed for packs on and anti-ice off

AIRPORT OAT		LANDING CLIMB LIMIT WEIGHT (1000 KG)					
		AIRPORT PRESSURE ALTITUDE (FT)					
°C	°F	0	2000	4000	6000	8000	10000
54	129	56.4					
52	126	57.9					
50	122	59.4	54.8				
48	118	60.5	56.2				
46	115	61.6	57.6	53.0			
44	111	62.6	58.6	54.3			
42	108	63.7	59.6	55.6	51.0		
40	104	64.8	60.6	56.6	52.2		
38	100	66.0	61.7	57.6	53.3	48.6	
36	97	67.1	62.7	58.6	54.3	49.4	
34	93	68.3	63.9	59.7	55.2	50.2	46.1
32	90	69.6	65.0	60.6	56.1	51.2	47.1
30	86	70.7	65.9	61.3	56.9	52.0	48.0
28	82	70.8	66.7	62.0	57.6	52.8	48.7
26	79	70.9	67.5	62.6	58.1	53.6	49.5
24	75	71.0	67.6	63.1	58.5	54.3	50.0
22	72	71.0	67.6	63.6	58.9	54.7	50.4
20	68	71.1	67.7	63.6	59.4	55.0	50.9
18	64	71.1	67.7	63.6	59.7	55.3	51.2
16	61	71.2	67.8	63.7	59.8	55.7	51.5
14	57	71.2	67.8	63.7	59.8	56.0	51.8
12	54	71.3	67.8	63.7	59.8	56.0	52.1
10	50	71.3	67.9	63.7	59.8	56.0	52.4
-40	-40	71.8	68.3	64.2	60.2	56.4	52.9

With engine bleed for packs off, increase weight by 1150 kg.
With engine anti-ice on, decrease weight by 200 kg.
With engine and wing anti-ice on, decrease weight by 1250 kg.
When operating in icing conditions during any part of the flight with forecast landing temperature below 10°C, decrease weight by 7600 kg.

GEAR DOWN

Takeoff Obstacle Limit Weight

Flaps 5

Sea Level, 30°C & Below, Zero Wind

Based on engine bleed for packs on and anti-ice off

Reference Obstacle Limit Weight (1000 KG)

OBSTACLE HEIGHT (M)	DISTANCE FROM BRAKE RELEASE (100 M)										
	25	30	35	40	45	50	55	60	65	70	75
5	74.3										
20	67.6	72.5	75.8	78.0							
40	62.1	66.8	70.4	73.1	75.3	76.9	78.1				
60	58.1	62.6	66.3	69.2	71.5	73.4	75.0	76.2	77.2	78.1	
80	54.8	59.3	62.9	65.9	68.4	70.4	72.1	73.5	74.7	75.8	76.6
100	52.0	56.5	60.1	63.1	65.7	67.8	69.6	71.1	72.4	73.6	74.6
120	49.5	54.0	57.7	60.7	63.3	65.4	67.3	68.9	70.3	71.6	72.6
140	47.3	51.8	55.5	58.5	61.1	63.4	65.3	67.0	68.4	69.7	70.9
160	45.3	49.8	53.5	56.6	59.2	61.5	63.4	65.1	66.6	68.0	69.2
180	43.4	48.0	51.6	54.7	57.4	59.7	61.7	63.4	65.0	66.4	67.6
200		46.3	49.9	53.1	55.7	58.1	60.1	61.9	63.5	64.9	66.2
220		44.7	48.4	51.5	54.2	56.5	58.6	60.4	62.0	63.5	64.8
240		43.2	46.9	50.0	52.7	55.1	57.2	59.0	60.7	62.1	63.5
260		41.9	45.5	48.7	51.4	53.8	55.9	57.7	59.4	60.9	62.2
280			44.2	47.4	50.1	52.5	54.6	56.5	58.2	59.7	61.1
300			43.0	46.2	48.9	51.3	53.4	55.3	57.0	58.5	59.9

Obstacle height must be calculated from lowest point of the runway to conservatively account for runway slope.

OAT Adjustments

OAT (°C)	REFERENCE OBSTACLE LIMIT WEIGHT (1000 KG)							
	40	45	50	55	60	65	70	75
30 & BELOW	0	0	0	0	0	0	0	0
32	-0.6	-0.7	-0.8	-0.9	-1.0	-1.1	-1.2	-1.3
34	-1.3	-1.5	-1.7	-1.9	-2.1	-2.3	-2.4	-2.6
36	-1.9	-2.2	-2.5	-2.8	-3.1	-3.4	-3.7	-4.0
38	-2.6	-2.9	-3.3	-3.7	-4.1	-4.5	-4.9	-5.3
40	-3.1	-3.6	-4.1	-4.5	-5.0	-5.5	-6.0	-6.4
42	-3.6	-4.2	-4.8	-5.3	-5.9	-6.5	-7.0	-7.6
44	-4.2	-4.9	-5.5	-6.2	-6.8	-7.5	-8.1	-8.8
46	-4.9	-5.6	-6.4	-7.1	-7.8	-8.5	-9.2	-10.0
48	-5.6	-6.4	-7.2	-8.0	-8.8	-9.6	-10.4	-11.2
50	-6.2	-7.1	-8.0	-8.9	-9.8	-10.6	-11.5	-12.4

GEAR DOWN

Takeoff Obstacle Limit Weight
Flaps 5
Sea Level, 30°C & Below, Zero Wind
Pressure Altitude Adjustments

ALT (FT)	OAT ADJUSTED OBSTACLE LIMIT WEIGHT (1000 KG)							
	40	45	50	55	60	65	70	75
S.L. & BELOW	0	0	0	0	0	0	0	0
1000	-1.6	-1.8	-2.0	-2.2	-2.4	-2.6	-2.8	-2.9
2000	-3.2	-3.6	-4.0	-4.4	-4.8	-5.1	-5.5	-5.9
3000	-4.1	-4.7	-5.3	-5.9	-6.5	-7.1	-7.7	-8.3
4000	-5.0	-5.8	-6.6	-7.4	-8.2	-9.1	-9.9	-10.7
5000	-6.5	-7.5	-8.4	-9.4	-10.3	-11.3	-12.2	-13.2
6000	-8.0	-9.1	-10.2	-11.3	-12.4	-13.5	-14.6	-15.7
7000	-9.4	-10.6	-11.8	-13.0	-14.2	-15.5	-16.7	-17.9
8000	-10.8	-12.1	-13.4	-14.8	-16.1	-17.5	-18.8	-20.2
9000	-11.6	-13.2	-14.7	-16.3	-17.8	-19.4	-20.9	-22.5
10000	-12.5	-14.2	-16.0	-17.8	-19.5	-21.2	-23.0	-24.8

Wind Adjustments

WIND (KTS)	OAT & ALT ADJUSTED OBSTACLE LIMIT WEIGHT (1000 KG)							
	40	45	50	55	60	65	70	75
15 TW	-9.0	-8.7	-8.5	-8.2	-7.9	-7.6	-7.4	-7.1
10 TW	-6.0	-5.8	-5.6	-5.5	-5.3	-5.1	-4.9	-4.7
5 TW	-3.0	-2.9	-2.8	-2.7	-2.6	-2.5	-2.5	-2.4
0	0	0	0	0	0	0	0	0
10 HW	0.9	0.8	0.8	0.7	0.6	0.6	0.5	0.4
20 HW	1.8	1.6	1.5	1.4	1.2	1.1	1.0	0.9
30 HW	2.8	2.6	2.4	2.2	2.0	1.8	1.6	1.4
40 HW	3.8	3.5	3.2	3.0	2.8	2.5	2.2	2.0

With engine bleed for packs off, increase weight by 250 kg.
With engine anti-ice on, decrease weight by 250 kg.
With engine and wing anti-ice on, decrease weight by 5850 kg (optional system).

GEAR DOWN

Long Range Cruise Altitude Capability

Max Cruise Thrust, 100 ft/min residual rate of climb

WEIGHT (1000 KG)	PRESSURE ALTITUDE (FT)		
	ISA + 10°C & BELOW	ISA + 15°C	ISA + 20°C
85	15600	12500	9400
80	18400	15500	12600
75	21100	18500	15700
70	23600	21400	18600
65	26100	24400	21800
60	28600	27100	25300
55	30800	29600	28100
50	32900	31900	30700
45	35100	34100	33000
40	37500	36500	35400

GEAR DOWN

Long Range Cruise Trip Fuel and Time

Ground to Air Miles Conversion

AIR DISTANCE (NM) HEADWIND COMPONENT (KTS)					GROUND DISTANCE (NM)	AIR DISTANCE (NM) TAILWIND COMPONENT (KTS)				
100	80	60	40	20		20	40	60	80	100
340	300	266	239	218	200	187	174	164	155	147
508	449	399	359	328	300	280	262	246	233	221
675	597	531	479	437	400	374	350	329	311	295
841	745	662	598	545	500	467	438	412	389	369
1006	892	794	717	654	600	561	526	495	468	444
1170	1038	925	835	763	700	655	614	578	546	518
1332	1183	1055	954	872	800	749	703	661	625	593
1494	1328	1185	1072	980	900	843	791	745	704	668
1655	1472	1315	1190	1089	1000	937	879	828	783	743
1814	1615	1444	1308	1197	1100	1031	968	911	862	818
1973	1758	1573	1426	1305	1200	1125	1056	995	941	894
2131	1900	1701	1543	1413	1300	1218	1145	1079	1020	969
2288	2041	1829	1660	1521	1400	1313	1233	1162	1100	1045
2444	2182	1957	1777	1629	1500	1407	1322	1246	1179	1121
2599	2323	2084	1894	1737	1600	1501	1411	1330	1259	1197
2754	2463	2212	2011	1845	1700	1595	1500	1414	1339	1273
2907	2602	2338	2127	1953	1800	1689	1589	1499	1419	1350
3060	2741	2465	2243	2060	1900	1784	1678	1583	1499	1426
3212	2879	2591	2359	2168	2000	1878	1767	1668	1580	1503

Reference Fuel and Time Required

AIR DIST (NM)	PRESSURE ALTITUDE (1000 FT)									
	10		14		20		24		28	
	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)
200	2.6	0:53	2.5	0:51	2.3	0:49	2.2	0:48	2.2	0:47
300	3.8	1:18	3.6	1:14	3.3	1:10	3.2	1:08	3.1	1:05
400	5.0	1:42	4.7	1:37	4.4	1:31	4.2	1:27	4.0	1:24
500	6.3	2:06	5.9	2:00	5.4	1:52	5.1	1:47	5.0	1:43
600	7.6	2:30	7.1	2:22	6.5	2:13	6.1	2:06	5.9	2:01
700	8.9	2:53	8.3	2:44	7.5	2:33	7.1	2:25	6.9	2:19
800	10.2	3:16	9.5	3:06	8.6	2:53	8.1	2:44	7.8	2:37
900	11.5	3:39	10.7	3:28	9.7	3:13	9.2	3:03	8.8	2:56
1000	12.8	4:02	11.9	3:50	10.8	3:33	10.2	3:23	9.7	3:14
1100	14.2	4:24	13.2	4:11	11.9	3:53	11.2	3:41	10.8	3:31
1200	15.5	4:46	14.5	4:32	13.1	4:12	12.3	3:59	11.8	3:49
1300	16.9	5:08	15.8	4:53	14.2	4:31	13.4	4:18	12.8	4:07
1400	18.3	5:30	17.0	5:14	15.4	4:51	14.4	4:36	13.8	4:25
1500	19.6	5:52	18.3	5:35	16.5	5:10	15.5	4:55	14.9	4:42
1600	21.1	6:13	19.7	5:55	17.7	5:29	16.6	5:13		
1700	22.5	6:34	21.0	6:15	18.9	5:48	17.8	5:31		
1800	24.0	6:55	22.4	6:35	20.1	6:06	18.9	5:48		
1900	25.4	7:16	23.7	6:55	21.3	6:25	20.0	6:06		
2000	26.9	7:37	25.1	7:16	22.5	6:44	21.1	6:24		

GEAR DOWN

Long Range Cruise Trip Fuel and Time

Fuel Required Adjustments (1000 KG)

REFERENCE FUEL REQUIRED (1000 KG)	LANDING WEIGHT (1000 KG)						
	40	45	50	55	60	65	70
2	-0.2	-0.1	0.0	0.1	0.3	0.4	0.5
4	-0.4	-0.2	0.0	0.2	0.5	0.7	1.0
6	-0.6	-0.3	0.0	0.4	0.7	1.1	1.4
8	-0.8	-0.4	0.0	0.5	0.9	1.4	1.8
10	-1.0	-0.5	0.0	0.6	1.1	1.7	2.3
12	-1.1	-0.6	0.0	0.7	1.4	2.0	2.7
14	-1.3	-0.7	0.0	0.8	1.6	2.4	3.2
16	-1.5	-0.8	0.0	0.9	1.8	2.7	3.6
18	-1.7	-0.9	0.0	1.0	2.0	3.0	4.0
20	-1.9	-0.9	0.0	1.1	2.2	3.3	4.5
22	-2.1	-1.0	0.0	1.2	2.4	3.7	4.9
24	-2.3	-1.1	0.0	1.3	2.6	4.0	5.3
26	-2.4	-1.2	0.0	1.4	2.9	4.3	5.8
28	-2.6	-1.3	0.0	1.5	3.1	4.6	6.2

Based on VREF40 + 70 climb, Long Range Cruise and VREF40 + 70 descent.

GEAR DOWN

Holding Planning

Flaps Up

WEIGHT (1000 KG)	TOTAL FUEL FLOW (KG/HR)						
	PRESSURE ALTITUDE (FT)						
	1500	5000	10000	15000	20000	25000	30000
80	4240	4210	4190	4210	4220		
75	4000	3970	3940	3940	3950	4100	
70	3770	3730	3700	3690	3680	3750	
65	3550	3500	3470	3440	3430	3460	
60	3310	3260	3220	3190	3170	3180	3340
55	3090	3030	2990	2950	2920	2920	3000
50	2860	2810	2760	2720	2670	2660	2710
45	2630	2590	2540	2490	2440	2420	2450
40	2400	2360	2320	2270	2220	2180	2200

This table includes 5% additional fuel for holding in a racetrack pattern.

GEAR DOWN

ENGINE INOP

MAX CONTINUOUS THRUST

Net Level Off Weight

PRESSURE ALTITUDE (1000 FT)	LEVEL OFF WEIGHT (1000 KG)		
	ISA + 10°C & BELOW	ISA + 15°C	ISA + 20°C
22	42.9	41.7	
20	46.4	45.1	43.8
18	50.0	48.4	46.7
16	53.6	51.7	49.8
14	56.8	55.1	53.3
12	60.5	58.5	56.2
10	64.1	61.9	59.1
8	68.1	65.6	62.6
6	72.1	69.2	66.0
4	75.9	72.7	69.2
2	79.5	76.1	72.6
0	82.9	79.3	75.9

Anti-Ice Adjustments

ANTI-ICE CONFIGURATION	LEVEL OFF WEIGHT ADJUSTMENT (1000 KG)				
	PRESSURE ALTITUDE (1000 FT)				
	2	6	10	14	18
ENGINE ONLY	-1.7	-1.3	-1.5	-1.5	-1.3
ENGINE AND WING	-6.6	-5.9	-5.6	-5.1	-4.9

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Performance Dispatch — Chapter PD
Text — Section 54

Introduction

This chapter contains self dispatch performance data intended primarily for use by flight crews in the event that information cannot be obtained from the airline dispatch office. The takeoff data provided is for a single takeoff flap at max takeoff thrust. The range of conditions covered is limited to those normally encountered in airline operation. In the event of conflict between the data presented in this chapter and that contained in the approved Airplane Flight Manual, the Flight Manual shall always take precedence.

Takeoff

The maximum allowable takeoff weight will be the least of the Field, Climb, Obstacle, Brake Energy and Tire Speed Limit Weights as determined from the tables shown.

Brake Energy or Tire Speed Limit Weight tables are only provided if they are limiting for the range of conditions covered in the FCOM Section PD.

Field Limit Weight - Slope and Wind Corrections

These tables for dry and wet runways provide corrections to the field length available for the effects of runway slope and wind component along the runway. Enter the appropriate table with the available field length and runway slope to determine the slope corrected field length. Next enter the appropriate table with slope corrected field length and wind component to determine the slope and wind corrected field length.

Field and Climb Limit Weight

Tables are presented for selected airport pressure altitudes and runway conditions and show both Field and Climb Limit Weights. Enter the appropriate table for pressure altitude and runway condition with “Slope and Wind Corrected Field Length” determined above and airport OAT to obtain Field Limit Weight. Also read Climb Limit Weight for the same OAT. Intermediate altitudes may be interpolated or use next higher altitude. When finding a maximum weight for a wet runway, the dry runway limit weight must also be determined and the lower of the two weights used.

Obstacle Limit Weight

The Reference Obstacle Limit Weight table provides obstacle limit weights for reference airport conditions based on obstacle height above the runway surface and distance from brake release. Enter the adjustment tables to adjust the reference Obstacle Limit Weight for the effects of OAT, pressure altitude and wind as indicated. In the case of multiple obstacles, enter the tables successively with each obstacle and determine the most limiting weight.

Tire Speed Limit

Tire Speed Limit Weight tables are only provided if they are limiting for the range of conditions covered in the FCOM Section PD.

Maximum tire speed limited weights are presented for 225 MPH tires. To determine the tire speed limit weight, enter the table with OAT and airport pressure altitude. Adjust the tire speed limit weight according to the notes below the table to account for wind.

Brake Energy Limit VMBE

Brake Energy Limit Weight tables are only provided if they are limiting for the range of conditions covered in the FCOM Section PD.

The Maximum Brake Energy Speed table provides the Reference VMBE for a variety of airport pressure altitudes and temperatures. Enter the Weight Adjusted VMBE table to adjust the Reference VMBE for the actual brake release gross weight. Correct VMBE for slope and wind. If V1 exceeds VMBE, decrease brake release weight as indicated for each knot that V1 exceeds VMBE and determine V1, VR, and V2 for the lower brake release weight.

Enroute

Long Range Cruise Maximum Operating Altitude

These tables provide the maximum operating altitude in the same manner as the FMC. Maximum altitudes are shown for a given cruise weight and maneuver capability. Note that this table considers both thrust and buffet limits, providing the more limiting of the two. Any data that is thrust limited is denoted by an asterisk and represents only a thrust limited condition in level flight with 100 ft/min residual rate of climb. Flying above these altitudes with sustained banks in excess of approximately 15° may cause the airplane to lose speed and/or altitude. The altitudes shown in the table are limited to the maximum certified altitude of 41000 ft.

Long Range Cruise Trip Fuel and Time

Long Range Cruise Trip Fuel and Time tables are provided to determine trip time and fuel required to destination.

To determine trip fuel and time for a constant altitude cruise, first enter the Ground to Air Miles Conversion table to convert ground distance and enroute wind to an equivalent still air distance for use with the Reference Fuel and Time tables. Next, enter the Reference Fuel and Time table with air distance from the Ground to Air Miles Conversion table and the desired altitude and read Reference Fuel and Time Required. Lastly, enter the Fuel Required Adjustment table with the Reference Fuel and the planned landing weight to obtain the adjustment to the fuel required at the planned landing weight.

Long Range Cruise Step Climb Trip Fuel and Time

The Long Range Cruise Step Climb Trip Fuel and Time tables are provided to determine trip time and fuel required to destination when flying a step climb profile. Step climb profiles are based on 4000 ft step climbs to keep the flight within 2000 ft of the optimum altitude for the current cruise weight. To determine trip fuel and time, enter the Ground to Air Miles Conversion table and determine air distance as discussed above. Then enter the Trip Fuel and Time Required table with air distance and planned landing weight to read trip fuel. Continue across the table to read trip time.

Short Trip Fuel and Time

These tables are provided to determine trip fuel and time for short distances or alternates. Obtain air distance from the table using the ground distance and wind component to the alternate. Enter the Trip Fuel and Time Required table with air distance and read trip fuel required for the expected landing weight, together with time to alternate at right. For distances greater than shown or other altitudes, use the Long Range Cruise Trip Fuel and Time tables.

Holding Planning

This table provides total fuel flow information necessary for planning flaps up holding and reserve fuel requirements. Data is based on the FMC holding speed schedule which is the higher of the maximum endurance and flaps up maneuver speeds. As noted, the fuel flow is based on flight in a racetrack holding pattern. For holding in straight and level flight, reduce table values by 5%.

Flight Crew Requirements for Chemical Passenger Oxygen System

The flight crew oxygen system is a gaseous system. Flight crew oxygen tables are provided for both the chemical passenger oxygen system and the freighter oxygen system. Use the tables corresponding to the appropriate oxygen system installed.

Regulations require that sufficient oxygen be provided to the flight crew to account for the greater of supplemental breathing oxygen in the event of a cabin depressurization or protective breathing in the event of smoke or harmful fumes in the flight deck. The oxygen quantity associated with the above requirements is achieved for the flight crew with the minimum dispatch oxygen cylinder pressure.

Tables are provided to determine the flight crew oxygen dispatch requirements for a chemical passenger oxygen system. To determine the minimum dispatch oxygen cylinder pressure enter the appropriate flight crew oxygen table with the number of crew plus observers using oxygen and read the minimum cylinder pressure required for the appropriate cylinder temperature.

Flight Crew and Supernumerary Requirements for Freighter Oxygen System

The flight crew oxygen system is a gaseous system.

Regulations require that sufficient oxygen be provided to the flight crew to account for the greater of supplemental breathing oxygen in the event of a cabin depressurization or protective breathing in the event of smoke or harmful fumes in the flight deck. Sufficient oxygen must be provided to the supernumeraries for supplemental breathing in the event of a cabin depressurization or a main deck cargo fire.

Data are provided to determine the total oxygen dispatch requirement. Table 1 shows the quantity of oxygen required to complete an emergency descent to 25000 ft, level off for the diversion time, and continue descent below 10000 ft with the regulator set to "100%" for the flight crew protective breathing requirement. Table 1 includes values for up to eight people to account for up to four crew members and up to four supernumeraries.

Both the crew oxygen and supernumerary oxygen draw from the same set of oxygen cylinders. To determine the total oxygen required for dispatch, enter the table for the total number of crew plus supernumeraries and read required liters of 100% oxygen for the maximum diversion time.

Additional adjustments for more extensive than normal crew usage can be made by adding 2.05 liters/person/minute (0.6 psi/person/minute for the dual cylinder system) or 13 liters/person/minute (4 psi/person/minute) if 100% oxygen is selected during normal usage.

After determining the total volume (liters) required for the flight crew plus supernumeraries, obtain the dispatch pressure required from the Cylinder Volume to Pressure Conversion table (Table 2). Adjust this reading for cylinder temperature as required, using the adjustments given (Table 3).

Net Level Off Weight

The Net Level Off Weight table is provided to determine terrain clearance capability in straight and level flight following an engine failure. Regulations require terrain clearance planning based on net performance which is the gross (or actual) gradient performance degraded by 1.1%. In addition, the net level off pressure altitude must clear the terrain by 1000 ft.

To determine the maximum weight for terrain clearance, enter the table with required net level off pressure altitude and expected ISA deviation to obtain weight. Adjust weight for anti-ice operation as noted below the table.

Landing

Tables are provided for determining the maximum landing weight as limited by field length or climb requirements for a single landing flap.

Maximum landing weight is the lowest of the field length limit weight, climb limit weight, or maximum certified landing weight.

Landing Field Limit Weight

For the expected runway condition and anti-skid system configuration, obtain wind corrected field length by entering the Wind Corrected Field Length table with field length available and wind component along the runway. Now enter the Field Limit Weight table with wind corrected field length and pressure altitude to read field limit weight.

Landing Climb Limit Weight

Enter the table with airport OAT and pressure altitude to read landing climb limit weight. Apply the noted adjustments as required.

Go-Around Climb Gradient

Enter the Reference Go-Around Gradient table with airport OAT and pressure altitude to determine the reference go-around gradient. Then adjust the reference gradient for airplane weight and speed using the tables provided to determine the weight and speed adjusted go-around gradient. Apply the necessary corrections for engine bleed configuration and icing conditions as noted.

Quick Turnaround Limit Weight

Enter the appropriate table (Steel or Carbon Brakes) with airport pressure altitude and OAT to read maximum quick turnaround weight. Apply the noted adjustments as required.

If the landing weight exceeds the maximum quick turnaround weight, wait the specified time and then check that the wheel thermal plugs have not melted before executing a subsequent takeoff. For Steel Brakes, the alternate procedures on the charts can be used to ensure the brake temperature is within limits. These procedures cannot be used for carbon brakes.

Gear Down

This section provides flight planning data for revenue operation with gear down. Unless otherwise noted, the gear down tables in this section are identical in format and usage to the corresponding gear up tables previously described.

To eliminate erroneous displays the flight crew should enter only gross weight data on the PERF INIT page of the Control Display Unit (CDU). Omission of the cost index and cruise altitude entries on the PERF INIT page will render the VNAV function unavailable during flight. As a result, the following information will not be provided: VNAV guidance and speed schedules, trip fuel and ETA predictions, optimum and maximum altitude data, step climb and top of descent predictions, and the VNAV descent guidance path.

The gross weight entry allows the FMCS takeoff and approach speed schedules to be generated. In addition, the flap maneuver speed and VREF speed bugs will be available for display on the primary flight display speed tape. Except for VNAV, normal autopilot and autothrottle modes will remain available for use during the flight, as will the LNAV mode.

Takeoff/Landing Climb Limit Weight

Enter the appropriate table with airport OAT and pressure altitude to determine Takeoff/Landing Climb Limit Weight with gear down. Correct the weight obtained for engine bleed configuration as required.

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737-900 CFM56-7B26 C FT LB FAA CATG/O

Performance Dispatch — Chapter PD
Pkg Model Identification — Section 60

General

The table below shows the airplanes that have been identified with the following performance package. Note, some airplanes may be identified with more than one performance package. This configuration table information reflects the Boeing delivered configuration updated for service bulletin incorporations in conformance with the policy stated in the introduction section of the FCOM. The performance data is prepared for the owner/operator named on the title page. The intent of this information is to assist flight crews and airlines in knowing which performance package is applicable to a given airplane. The performance package model identification information is based on Boeing's knowledge of the airline's fleet at a point in time approximately three months prior to the page date. Notice of Errata (NOE) will not be provided to airlines to identify airplanes that are moved between performance packages within this manual or airplanes added to the airline's fleet whose performance packages are already represented in this manual. These types of changes will be updated in the next block revision. Owners/operators are responsible for ensuring the operational documentation they are using is complete and matches the current configuration of their airplanes, and the accuracy and validity of all information furnished by the owner/operator or any other party. Owners/operators receiving active revision service are responsible to ensure that any modifications to the listed airplanes are properly reflected in this manual.

Serial and tabulation number are supplied by Boeing.

Registry Number	Serial Number	Tabulation Number
YX900	YX900	YX900

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Performance Dispatch — Chapter PD
Takeoff — Section 60

Takeoff Field Corrections - Dry Runway
Slope Corrections

FIELD LENGTH AVAILABLE (FT)	SLOPE CORRECTED FIELD LENGTH (FT)								
	RUNWAY SLOPE (%)								
	-2.0	-1.5	-1.0	-0.5	0.0	0.5	1.0	1.5	2.0
4200	4280	4260	4240	4220	4200	4150	4100	4050	4000
4600	4710	4680	4650	4630	4600	4520	4450	4370	4300
5000	5130	5100	5070	5030	5000	4900	4800	4700	4600
5400	5560	5520	5480	5440	5400	5270	5150	5020	4900
5800	5990	5940	5890	5850	5800	5650	5500	5350	5200
6200	6420	6370	6310	6260	6200	6030	5850	5680	5500
6600	6870	6800	6730	6670	6600	6400	6200	6000	5800
7000	7310	7230	7160	7080	7000	6780	6550	6330	6100
7400	7760	7670	7580	7490	7400	7150	6900	6650	6400
7800	8200	8100	8000	7900	7800	7530	7250	6980	6700
8200	8650	8540	8420	8310	8200	7900	7600	7300	7000
8600	9090	8970	8850	8720	8600	8280	7950	7630	7300
9000	9540	9400	9270	9130	9000	8650	8300	7950	7600
9400	9980	9840	9690	9550	9400	9030	8650	8280	7900
9800	10430	10270	10110	9960	9800	9400	9000	8600	8200
10200	10890	10710	10540	10370	10200	9780	9350	8930	8500
10600	11360	11170	10980	10790	10600	10150	9700	9250	8810
11000	11830	11620	11420	11210	11000	10530	10050	9580	9110
11400	12300	12080	11850	11630	11400	10900	10400	9900	9410
11800	12770	12530	12290	12040	11800	11280	10750	10230	9710

Wind Corrections

SLOPE CORR'D FIELD LENGTH (FT)	SLOPE & WIND CORRECTED FIELD LENGTH (FT)							
	WIND COMPONENT (KTS)							
	-15	-10	-5	0	10	20	30	40
4200	3130	3490	3840	4200	4430	4670	4900	5140
4600	3460	3840	4220	4600	4840	5090	5340	5590
5000	3800	4200	4600	5000	5250	5510	5770	6040
5400	4130	4550	4980	5400	5670	5930	6210	6480
5800	4470	4910	5360	5800	6080	6360	6640	6930
6200	4800	5270	5730	6200	6490	6780	7080	7380
6600	5130	5620	6110	6600	6900	7200	7510	7820
7000	5470	5980	6490	7000	7310	7630	7950	8270
7400	5800	6340	6870	7400	7720	8050	8380	8720
7800	6140	6690	7250	7800	8130	8470	8820	9160
8200	6470	7050	7620	8200	8540	8890	9250	9610
8600	6810	7400	8000	8600	8960	9320	9680	10060
9000	7140	7760	8380	9000	9370	9740	10120	10500
9400	7470	8120	8760	9400	9780	10160	10550	10950
9800	7810	8470	9140	9800	10190	10590	10990	11400
10200	8140	8830	9510	10200	10600	11010	11420	11850
10600	8480	9180	9890	10600	11010	11430	11860	12290
11000	8810	9540	10270	11000	11420	11850	12290	12740
11400	9140	9900	10650	11400	11830	12280	12730	13190
11800	9480	10250	11030	11800	12250	12700	13160	13630

Takeoff Field & Climb Limit Weights - Dry Runway

Flaps 5

Sea Level Pressure Altitude

CORR'D FIELD LENGTH (FT)	FIELD LIMIT WEIGHT (1000 LB)										
	OAT (°C)										
	-40	0	11	14	18	22	26	30	35	40	50
4000	123.5	115.5	113.4	112.8	112.0	111.2	110.5	109.7	106.5	103.4	97.1
4200	127.2	119.0	116.8	116.2	115.4	114.6	113.8	113.0	109.8	106.5	100.0
4600	134.4	125.8	123.4	122.8	122.0	121.1	120.3	119.5	116.1	112.7	105.9
5000	141.2	132.2	129.7	129.1	128.2	127.4	126.5	125.7	122.1	118.5	111.4
5400	147.6	138.2	135.6	135.0	134.1	133.2	132.3	131.4	127.6	123.9	116.5
5800	153.8	144.0	141.3	140.6	139.7	138.7	137.8	136.9	133.0	129.1	121.4
6200	159.7	149.5	146.8	146.0	145.0	144.1	143.1	142.1	138.1	134.1	126.0
6600	165.4	154.9	152.0	151.2	150.2	149.2	148.2	147.2	143.0	138.8	130.5
7000	170.9	160.0	157.0	156.2	155.2	154.1	153.1	152.1	147.7	143.4	134.8
7400	176.2	165.0	161.9	161.1	160.0	158.9	157.9	156.8	152.3	147.9	139.0
7800	181.3	169.7	166.5	165.7	164.6	163.5	162.4	161.3	156.7	152.1	142.9
8200	186.2	174.3	171.1	170.2	169.1	167.9	166.8	165.7	160.9	156.3	146.9
8600	189.9	178.7	175.4	174.5	173.3	172.2	171.1	169.9	165.0	160.3	150.6
9000	189.9	182.8	179.4	178.4	177.2	176.1	174.9	173.7	168.8	163.9	154.0
9400	189.9	186.3	182.9	181.9	180.7	179.5	178.3	177.1	172.1	167.1	157.0
9800	189.9	189.7	186.2	185.3	184.0	182.8	181.6	180.3	175.2	170.1	159.8
10200	189.9	189.9	189.3	188.3	187.1	185.8	184.6	183.3	178.1	172.9	162.4
10600	189.9	189.9	189.9	189.9	189.9	188.7	187.4	186.2	180.8	175.6	165.0
CLIMB LIMIT WT (1000 LB)	188.1	187.4	186.8	186.6	186.4	186.1	185.8	185.4	177.7	170.3	155.9

2000 FT Pressure Altitude

CORR'D FIELD LENGTH (FT)	FIELD LIMIT WEIGHT (1000 LB)										
	OAT (°C)										
	-40	0	11	14	18	22	26	30	35	40	50
4000	116.9	108.9	106.9	106.3	105.6	104.9	104.3	102.4	99.5	96.4	90.4
4200	120.4	112.2	110.1	109.6	108.8	108.1	107.4	105.5	102.5	99.4	93.2
4600	127.2	118.6	116.5	115.9	115.1	114.4	113.6	111.6	108.5	105.2	98.7
5000	133.7	124.7	122.5	121.9	121.1	120.3	119.5	117.4	114.1	110.6	103.9
5400	139.8	130.4	128.0	127.4	126.6	125.8	124.9	122.8	119.3	115.7	108.6
5800	145.6	135.9	133.4	132.8	131.9	131.0	130.2	127.9	124.4	120.6	113.2
6200	151.2	141.1	138.5	137.8	136.9	136.1	135.2	132.8	129.1	125.2	117.5
6600	156.6	146.1	143.4	142.7	141.8	140.9	140.0	137.5	133.7	129.6	121.7
7000	161.8	150.9	148.2	147.4	146.5	145.5	144.6	142.1	138.1	133.9	125.7
7400	166.8	155.6	152.8	152.0	151.0	150.1	149.1	146.5	142.4	138.0	129.5
7800	171.6	160.1	157.2	156.4	155.4	154.3	153.3	150.7	146.4	142.0	133.3
8200	176.3	164.5	161.5	160.7	159.6	158.6	157.5	154.8	150.5	145.9	136.9
8600	180.8	168.7	165.6	164.8	163.7	162.6	161.6	158.7	154.3	149.6	140.4
9000	184.8	172.4	169.3	168.4	167.3	166.3	165.2	162.3	157.8	153.0	143.6
9400	188.5	175.8	172.6	171.7	170.6	169.5	168.4	165.5	160.8	155.9	146.4
9800	189.9	179.0	175.7	174.9	173.7	172.6	171.5	168.5	163.7	158.7	149.0
10200	189.9	182.0	178.6	177.8	176.6	175.4	174.3	171.2	166.5	161.4	151.4
10600	189.9	184.8	181.4	180.5	179.3	178.1	177.0	173.9	169.0	163.9	153.8
CLIMB LIMIT WT (1000 LB)	179.3	178.6	178.1	178.0	177.8	177.6	177.3	173.1	166.2	159.2	145.8

With engine bleed for packs off, increase field limit weight by 800 lb and climb limit weight by 3100 lb.
With engine anti-ice on, decrease field limit weight by 500 lb and climb limit weight by 600 lb.
With engine and wing anti-ice on (optional system), decrease field limit weight by 1900 lb and climb limit weight by 3200 lb.

Takeoff Field & Climb Limit Weights - Dry Runway

Flaps 5

4000 FT Pressure Altitude

CORR'D FIELD LENGTH (FT)	FIELD LIMIT WEIGHT (1000 LB)										
	OAT (°C)										
	-40	0	11	14	18	22	26	30	35	40	50
4000	109.4	101.9	100.0	99.5	98.8	98.1	96.7	95.1	92.5	89.5	84.3
4200	112.7	105.0	103.1	102.6	101.8	101.1	99.7	98.0	95.3	92.3	86.9
4600	119.2	111.1	109.1	108.5	107.8	107.0	105.5	103.8	101.0	97.8	92.1
5000	125.3	116.9	114.7	114.1	113.4	112.6	111.0	109.2	106.2	102.9	97.0
5400	131.0	122.2	120.0	119.4	118.6	117.7	116.1	114.2	111.1	107.7	101.5
5800	136.5	127.3	125.0	124.4	123.5	122.7	121.0	119.0	115.8	112.2	105.7
6200	141.7	132.2	129.8	129.1	128.3	127.4	125.6	123.5	120.2	116.5	109.8
6600	146.8	136.9	134.4	133.7	132.8	131.9	130.0	127.9	124.4	120.6	113.6
7000	151.6	141.4	138.8	138.1	137.2	136.2	134.3	132.1	128.5	124.5	117.3
7400	156.3	145.8	143.1	142.4	141.4	140.5	138.5	136.2	132.5	128.4	121.0
7800	160.8	150.0	147.2	146.5	145.5	144.5	142.5	140.1	136.3	132.1	124.4
8200	165.2	154.1	151.3	150.5	149.5	148.4	146.4	143.9	140.1	135.7	127.9
8600	169.4	158.0	155.1	154.3	153.3	152.2	150.1	147.6	143.7	139.2	131.2
9000	173.2	161.6	158.6	157.8	156.7	155.7	153.5	150.9	146.9	142.3	134.1
9400	176.6	164.7	161.7	160.9	159.8	158.7	156.5	153.9	149.7	145.1	136.7
9800	179.8	167.7	164.6	163.8	162.7	161.5	159.3	156.6	152.4	147.7	139.1
10200	182.8	170.5	167.3	166.5	165.3	164.2	161.9	159.2	154.9	150.1	141.4
10600	185.6	173.1	169.9	169.1	167.9	166.8	164.4	161.7	157.3	152.4	143.6
CLIMB LIMIT WT (1000 LB)	168.6	167.9	167.5	167.4	167.2	167.0	164.5	161.0	155.2	148.5	136.5

6000 FT Pressure Altitude

CORR'D FIELD LENGTH (FT)	FIELD LIMIT WEIGHT (1000 LB)										
	OAT (°C)										
	-40	0	11	14	18	22	26	30	35	40	50
4000	102.2	95.0	93.1	92.7	92.0	90.8	89.5	88.0	85.6	83.0	78.1
4200	105.3	97.9	96.0	95.5	94.9	93.6	92.3	90.8	88.3	85.6	80.6
4600	111.4	103.7	101.7	101.2	100.5	99.1	97.8	96.1	93.6	90.7	85.5
5000	117.1	109.1	107.0	106.4	105.7	104.3	102.9	101.2	98.5	95.5	90.1
5400	122.5	114.1	111.9	111.3	110.6	109.1	107.6	105.9	103.1	100.0	94.2
5800	127.6	118.9	116.6	116.0	115.2	113.7	112.2	110.3	107.4	104.2	98.2
6200	132.5	123.4	121.1	120.4	119.6	118.1	116.4	114.5	111.5	108.1	101.9
6600	137.2	127.7	125.3	124.7	123.8	122.2	120.5	118.5	115.4	111.9	105.5
7000	141.7	132.0	129.4	128.8	127.9	126.2	124.5	122.4	119.2	115.6	108.9
7400	146.1	136.1	133.5	132.8	131.9	130.1	128.4	126.2	122.9	119.1	112.3
7800	150.3	139.9	137.3	136.6	135.6	133.9	132.0	129.8	126.4	122.6	115.5
8200	154.4	143.8	141.1	140.3	139.4	137.6	135.7	133.4	129.9	125.9	118.7
8600	158.4	147.5	144.7	143.9	143.0	141.1	139.1	136.8	133.2	129.2	121.8
9000	161.9	150.8	147.9	147.2	146.2	144.3	142.3	139.9	136.2	132.1	124.5
9400	165.1	153.7	150.8	150.0	149.0	147.0	145.0	142.6	138.8	134.6	126.9
9800	168.1	156.5	153.5	152.7	151.7	149.7	147.6	145.2	141.3	137.0	129.2
10200	170.9	159.1	156.0	155.2	154.2	152.1	150.0	147.5	143.6	139.3	131.3
10600	173.5	161.5	158.4	157.6	156.5	154.5	152.4	149.8	145.9	141.4	133.3
CLIMB LIMIT WT (1000 LB)	158.1	157.5	157.2	157.1	156.9	154.8	152.5	149.3	143.6	137.3	126.7

With engine bleed for packs off, increase field limit weight by 800 lb and climb limit weight by 3100 lb.
With engine anti-ice on, decrease field limit weight by 500 lb and climb limit weight by 600 lb.
With engine and wing anti-ice on (optional system), decrease field limit weight by 1900 lb and climb limit weight by 3200 lb.

Takeoff Field & Climb Limit Weights - Dry Runway

Flaps 5

8000 FT Pressure Altitude

CORR'D FIELD LENGTH (FT)	FIELD LIMIT WEIGHT (1000 LB)										
	OAT (°C)										
	-40	0	11	14	18	22	26	30	35	40	50
4000	95.2	88.4	86.7	86.3	85.2	84.1	82.8	81.1	78.5	76.1	71.6
4200	98.1	91.1	89.4	89.0	87.9	86.7	85.4	83.6	81.1	78.6	73.9
4600	103.8	96.5	94.7	94.3	93.1	91.9	90.5	88.7	86.0	83.3	78.5
5000	109.2	101.6	99.7	99.2	98.0	96.8	95.3	93.4	90.6	87.8	82.7
5400	114.3	106.3	104.3	103.8	102.6	101.3	99.7	97.7	94.8	91.9	86.6
5800	119.1	110.8	108.7	108.2	106.9	105.5	103.9	101.8	98.8	95.8	90.3
6200	123.6	115.0	112.9	112.3	110.9	109.5	107.9	105.7	102.5	99.4	93.7
6600	128.0	119.0	116.8	116.2	114.8	113.4	111.6	109.4	106.1	102.8	96.9
7000	132.2	122.9	120.7	120.1	118.6	117.1	115.3	113.0	109.5	106.2	100.1
7400	136.3	126.7	124.4	123.8	122.3	120.7	118.9	116.4	112.9	109.5	103.1
7800	140.2	130.4	128.0	127.3	125.8	124.2	122.2	119.8	116.2	112.6	106.1
8200	144.0	134.0	131.5	130.8	129.2	127.6	125.6	123.1	119.4	115.7	109.1
8600	147.7	137.4	134.9	134.2	132.6	130.9	128.9	126.3	122.5	118.7	111.9
9000	151.0	140.5	137.9	137.2	135.5	133.8	131.8	129.1	125.2	121.4	114.4
9400	154.0	143.2	140.6	139.9	138.2	136.4	134.3	131.6	127.6	123.7	116.6
9800	156.7	145.8	143.1	142.4	140.6	138.8	136.7	133.9	129.9	125.9	118.6
10200	159.3	148.2	145.4	144.7	142.9	141.1	138.9	136.1	132.0	128.0	120.6
10600	161.8	150.4	147.7	146.9	145.1	143.3	141.1	138.2	134.0	129.9	122.4
CLIMB LIMIT WT (1000 LB)	148.0	147.4	147.2	147.0	145.3	143.4	140.6	136.5	130.7	125.3	115.7

10000 FT Pressure Altitude

CORR'D FIELD LENGTH (FT)	FIELD LIMIT WEIGHT (1000 LB)										
	OAT (°C)										
	-40	0	11	14	18	22	26	30	35	40	50
4000	88.6	82.3	80.7	79.9	78.8	77.8	76.5	74.8	72.4	69.9	65.2
4200	91.3	84.9	83.2	82.4	81.3	80.3	79.0	77.3	74.7	72.2	67.3
4600	96.7	90.0	88.2	87.4	86.3	85.1	83.8	82.0	79.3	76.7	71.6
5000	101.8	94.8	92.9	92.0	90.9	89.7	88.3	86.4	83.6	80.8	75.5
5400	106.5	99.2	97.2	96.3	95.1	93.8	92.4	90.4	87.5	84.6	79.0
5800	111.0	103.4	101.3	100.3	99.1	97.8	96.3	94.2	91.2	88.2	82.4
6200	115.2	107.3	105.2	104.2	102.8	101.5	100.0	97.8	94.6	91.5	85.5
6600	119.3	111.0	108.9	107.8	106.4	105.0	103.4	101.2	97.9	94.7	88.4
7000	123.2	114.7	112.4	111.3	109.9	108.5	106.8	104.5	101.1	97.8	91.3
7400	127.0	118.2	115.9	114.8	113.3	111.8	110.1	107.7	104.2	100.8	94.1
7800	130.6	121.6	119.2	118.0	116.5	115.0	113.3	110.8	107.2	103.7	96.8
8200	134.2	125.0	122.5	121.3	119.8	118.2	116.4	113.9	110.2	106.6	99.5
8600	137.7	128.2	125.7	124.5	122.9	121.3	119.4	116.8	113.1	109.3	102.1
9000	140.8	131.1	128.5	127.2	125.6	124.0	122.1	119.4	115.6	111.8	104.4
9400	143.5	133.6	131.0	129.7	128.0	126.4	124.4	121.7	117.8	113.9	106.3
9800	146.1	136.0	133.3	132.0	130.3	128.6	126.6	123.8	119.8	115.9	108.2
10200	148.5	138.2	135.5	134.1	132.4	130.7	128.7	125.9	121.8	117.8	109.9
10600	150.8	140.3	137.6	136.2	134.5	132.7	130.7	127.8	123.7	119.6	111.6
CLIMB LIMIT WT (1000 LB)	138.8	137.9	137.2	136.0	134.3	132.4	129.7	125.8	120.3	115.1	104.9

With engine bleed for packs off, increase field limit weight by 800 lb and climb limit weight by 3100 lb.
With engine anti-ice on, decrease field limit weight by 500 lb and climb limit weight by 600 lb.
With engine and wing anti-ice on (optional system), decrease field limit weight by 1900 lb and climb limit weight by 3200 lb.

Takeoff Field Corrections - Wet Runway

Slope Corrections

FIELD LENGTH AVAILABLE (FT)	SLOPE CORRECTED FIELD LENGTH (FT)								
	RUNWAY SLOPE (%)								
	-2.0	-1.5	-1.0	-0.5	0.0	0.5	1.0	1.5	2.0
4200	4330	4300	4260	4230	4200	4160	4110	4070	4020
4600	4770	4730	4690	4640	4600	4540	4480	4420	4360
5000	5210	5160	5110	5050	5000	4930	4850	4780	4700
5400	5660	5590	5530	5460	5400	5310	5220	5130	5040
5800	6100	6030	5950	5880	5800	5700	5590	5490	5380
6200	6540	6460	6370	6290	6200	6080	5960	5840	5720
6600	6990	6890	6790	6700	6600	6470	6330	6200	6060
7000	7430	7320	7210	7110	7000	6850	6700	6550	6400
7400	7870	7750	7640	7520	7400	7240	7070	6910	6740
7800	8310	8190	8060	7930	7800	7620	7440	7260	7080
8200	8760	8620	8480	8340	8200	8010	7810	7620	7420
8600	9200	9050	8900	8750	8600	8390	8180	7970	7760
9000	9640	9480	9320	9160	9000	8780	8550	8330	8100
9400	10090	9910	9740	9570	9400	9160	8920	8680	8440
9800	10530	10350	10160	9980	9800	9550	9290	9040	8780
10200	11000	10800	10600	10400	10200	9930	9660	9390	9120
10600	11500	11270	11050	10820	10600	10320	10030	9750	9460
11000	11990	11740	11500	11250	11000	10700	10400	10100	9800
11400	12490	12220	11940	11670	11400	11090	10770	10460	10140
11800	12990	12690	12390	12100	11800	11470	11140	10810	10480

Wind Corrections

SLOPE CORR'D FIELD LENGTH (FT)	SLOPE & WIND CORRECTED FIELD LENGTH (FT)							
	WIND COMPONENT (KTS)							
	-15	-10	-5	0	10	20	30	40
4200	3050	3430	3820	4200	4460	4730	5000	5280
4600	3390	3790	4200	4600	4870	5160	5440	5740
5000	3730	4150	4580	5000	5290	5580	5890	6190
5400	4070	4520	4960	5400	5700	6010	6330	6650
5800	4410	4880	5340	5800	6120	6440	6770	7110
6200	4750	5240	5720	6200	6530	6870	7220	7570
6600	5100	5600	6100	6600	6940	7300	7660	8030
7000	5440	5960	6480	7000	7360	7730	8100	8490
7400	5780	6320	6860	7400	7770	8150	8550	8950
7800	6120	6680	7240	7800	8190	8580	8990	9410
8200	6460	7040	7620	8200	8600	9010	9430	9870
8600	6800	7400	8000	8600	9010	9440	9880	10320
9000	7140	7760	8380	9000	9430	9870	10320	10780
9400	7480	8120	8760	9400	9840	10300	10760	11240
9800	7820	8480	9140	9800	10260	10720	11210	11700
10200	8160	8840	9520	10200	10670	11150	11650	12160
10600	8500	9200	9900	10600	11080	11580	12090	12620
11000	8840	9560	10280	11000	11500	12010	12540	13080
11400	9180	9920	10660	11400	11910	12440	12980	13540
11800	9520	10280	11040	11800	12330	12870	13420	14000

Takeoff Field & Climb Limit Weights - Wet Runway

Flaps 5

Sea Level Pressure Altitude

CORR'D FIELD LENGTH (FT)	FIELD LIMIT WEIGHT (1000 LB)										
	OAT (°C)										
	-40	0	11	14	18	22	26	30	35	40	50
4000	124.0	115.5	113.2	112.6	111.8	111.0	110.2	109.4	106.1	103.0	96.8
4200	127.6	118.8	116.4	115.8	114.9	114.1	113.3	112.5	109.2	105.9	99.5
4600	134.6	125.3	122.8	122.1	121.2	120.3	119.5	118.6	115.1	111.6	104.8
5000	141.2	131.4	128.8	128.1	127.1	126.2	125.3	124.4	120.7	117.0	109.9
5400	147.5	137.2	134.5	133.7	132.7	131.8	130.8	129.9	126.0	122.2	114.7
5800	153.5	142.8	139.9	139.1	138.1	137.1	136.1	135.1	131.1	127.1	119.3
6200	159.1	148.0	145.0	144.2	143.2	142.1	141.1	140.1	135.9	131.7	123.6
6600	164.6	153.1	150.0	149.1	148.0	147.0	145.9	144.8	140.5	136.2	127.8
7000	169.9	157.9	154.7	153.9	152.8	151.6	150.6	149.4	144.9	140.5	131.8
7400	175.0	162.7	159.4	158.5	157.3	156.2	155.1	153.9	149.3	144.7	135.8
7800	179.9	167.3	163.9	163.0	161.8	160.6	159.4	158.2	153.4	148.7	139.5
8200	184.8	171.7	168.2	167.3	166.1	164.9	163.7	162.4	157.5	152.7	143.2
8600	189.4	176.0	172.4	171.5	170.2	169.0	167.7	166.5	161.4	156.5	146.7
9000	189.9	180.0	176.3	175.3	174.0	172.8	171.5	170.2	165.0	160.0	150.0
9400	189.9	183.7	180.0	179.0	177.6	176.3	175.0	173.7	168.4	163.2	153.0
9800	189.9	187.4	183.5	182.5	181.1	179.8	178.5	177.2	171.7	166.4	156.0
10200	189.9	189.9	187.0	185.9	184.5	183.2	181.8	180.5	174.9	169.5	158.8
10600	189.9	189.9	189.9	189.2	187.8	186.4	185.1	183.7	178.0	172.4	161.6
CLIMB LIMIT WT (1000 LB)	188.1	187.4	186.8	186.6	186.4	186.1	185.8	185.4	177.7	170.3	155.9

2000 FT Pressure Altitude

CORR'D FIELD LENGTH (FT)	FIELD LIMIT WEIGHT (1000 LB)										
	OAT (°C)										
	-40	0	11	14	18	22	26	30	35	40	50
4000	117.0	108.6	106.5	105.9	105.2	104.4	103.7	101.8	98.9	96.0	90.3
4200	120.4	111.7	109.5	108.9	108.1	107.4	106.6	104.7	101.7	98.7	92.8
4600	127.0	117.8	115.4	114.8	114.0	113.2	112.4	110.4	107.2	104.0	97.7
5000	133.2	123.5	121.1	120.4	119.6	118.7	117.9	115.7	112.4	109.0	102.5
5400	139.1	128.9	126.4	125.7	124.8	123.9	123.1	120.8	117.3	113.8	106.9
5800	144.7	134.1	131.5	130.8	129.8	128.9	128.0	125.7	122.0	118.3	111.2
6200	150.0	139.1	136.3	135.6	134.6	133.6	132.7	130.2	126.5	122.6	115.2
6600	155.1	143.8	140.9	140.1	139.1	138.2	137.2	134.6	130.7	126.7	119.1
7000	160.1	148.4	145.4	144.6	143.6	142.5	141.5	138.9	134.9	130.7	122.8
7400	164.9	152.8	149.7	148.9	147.9	146.8	145.8	143.1	138.9	134.6	126.5
7800	169.6	157.1	153.9	153.1	152.0	150.9	149.8	147.1	142.8	138.4	130.0
8200	174.1	161.3	158.0	157.2	156.0	154.9	153.8	151.0	146.5	142.0	133.4
8600	178.4	165.3	161.9	161.1	159.9	158.8	157.6	154.7	150.2	145.5	136.6
9000	182.5	169.0	165.6	164.7	163.5	162.3	161.2	158.1	153.5	148.8	139.7
9400	186.3	172.5	169.0	168.0	166.8	165.6	164.5	161.4	156.6	151.8	142.4
9800	189.9	175.9	172.3	171.3	170.1	168.9	167.7	164.5	159.6	154.7	145.1
10200	189.9	179.1	175.5	174.5	173.2	172.0	170.8	167.5	162.6	157.5	147.8
10600	189.9	182.3	178.6	177.6	176.3	175.0	173.8	170.5	165.4	160.2	150.3
CLIMB LIMIT WT (1000 LB)	179.3	178.6	178.1	178.0	177.8	177.6	177.3	173.1	166.2	159.2	145.8

With engine bleed for packs off, increase field limit weight by 800 lb and climb limit weight by 3100 lb.
With engine anti-ice on, decrease field limit weight by 400 lb and climb limit weight by 600 lb.
With engine and wing anti-ice on (optional system), decrease field limit weight by 1700 lb and climb limit weight by 3200 lb.

Takeoff Field & Climb Limit Weights - Wet Runway

Flaps 5

4000 FT Pressure Altitude

CORR'D FIELD LENGTH (FT)	FIELD LIMIT WEIGHT (1000 LB)										
	OAT (°C)										
	-40	0	11	14	18	22	26	30	35	40	50
4000	109.3	101.4	99.4	98.9	98.2	97.6	96.2	94.6	92.1	89.4	84.4
4200	112.4	104.3	102.2	101.7	101.0	100.3	98.9	97.3	94.7	91.9	86.8
4600	118.5	109.9	107.7	107.2	106.4	105.7	104.2	102.5	99.8	96.8	91.4
5000	124.3	115.2	113.0	112.4	111.6	110.8	109.3	107.5	104.6	101.5	95.7
5400	129.8	120.3	117.9	117.3	116.5	115.7	114.1	112.2	109.2	105.9	99.9
5800	135.0	125.1	122.7	122.0	121.1	120.3	118.6	116.6	113.5	110.1	103.9
6200	140.0	129.7	127.1	126.5	125.6	124.7	122.9	120.9	117.6	114.1	107.6
6600	144.7	134.1	131.4	130.7	129.8	128.9	127.1	124.9	121.6	117.9	111.2
7000	149.3	138.3	135.6	134.8	133.9	133.0	131.1	128.9	125.4	121.6	114.7
7400	153.8	142.5	139.6	138.9	137.9	136.9	135.0	132.7	129.1	125.2	118.0
7800	158.1	146.4	143.5	142.7	141.7	140.7	138.7	136.4	132.7	128.7	121.3
8200	162.4	150.3	147.3	146.5	145.5	144.5	142.4	140.0	136.2	132.1	124.5
8600	166.4	154.0	150.9	150.1	149.1	148.0	145.9	143.5	139.6	135.3	127.5
9000	170.1	157.5	154.3	153.5	152.4	151.3	149.2	146.6	142.6	138.3	130.3
9400	173.6	160.7	157.4	156.6	155.5	154.4	152.2	149.6	145.5	141.0	132.9
9800	177.0	163.8	160.5	159.6	158.5	157.3	155.1	152.4	148.3	143.7	135.4
10200	180.3	166.8	163.4	162.5	161.4	160.2	157.9	155.2	150.9	146.3	137.8
10600	183.5	169.7	166.3	165.4	164.2	163.0	160.7	157.9	153.5	148.8	140.1
CLIMB LIMIT WT (1000 LB)	168.6	167.9	167.5	167.4	167.2	167.0	164.5	161.0	155.2	148.5	136.5

6000 FT Pressure Altitude

CORR'D FIELD LENGTH (FT)	FIELD LIMIT WEIGHT (1000 LB)										
	OAT (°C)										
	-40	0	11	14	18	22	26	30	35	40	50
4000	101.9	94.6	92.8	92.3	91.7	90.5	89.3	87.9	85.6	83.1	78.6
4200	104.8	97.2	95.4	94.9	94.2	93.0	91.8	90.3	88.0	85.4	80.8
4600	110.4	102.4	100.4	99.9	99.2	98.0	96.7	95.1	92.6	89.9	85.0
5000	115.8	107.4	105.3	104.8	104.0	102.7	101.3	99.7	97.1	94.2	89.1
5400	120.9	112.1	109.9	109.3	108.6	107.2	105.8	104.0	101.3	98.3	92.9
5800	125.7	116.6	114.3	113.7	112.9	111.5	110.0	108.2	105.3	102.2	96.6
6200	130.3	120.8	118.4	117.8	117.0	115.5	114.0	112.1	109.1	105.9	100.0
6600	134.7	124.9	122.4	121.8	120.9	119.4	117.8	115.8	112.8	109.4	103.3
7000	139.0	128.8	126.3	125.6	124.7	123.1	121.5	119.5	116.3	112.8	106.5
7400	143.2	132.6	130.0	129.3	128.4	126.8	125.1	123.0	119.7	116.1	109.7
7800	147.2	136.3	133.6	132.9	132.0	130.3	128.5	126.4	123.0	119.3	112.7
8200	151.1	139.9	137.2	136.4	135.5	133.7	131.9	129.7	126.3	122.5	115.6
8600	154.8	143.4	140.5	139.8	138.8	137.0	135.1	132.9	129.4	125.4	118.4
9000	158.3	146.5	143.6	142.9	141.8	140.0	138.1	135.8	132.2	128.2	121.0
9400	161.5	149.5	146.5	145.7	144.7	142.8	140.9	138.5	134.8	130.7	123.3
9800	164.6	152.4	149.3	148.5	147.4	145.5	143.5	141.1	137.3	133.1	125.6
10200	167.6	155.1	152.0	151.2	150.1	148.1	146.1	143.6	139.8	135.5	127.8
10600	170.6	157.8	154.6	153.8	152.7	150.7	148.6	146.1	142.2	137.8	129.9
CLIMB LIMIT WT (1000 LB)	158.1	157.5	157.2	157.1	156.9	154.8	152.5	149.3	143.6	137.3	126.7

With engine bleed for packs off, increase field limit weight by 800 lb and climb limit weight by 3100 lb.
With engine anti-ice on, decrease field limit weight by 400 lb and climb limit weight by 600 lb.
With engine and wing anti-ice on (optional system), decrease field limit weight by 1700 lb and climb limit weight by 3200 lb.

Takeoff Field & Climb Limit Weights - Wet Runway

Flaps 5

8000 FT Pressure Altitude

CORR'D FIELD LENGTH (FT)	FIELD LIMIT WEIGHT (1000 LB)										
	OAT (°C)										
	-40	0	11	14	18	22	26	30	35	40	50
4000	95.0	88.3	86.6	86.2	85.2	84.1	82.8	81.2	78.8	76.6	72.5
4200	97.7	90.7	89.0	88.6	87.5	86.4	85.1	83.4	81.0	78.7	74.5
4600	102.9	95.5	93.7	93.3	92.1	91.0	89.6	87.8	85.2	82.8	78.3
5000	107.9	100.1	98.2	97.7	96.6	95.3	93.9	92.0	89.3	86.7	82.0
5400	112.6	104.5	102.5	102.0	100.8	99.5	97.9	96.0	93.1	90.5	85.6
5800	117.1	108.7	106.6	106.1	104.8	103.4	101.8	99.8	96.8	94.0	88.9
6200	121.3	112.6	110.5	109.9	108.5	107.2	105.5	103.4	100.3	97.4	92.1
6600	125.4	116.3	114.1	113.5	112.2	110.7	109.0	106.8	103.6	100.6	95.1
7000	129.4	120.0	117.7	117.1	115.7	114.2	112.4	110.1	106.8	103.7	98.0
7400	133.2	123.6	121.2	120.6	119.1	117.6	115.7	113.4	110.0	106.8	100.9
7800	136.9	127.0	124.5	123.9	122.4	120.8	118.9	116.5	113.0	109.7	103.7
8200	140.6	130.3	127.8	127.1	125.6	124.0	122.0	119.5	115.9	112.6	106.4
8600	144.0	133.5	130.9	130.3	128.6	127.0	125.0	122.5	118.8	115.3	108.9
9000	147.2	136.4	133.8	133.1	131.4	129.7	127.7	125.1	121.3	117.8	111.2
9400	150.2	139.1	136.4	135.7	134.0	132.3	130.2	127.5	123.7	120.0	113.3
9800	153.0	141.8	139.0	138.3	136.6	134.8	132.6	129.9	125.9	122.2	115.4
10200	155.8	144.3	141.5	140.8	139.0	137.2	135.0	132.2	128.1	124.3	117.4
10600	158.5	146.8	143.9	143.1	141.3	139.5	137.3	134.4	130.3	126.4	119.3
CLIMB LIMIT WT (1000 LB)	148.0	147.4	147.2	147.0	145.3	143.4	140.6	136.5	130.7	125.3	115.7

10000 FT Pressure Altitude

CORR'D FIELD LENGTH (FT)	FIELD LIMIT WEIGHT (1000 LB)										
	OAT (°C)										
	-40	0	11	14	18	22	26	30	35	40	50
4000	88.7	82.4	80.8	80.0	79.0	78.0	76.8	75.2	73.0	70.8	66.5
4200	91.2	84.7	83.0	82.2	81.2	80.1	78.9	77.3	75.0	72.7	68.3
4600	96.0	89.1	87.4	86.5	85.4	84.3	83.0	81.3	78.9	76.5	71.8
5000	100.7	93.4	91.5	90.6	89.5	88.3	87.0	85.1	82.6	80.1	75.1
5400	105.0	97.5	95.5	94.6	93.4	92.1	90.7	88.8	86.1	83.5	78.3
5800	109.2	101.3	99.3	98.3	97.1	95.8	94.3	92.3	89.5	86.8	81.4
6200	113.2	105.0	102.8	101.8	100.5	99.2	97.7	95.6	92.7	89.9	84.3
6600	117.0	108.4	106.2	105.2	103.9	102.5	100.9	98.8	95.8	92.8	87.0
7000	120.6	111.8	109.6	108.5	107.1	105.7	104.0	101.8	98.7	95.6	89.7
7400	124.2	115.1	112.8	111.7	110.2	108.8	107.1	104.8	101.6	98.4	92.3
7800	127.6	118.3	115.9	114.7	113.3	111.8	110.0	107.7	104.4	101.1	94.8
8200	131.0	121.4	118.9	117.7	116.2	114.7	112.9	110.5	107.1	103.7	97.2
8600	134.2	124.3	121.8	120.6	119.0	117.5	115.6	113.1	109.6	106.2	99.5
9000	137.2	127.0	124.4	123.2	121.6	120.0	118.1	115.5	112.0	108.5	101.6
9400	139.9	129.5	126.9	125.6	124.0	122.3	120.4	117.8	114.1	110.5	103.5
9800	142.5	131.9	129.2	127.9	126.3	124.6	122.6	119.9	116.2	112.5	105.3
10200	145.1	134.3	131.5	130.2	128.5	126.7	124.7	122.0	118.2	114.4	107.1
10600	147.6	136.5	133.7	132.3	130.6	128.8	126.8	124.0	120.1	116.3	108.8
CLIMB LIMIT WT (1000 LB)	138.8	137.9	137.2	136.0	134.3	132.4	129.7	125.8	120.3	115.1	104.9

With engine bleed for packs off, increase field limit weight by 800 lb and climb limit weight by 3100 lb.
With engine anti-ice on, decrease field limit weight by 400 lb and climb limit weight by 600 lb.
With engine and wing anti-ice on (optional system), decrease field limit weight by 1700 lb and climb limit weight by 3200 lb.

Takeoff Obstacle Limit Weight

Flaps 5

Sea Level, 30°C & Below, Zero Wind

Based on engine bleed for packs on and anti-ice off

Reference Obstacle Limit Weight (1000 LB)

OBSTACLE HEIGHT (FT)	DISTANCE FROM BRAKE RELEASE (1000 FT)								
	8	10	12	14	16	18	20	22	24
10	157.5	175.5	188.6						
50	147.5	163.9	176.8	186.3					
100	138.4	153.9	166.1	175.5	182.9	187.9			
150	131.4	146.1	158.0	167.3	174.7	180.7	185.3	188.6	
200	125.4	139.7	151.3	160.6	168.1	174.2	179.2	183.2	186.5
250	120.2	134.2	145.5	154.8	162.4	168.6	173.8	178.1	181.7
300	115.6	129.3	140.4	149.6	157.3	163.6	168.9	173.4	177.2
350	111.4	124.9	135.8	145.0	152.7	159.1	164.6	169.2	173.1
400	107.5	120.8	131.7	140.8	148.5	155.0	160.5	165.3	169.3
450	103.9	117.2	127.9	136.9	144.6	151.2	156.8	161.6	165.8
500	100.6	113.7	124.4	133.4	141.0	147.6	153.3	158.2	162.5
550	97.5	110.6	121.2	130.1	137.7	144.3	150.0	155.0	159.3
600	94.6	107.6	118.1	127.0	134.6	141.1	146.9	151.9	156.3
650	91.9	104.7	115.2	124.1	131.6	138.2	144.0	149.0	153.5
700		102.1	112.5	121.3	128.9	135.4	141.2	146.3	150.8
750		99.5	109.9	118.7	126.2	132.8	138.6	143.7	148.3
800		97.2	107.5	116.2	123.7	130.3	136.1	141.2	145.8
850		94.9	105.2	113.9	121.3	127.9	133.7	138.8	143.4
900		92.7	102.9	111.6	119.1	125.6	131.4	136.6	141.2
950		90.7	100.8	109.4	116.9	123.4	129.2	134.4	139.0
1000			98.8	107.4	114.8	121.3	127.1	132.3	136.9

Obstacle height must be calculated from lowest point of the runway to conservatively account for runway slope.

OAT Adjustments

OAT (°C)	REFERENCE OBSTACLE LIMIT WEIGHT (1000 LB)					
	90	110	130	150	170	190
30 & BELOW	0	0	0	0	0	0
32	-1.3	-1.7	-2.0	-2.3	-2.7	-3.0
34	-2.6	-3.3	-4.0	-4.7	-5.4	-6.0
36	-4.0	-5.0	-6.0	-7.0	-8.0	-9.1
38	-5.3	-6.6	-8.0	-9.4	-10.7	-12.1
40	-6.5	-8.2	-9.9	-11.6	-13.3	-14.9
42	-7.7	-9.8	-11.8	-13.8	-15.8	-17.8
44	-9.0	-11.3	-13.6	-16.0	-18.3	-20.7
46	-10.2	-12.9	-15.5	-18.2	-20.8	-23.5
48	-11.4	-14.4	-17.4	-20.4	-23.4	-26.3
50	-12.7	-16.0	-19.3	-22.6	-25.9	-29.2

Takeoff Obstacle Limit Weight

Flaps 5

Sea Level, 30°C & Below, Zero Wind

Pressure Altitude Adjustments

ALT (FT)	OAT ADJUSTED OBSTACLE LIMIT WEIGHT (1000 LB)					
	90	110	130	150	170	190
S.L.& BELOW	0	0	0	0	0	0
1000	-3.3	-4.0	-4.6	-5.3	-6.0	-6.7
2000	-6.5	-7.9	-9.3	-10.6	-12.0	-13.4
3000	-9.6	-11.6	-13.7	-15.7	-17.8	-19.8
4000	-12.6	-15.3	-18.1	-20.8	-23.5	-26.2
5000	-15.5	-18.8	-22.2	-25.6	-29.0	-32.3
6000	-18.3	-22.4	-26.4	-30.4	-34.4	-38.4
7000	-20.9	-25.6	-30.3	-35.1	-39.8	-44.5
8000	-23.4	-28.9	-34.3	-39.8	-45.2	-50.6
9000	-26.0	-32.0	-38.0	-44.0	-50.1	-56.1
10000	-28.5	-35.1	-41.7	-48.3	-54.9	-61.5

Wind Adjustments

WIND (KTS)	OAT & ALT ADJUSTED OBSTACLE LIMIT WEIGHT (1000 LB)					
	90	110	130	150	170	190
15 TW	-19.2	-18.8	-18.3	-17.9	-17.4	-16.9
10 TW	-12.8	-12.5	-12.2	-11.9	-11.6	-11.3
5 TW	-6.4	-6.3	-6.1	-6.0	-5.8	-5.6
0	0	0	0	0	0	0
10 HW	2.3	2.1	1.9	1.7	1.5	1.3
20 HW	4.5	4.1	3.8	3.4	3.0	2.6
30 HW	7.0	6.5	5.9	5.3	4.7	4.1
40 HW	9.5	8.8	8.0	7.2	6.4	5.6

With engine bleed for packs off, increase weight by 1400 lb.
With engine anti-ice on, decrease weight by 700 lb.
With engine and wing anti-ice on, decrease weight by 3300 lb (optional system).

Tire Speed Limit Weight

Flaps 5 Limit Weight (1000 LB)

OAT (°C)	AIRPORT PRESSURE ALTITUDE (FT)					
	0	2000	4000	6000	8000	10000
54	190.0	187.8	173.3	159.8	147.2	
52	190.0	189.0	174.5	160.9	148.2	
50	190.0	190.0	175.7	162.0	149.2	137.6
48	190.0	190.0	176.9	163.1	150.3	138.5
46	190.0	190.0	178.2	164.3	151.3	139.4
44	190.0	190.0	179.4	165.4	152.4	140.3
42	190.0	190.0	180.7	166.6	153.4	141.3
40	190.0	190.0	182.0	167.7	154.5	142.2
38	190.0	190.0	183.3	169.0	155.6	143.2
36	190.0	190.0	184.6	170.2	156.7	144.3
34	190.0	190.0	186.0	171.4	157.8	145.3
32	190.0	190.0	187.3	172.7	159.0	146.3
30	190.0	190.0	188.7	173.9	160.1	147.4
28	190.0	190.0	190.0	175.2	161.3	148.5
26	190.0	190.0	190.0	176.5	162.5	149.6
24	190.0	190.0	190.0	177.8	163.7	150.7
22	190.0	190.0	190.0	179.1	164.9	151.8
20	190.0	190.0	190.0	180.4	166.1	152.9
18	190.0	190.0	190.0	181.8	167.4	154.0
16	190.0	190.0	190.0	183.1	168.6	155.2
14	190.0	190.0	190.0	184.5	169.9	156.3
12	190.0	190.0	190.0	185.9	171.2	157.5
10	190.0	190.0	190.0	187.3	172.5	158.7
-40	190.0	190.0	190.0	190.0	190.0	190.0

Increase tire speed limit weight by 1200 lb per knot headwind.
Decrease tire speed limit weight by 2500 lb per knot tailwind.

Brake Energy Limits VMBE

Maximum Brake Energy Speed

OAT (°C)	REFERENCE VMBE (KIAS)						
	PRESSURE ALTITUDE (FT)						
	-2000	0	2000	4000	6000	8000	10000
54	181	174					
50	182	175	169				
46	183	176	170	164			
42	184	177	171	164	159		
38	184	178	171	165	159	153	
34	185	178	172	166	160	154	146
30	187	179	173	167	161	155	148
26	188	180	174	168	162	156	149
22	189	182	175	169	163	157	150
18	191	183	177	170	164	158	152
14	193	185	178	172	165	159	153
10	194	186	179	173	167	161	154
6	196	188	181	174	168	162	156
2	197	189	182	176	169	163	157
-2	199	191	184	177	171	164	158
-6	201	193	186	179	172	166	160
-10	203	194	187	180	174	167	161

Weight Adjusted VMBE

WEIGHT (1000 LB)	REFERENCE VMBE (KIAS)										
	160	165	170	175	180	185	190	195	200	205	210
190	139	144	148	152	156	160	164	168	172	176	181
180	143	147	151	156	160	164	169	173	177	182	186
170	147	152	156	161	165	170	174	179	183	188	192
160	152	157	161	166	171	175	180	185	190	194	199
150	157	162	167	172	177	182	187	192	197	201	206
140	163	169	174	179	184	189	194	199	204	209	210
130	170	176	181	186	192	197	202	208	210	210	210
120	178	184	190	195	201	206	210	210	210	210	210
110	188	194	200	206	210	210	210	210	210	210	210
100	199	205	210	210	210	210	210	210	210	210	210

Increase VMBE by 1 knot per 1% uphill runway slope. Decrease VMBE by 4 knots per 1% downhill runway slope.
Increase VMBE by 2 knots per 10 knots headwind. Decrease VMBE by 19 knots per 10 knots tailwind.
Decrease brake release weight by 1100 lb for each knot V1 exceeds VMBE.
Determine normal V1, VR, V2 speeds for lower brake release weight.

Performance Dispatch — Chapter PD
Enroute — Section 61

Long Range Cruise Maximum Operating Altitude
Max Cruise Thrust
ISA + 10°C and Below

WEIGHT (1000 LB)	OPTIMUM ALT (FT)	TAT (°C)	MARGIN TO INITIAL BUFFET 'G' (BANK ANGLE)				
			1.20 (33°)	1.25 (36°)	1.30 (39°)	1.40 (44°)	1.50 (48°)
190	30000	-5	31900*	31900*	31900*	31500	30100
180	31200	-7	33500*	33500*	33500*	32600	31300
170	32400	-10	35000*	35000*	35000*	33900	32500
160	33700	-13	36300*	36300*	36300*	35100	33800
150	35100	-16	37600*	37600*	37600*	36500	35100
140	36500	-18	38900*	38900*	38900*	37900	36600
130	38100	-18	40300*	40300*	40300*	39500	38100
120	39700	-18	41000	41000	41000	41000	39800
110	41000	-18	41000	41000	41000	41000	41000
100	41000	-18	41000	41000	41000	41000	41000
90	41000	-18	41000	41000	41000	41000	41000

ISA + 15°C

WEIGHT (1000 LB)	OPTIMUM ALT (FT)	TAT (°C)	MARGIN TO INITIAL BUFFET 'G' (BANK ANGLE)				
			1.20 (33°)	1.25 (36°)	1.30 (39°)	1.40 (44°)	1.50 (48°)
190	30000	1	29300*	29300*	29300*	29300*	29300*
180	31200	-2	31500*	31500*	31500*	31500*	31300
170	32400	-4	33600*	33600*	33600*	33600*	32500
160	33700	-7	35300*	35300*	35300*	35100	33800
150	35100	-10	36700*	36700*	36700*	36500	35100
140	36500	-13	38000*	38000*	38000*	37900	36600
130	38100	-13	39300*	39300*	39300*	39300*	38100
120	39700	-13	40700*	40700*	40700*	40700*	39800
110	41000	-13	41000	41000	41000	41000	41000
100	41000	-13	41000	41000	41000	41000	41000
90	41000	-13	41000	41000	41000	41000	41000

ISA + 20°C

WEIGHT (1000 LB)	OPTIMUM ALT (FT)	TAT (°C)	MARGIN TO INITIAL BUFFET 'G' (BANK ANGLE)				
			1.20 (33°)	1.25 (36°)	1.30 (39°)	1.40 (44°)	1.50 (48°)
190	30000	7	26000*	26000*	26000*	26000*	26000*
180	31200	4	28200*	28200*	28200*	28200*	28200*
170	32400	1	30600*	30600*	30600*	30600*	30600*
160	33700	-2	33200*	33200*	33200*	33200*	33200*
150	35100	-5	35200*	35200*	35200*	35200*	35100
140	36500	-7	36600*	36600*	36600*	36600*	36600
130	38100	-7	38000*	38000*	38000*	38000*	38000*
120	39700	-7	39400*	39400*	39400*	39400*	39400*
110	41000	-7	40900*	40900*	40900*	40900*	40900*
100	41000	-7	41000	41000	41000	41000	41000
90	41000	-7	41000	41000	41000	41000	41000

***Denotes altitude thrust limited in level flight, 100 fpm residual rate of climb.**

Long Range Cruise Trip Fuel and Time

Ground to Air Miles Conversion

AIR DISTANCE (NM)					GROUND DISTANCE (NM)	AIR DISTANCE (NM)				
HEADWIND COMPONENT (KTS)						TAILWIND COMPONENT (KTS)				
100	80	60	40	20		20	40	60	80	100
276	257	240	225	212	200	190	181	173	165	158
544	508	475	447	423	400	381	364	348	333	320
810	758	711	670	633	600	572	547	523	502	482
1077	1008	946	892	844	800	763	730	699	670	645
1342	1258	1181	1114	1054	1000	955	913	874	839	807
1606	1506	1416	1336	1265	1200	1146	1096	1050	1008	969
1870	1754	1650	1557	1475	1400	1337	1279	1225	1176	1132
2133	2002	1883	1779	1685	1600	1528	1462	1401	1345	1295
2395	2249	2117	2000	1895	1800	1720	1645	1577	1514	1458
2657	2496	2350	2221	2105	2000	1911	1829	1753	1684	1621
2917	2741	2582	2441	2315	2200	2103	2012	1929	1853	1784
3177	2987	2814	2661	2525	2400	2294	2196	2106	2023	1948
3437	3232	3046	2882	2735	2600	2486	2380	2282	2193	2111
3696	3477	3278	3102	2944	2800	2677	2563	2458	2362	2275
3955	3721	3509	3322	3154	3000	2869	2747	2635	2532	2439
4213	3966	3741	3542	3363	3200	3061	2931	2812	2703	2603
4471	4210	3972	3762	3573	3400	3252	3115	2989	2873	2767
4729	4454	4203	3981	3782	3600	3444	3299	3166	3043	2931
4986	4697	4434	4201	3992	3800	3636	3483	3343	3213	3096
5243	4940	4665	4420	4201	4000	3828	3668	3520	3384	3260
5500	5183	4895	4640	4410	4200	4019	3852	3696	3554	3424
5756	5426	5126	4859	4620	4400	4211	4036	3873	3724	3589
6011	5669	5356	5079	4829	4600	4403	4220	4050	3895	3753
6267	5911	5586	5298	5038	4800	4595	4404	4227	4065	3918
6522	6153	5816	5517	5247	5000	4786	4588	4404	4236	4082

Long Range Cruise Trip Fuel and Time

Reference Fuel and Time Required

AIR DIST (NM)	PRESSURE ALTITUDE (1000 FT)									
	29		31		33		35		37	
	FUEL (1000 LB)	TIME (HR:MIN)	FUEL (1000 LB)	TIME (HR:MIN)	FUEL (1000 LB)	TIME (HR:MIN)	FUEL (1000 LB)	TIME (HR:MIN)	FUEL (1000 LB)	TIME (HR:MIN)
200	3.7	0:38	3.7	0:38	3.7	0:37	3.7	0:38	3.7	0:38
400	6.3	1:06	6.2	1:05	6.2	1:05	6.1	1:04	6.1	1:04
600	8.8	1:35	8.7	1:33	8.6	1:32	8.5	1:31	8.4	1:31
800	11.4	2:03	11.2	2:01	11.0	1:59	10.9	1:58	10.8	1:57
1000	14.1	2:31	13.8	2:28	13.5	2:26	13.3	2:25	13.2	2:24
1200	16.8	2:59	16.4	2:55	16.1	2:53	15.8	2:51	15.7	2:50
1400	19.5	3:26	19.1	3:22	18.6	3:20	18.3	3:18	18.3	3:17
1600	22.2	3:54	21.7	3:50	21.2	3:47	20.8	3:44	20.8	3:43
1800	24.9	4:21	24.3	4:17	23.8	4:13	23.3	4:11	23.3	4:09
2000	27.6	4:49	27.0	4:44	26.3	4:40	25.8	4:38	25.8	4:36
2200	30.5	5:15	29.7	5:10	29.0	5:06	28.5	5:04		
2400	33.3	5:42	32.5	5:37	31.8	5:33	31.3	5:30		
2600	36.2	6:09	35.3	6:03	34.5	5:59	34.0	5:57		
2800	39.0	6:36	38.1	6:30	37.2	6:25	36.7	6:23		
3000	41.9	7:03	40.9	6:56	39.9	6:52	39.4	6:49		
3200	44.9	7:29	43.8	7:23	42.9	7:18				
3400	47.9	7:56	46.8	7:49	45.8	7:44				
3600	51.0	8:22	49.7	8:15	48.7	8:10				
3800	54.0	8:48	52.7	8:41	51.7	8:36				
4000	57.0	9:15	55.6	9:07	54.6	9:02				
4200	60.2	9:40	58.8	9:33						
4400	63.4	10:06	62.0	9:59						
4600	66.6	10:32	65.2	10:25						
4800	69.8	10:58	68.3	10:51						
5000	73.1	11:24	71.5	11:17						

Fuel Required Adjustments (1000 LB)

REFERENCE FUEL REQUIRED (1000 LB)	LANDING WEIGHT (1000 LB)				
	90	110	130	150	170
5	-0.8	-0.4	0.0	0.5	1.0
10	-1.6	-0.8	0.0	0.9	2.1
15	-2.4	-1.3	0.0	1.4	3.3
20	-3.2	-1.7	0.0	2.0	4.6
25	-4.0	-2.1	0.0	2.6	5.9
30	-4.8	-2.5	0.0	3.2	7.4
35	-5.6	-2.9	0.0	3.8	9.0
40	-6.4	-3.3	0.0	4.6	10.7
45	-7.2	-3.7	0.0	5.3	12.4
50	-8.0	-4.1	0.0	6.1	14.3
55	-8.8	-4.5	0.0	7.0	16.3
60	-9.6	-4.9	0.0	7.9	18.3
65	-10.4	-5.3	0.0	8.8	20.5
70	-11.2	-5.7	0.0	9.8	22.8
75	-12.0	-6.1	0.0	10.8	25.1
80	-12.8	-6.5	0.0	11.9	27.6

Based on 280/.78 climb, Long Range Cruise and .78/280/250 descent.

Long Range Cruise Step Climb

Ground to Air Miles Conversion

AIR DISTANCE (NM)					GROUND DISTANCE (NM)	AIR DISTANCE (NM)				
HEADWIND COMPONENT (KTS)						TAILWIND COMPONENT (KTS)				
100	80	60	40	20		20	40	60	80	100
1317	1239	1169	1107	1051	1000	954	912	874	838	806
1832	1725	1631	1546	1469	1400	1337	1279	1227	1178	1133
2346	2212	2092	1985	1888	1800	1720	1647	1580	1518	1460
2859	2698	2553	2424	2306	2200	2103	2014	1933	1857	1788
3372	3183	3014	2862	2725	2600	2486	2382	2286	2197	2115
3885	3669	3475	3301	3143	3000	2869	2749	2639	2538	2443
4397	4154	3936	3739	3562	3400	3252	3117	2993	2878	2771
4909	4638	4396	4178	3980	3800	3636	3485	3346	3218	3100
5421	5123	4856	4616	4398	4200	4019	3853	3700	3559	3428
5932	5607	5316	5054	4816	4600	4402	4221	4054	3900	3757
6443	6091	5776	5492	5234	5000	4786	4589	4408	4240	4085

Trip Fuel and Time Required

AIR DIST (NM)	TRIP FUEL (1000 LB)							TIME (HRS:MIN)
	LANDING WEIGHT (1000 LB)							
	90	100	110	120	130	140	150	
1000	10.4	11.0	11.7	12.4	13.3	14.0	14.8	2:25
1400	14.2	15.0	15.9	17.1	18.2	19.2	20.4	3:18
1800	18.0	19.1	20.3	21.8	23.3	24.6	26.1	4:11
2200	22.0	23.3	24.9	26.7	28.5	30.2	32.1	5:04
2600	26.0	27.6	29.6	31.7	33.9	35.9	38.2	5:57
3000	30.1	32.1	34.4	36.9	39.4	41.9	44.5	6:50
3400	34.4	36.7	39.4	42.2	45.2	48.0	50.9	7:43
3800	38.7	41.5	44.5	47.7	51.1	54.3	57.6	8:35
4200	43.2	46.4	49.7	53.4	57.1	60.7	64.5	9:28
4600	47.9	51.4	55.2	59.3	63.4	67.4	71.6	10:20
5000	52.7	56.5	60.8	65.3	69.8	74.3	78.9	11:12

Based on 280/.78 climb, Long Range Cruise, and .78/280/250 descent.
Valid for all pressure altitudes with 4000 ft step climb to 2000 ft above optimum altitude.

Short Trip Fuel and Time

Ground to Air Miles Conversion

AIR DISTANCE (NM) HEADWIND COMPONENT (KTS)					GROUND DISTANCE (NM)	AIR DISTANCE (NM) TAILWIND COMPONENT (KTS)				
100	80	60	40	20		20	40	60	80	100
94	80	69	61	55	50	46	42	39	36	34
160	143	129	118	108	100	93	87	82	77	73
226	205	188	173	161	150	141	132	125	118	112
291	267	246	229	213	200	188	178	168	160	152
354	327	304	283	266	250	236	224	213	202	193
417	387	361	338	318	300	284	270	257	245	234
480	447	418	392	370	350	332	316	301	288	276
543	507	475	447	422	400	380	362	345	330	317
607	567	533	502	475	450	428	408	390	373	358
673	629	591	557	527	500	476	453	433	415	398

Trip Fuel and Time Required

AIR DIST (NM)		LANDING WEIGHT (1000 LB)					TIME (HRS:MIN)
		90	110	130	150	170	
50	FUEL (1000 LB)	1.2	1.3	1.5	1.6	1.7	0:14
	ALT (FT)	12000	11000	9000	8000	7000	
100	FUEL (1000 LB)	1.9	2.1	2.3	2.5	2.7	0:23
	ALT (FT)	19000	17000	17000	16000	15000	
150	FUEL (1000 LB)	2.5	2.7	3.0	3.3	3.5	0:30
	ALT (FT)	25000	24000	23000	22000	20000	
200	FUEL (1000 LB)	3.0	3.3	3.7	4.0	4.3	0:37
	ALT (FT)	31000	27000	26000	26000	24000	
250	FUEL (1000 LB)	3.5	3.9	4.3	4.7	5.1	0:44
	ALT (FT)	39000	35000	31000	31000	27000	
300	FUEL (1000 LB)	3.9	4.4	4.9	5.4	5.8	0:50
	ALT (FT)	41000	39000	35000	33000	29000	
350	FUEL (1000 LB)	4.4	4.9	5.5	6.0	6.6	0:57
	ALT (FT)	41000	39000	37000	33000	31000	
400	FUEL (1000 LB)	4.8	5.4	6.0	6.7	7.3	1:03
	ALT (FT)	41000	39000	37000	33000	31000	
450	FUEL (1000 LB)	5.3	5.9	6.6	7.3	8.1	1:10
	ALT (FT)	41000	41000	37000	35000	31000	
500	FUEL (1000 LB)	5.7	6.4	7.2	8.0	8.8	1:17
	ALT (FT)	41000	41000	37000	35000	31000	

Based on 280/.78 climb, Long Range Cruise, and .78/280/250 descent.

Holding Planning

Flaps Up

WEIGHT (1000 LB)	TOTAL FUEL FLOW (LB/HR)								
	PRESSURE ALTITUDE (FT)								
	1500	5000	10000	15000	20000	25000	30000	35000	41000
190	6890	6790	6760	6720	6690	6750	7040		
180	6560	6460	6400	6370	6300	6360	6570		
170	6240	6130	6060	6030	5930	5970	6140	6640	
160	5910	5800	5720	5680	5580	5590	5740	6040	
150	5590	5480	5400	5330	5240	5200	5340	5540	
140	5260	5150	5070	4990	4910	4830	4950	5080	
130	4940	4830	4740	4660	4580	4470	4570	4670	5360
120	4620	4510	4420	4330	4250	4140	4190	4270	4690
110	4310	4190	4090	4000	3920	3830	3880	3940	4220
100	4010	3880	3770	3750	3660	3590	3540	3570	3770
90	3800	3670	3540	3440	3350	3280	3240	3210	3360

This table includes 5% additional fuel for holding in a racetrack pattern.

Flight Crew Oxygen Requirements

Required Pressure (PSI) for 76 Cubic FT Cylinder

BOTTLE TEMPERATURE		NUMBER OF CREW USING OXYGEN		
°C	°F	2	3	4
50	122	735	1055	1360
45	113	725	1040	1340
40	104	715	1020	1320
35	95	700	1005	1300
30	86	690	990	1280
25	77	680	975	1255
20	68	670	960	1240
15	59	655	940	1215
10	50	645	925	1195
5	41	635	910	1175
0	32	620	890	1150
-5	23	610	875	1130
-10	14	600	860	1110

Required Pressure (PSI) for 114/115 Cubic FT Cylinder

BOTTLE TEMPERATURE		NUMBER OF CREW USING OXYGEN		
°C	°F	2	3	4
50	122	530	735	945
45	113	520	725	930
40	104	510	715	915
35	95	505	700	900
30	86	495	690	885
25	77	485	680	870
20	68	480	670	860
15	59	470	655	840
10	50	460	645	830
5	41	455	635	815
0	32	445	620	800
-5	23	440	610	785
-10	14	430	600	770

ENGINE INOP

MAX CONTINUOUS THRUST

Net Level Off Weight

PRESSURE ALTITUDE (1000 FT)	LEVEL OFF WEIGHT (1000 LB)		
	ISA + 10°C & BELOW	ISA + 15°C	ISA + 20°C
30	94.2	91.4	
28	101.9	98.7	95.5
26	110.2	106.5	103.2
24	119.4	115.5	111.7
22	130.0	125.5	121.1
20	141.4	136.2	131.0
18	151.9	146.3	140.2
16	162.2	156.6	150.2
14	171.6	166.2	160.7
12	181.9	175.5	168.7

Anti-Ice Adjustments

ANTI-ICE CONFIGURATION	EQUIVALENT WEIGHT ADJUSTMENT (1000 LB)								
	PRESSURE ALTITUDE (1000 FT)								
	12	14	16	18	20	22	24	26	28
ENGINE ONLY	-4.1	-3.8	-3.7	-3.6	-3.4	-3.2	-2.9	-2.6	-2.3
ENGINE & WING	-16.4	-15.3	-14.4	-14.2	-13.9	-12.6	-11.5	-10.6	

Performance Dispatch — Chapter PD
Landing — Section 62

Landing Field Limit Weight - Dry Runway
Based on anti-skid operative and automatic speedbrakes
Flaps 40
Wind Corrected Field Length (FT)

FIELD LENGTH AVAILABLE (FT)	WIND COMPONENT (KTS)							
	-15	-10	-5	0	10	20	30	40
3000						3430	3650	3880
3400					3620	3850	4090	4320
3800			3440	3800	4030	4270	4520	4770
4200		3490	3830	4200	4440	4690	4950	5210
4600	3520	3860	4220	4600	4850	5110	5380	5660
5000	3870	4230	4610	5000	5260	5530	5810	6100
5400	4220	4600	4990	5400	5670	5950	6240	6540
5800	4560	4970	5380	5800	6080	6370	6680	6990
6200	4910	5340	5770	6200	6490	6790	7110	7430
6600	5260	5710	6160	6600	6900	7210	7540	7880
7000	5610	6090	6550	7000	7310	7630	7970	8320
7400	5950	6460	6940	7400	7720	8060	8400	8770
7800	6300	6830	7330	7800	8130	8480	8840	9210
8200	6650	7200	7720	8200	8540	8900	9270	9650
8600	6860	7410	7990	8600	8950	9320	9700	
9000	7070	7620	8260	9000	9360	9740		
9400	7280	7830	8540	9400	9770			
9800	7490	8040	8810					
10200	7710	8260	9090					
10600	7920	8470	9360					

Field Limit Weight (1000 LB)

WIND CORR'D FIELD LENGTH (FT)	AIRPORT PRESSURE ALTITUDE (FT)					
	0	2000	4000	6000	8000	10000
3800	93.3	87.8				
4200	107.1	100.8	94.7	88.9		
4600	121.0	114.0	107.1	100.6	94.3	88.3
5000	132.2	125.9	119.8	112.5	105.5	98.8
5400	143.5	136.5	130.0	123.7	116.8	109.4
5800	159.6	151.9	140.0	133.2	126.6	120.2
6200	171.1	162.9	154.9	142.7	135.6	128.8
6600	182.7	173.8	165.2	157.1	146.7	137.3
7000	191.9	184.8	175.6	166.9	158.5	150.4
7400		193.0	186.0	176.7	167.8	159.2
7800			193.3	186.5	177.1	168.0
8200				193.3	186.3	176.7
8600					190.7	183.1
9000					194.3	187.2
9400						191.3

Decrease field limit weight 13300 lb when using manual speedbrakes.

Landing Field Limit Weight - Dry Runway

Based on anti-skid inoperative and manual speedbrakes

Flaps 40

Wind Corrected Field Length (FT)

FIELD LENGTH AVAILABLE (FT)	WIND COMPONENT (KTS)							
	-15	-10	-5	0	10	20	30	40
7000				7000	7460	8070	8610	9160
7400			6610	7400	7880	8490	9050	9610
7800			6990	7800	8300	8910	9480	10060
8200			7370	8200	8710	9330	9920	10510
8600		6940	7750	8600	9130	9760	10350	10960
9000		7300	8130	9000	9540	10180	10790	11410
9400	6870	7670	8510	9400	9960	10600	11220	11860
9800	7210	8030	8890	9800	10380	11020	11660	12310
10200	7560	8390	9280	10200	10790	11450	12090	12760
10600	7900	8750	9660	10600	11210	11870	12530	13200
11000	8240	9120	10040	11000	11620	12290	12960	13650
11400	8580	9480	10420	11400	12040	12710	13400	14100
11800	8920	9840	10800	11800	12450	13140	13830	14550
12200	9260	10200	11180	12200	12870	13560	14270	15000
12600	9600	10570	11560	12600	13290	13980	14700	15450
13000	9940	10930	11950	13000	13700	14400	15140	15900
13400	10290	11290	12330	13400	14120	14830	15570	16350
13800	10630	11650	12710	13800	14530	15250	16000	16800
14200	10970	12020	13090	14200	14950	15670	16440	17240
14600	11310	12380	13470	14600	15360	16090	16870	17690

Field Limit Weight (1000 LB)

WIND CORR'D FIELD LENGTH (FT)	AIRPORT PRESSURE ALTITUDE (FT)					
	0	2000	4000	6000	8000	10000
7400	91.3	85.1				
7800	97.9	91.3				
8200	104.5	97.6	89.9			
8600	111.1	103.9	95.8	89.4		
9000	117.8	110.2	101.8	95.0	88.5	
9400	124.5	116.5	107.8	100.6	93.8	87.1
9800	131.2	122.8	113.7	106.3	99.1	92.2
10200	138.0	129.2	119.7	112.0	104.5	97.2
10600	148.9	135.5	125.8	117.6	109.8	102.3
11000	156.8	142.0	131.8	123.3	115.2	107.3
11400	163.8	153.6	137.9	129.0	120.5	112.4
11800	170.9	160.2	144.5	134.8	125.9	117.4
12200	177.9	166.8	155.3	140.5	131.3	122.5
12600	185.0	173.5	161.6	151.4	136.7	127.6
13000	192.1	180.2	167.9	157.3	142.2	132.7
13400		186.9	174.2	163.3	152.8	137.8
13800		193.6	180.6	169.3	158.4	143.1
14200			186.9	175.3	164.1	153.3
14600			193.3	181.2	169.7	158.6
15000				187.2	175.4	163.9
15400				193.3	181.0	169.3
15800					186.7	174.6
16200					192.4	179.9
16600						185.3
17000						190.7

Landing Field Limit Weight - Wet Runway

Based on anti-skid operative and automatic speedbrakes

Flaps 40

Wind Corrected Field Length (FT)

FIELD LENGTH AVAILABLE (FT)	WIND COMPONENT (KTS)							
	-15	-10	-5	0	10	20	30	40
3000								3960
3400						3900	4150	4400
3800					4060	4320	4580	4850
4200				4200	4460	4740	5010	5290
4600			4180	4600	4870	5160	5440	5740
5000		4170	4570	5000	5280	5580	5880	6180
5400	4150	4540	4960	5400	5690	6000	6310	6630
5800	4490	4910	5340	5800	6100	6420	6740	7070
6200	4840	5280	5730	6200	6510	6840	7170	7510
6600	5190	5650	6120	6600	6920	7260	7600	7960
7000	5540	6020	6510	7000	7330	7680	8030	8400
7400	5880	6400	6900	7400	7740	8100	8470	8850
7800	6230	6770	7290	7800	8150	8520	8900	9290
8200	6580	7140	7680	8200	8560	8940	9330	9740
8600	6930	7510	8070	8600	8970	9360	9760	10180
9000	7270	7880	8460	9000	9380	9780	10190	10630
9400	7620	8250	8840	9400	9790	10200	10620	11070
9800	7840	8480	9130	9800	10200	10620	11060	
10200	8050	8690	9400	10200	10610	11040		
10600	8270	8900	9680	10600	11020			

Field Limit Weight (1000 LB)

WIND CORR'D FIELD LENGTH (FT)	AIRPORT PRESSURE ALTITUDE (FT)					
	0	2000	4000	6000	8000	10000
4200	88.3					
4600	100.2	94.3	88.6			
5000	112.3	105.6	99.3	93.2	87.4	
5400	123.7	117.2	110.1	103.5	97.0	90.8
5800	133.4	127.1	120.9	113.8	106.7	100.0
6200	143.2	136.3	129.7	123.5	116.6	109.2
6600	157.8	148.5	138.5	131.7	125.2	118.6
7000	167.9	159.8	151.8	140.0	133.0	126.4
7400	177.9	169.3	161.0	153.0	140.9	133.8
7800	187.5	178.8	170.0	161.6	153.5	141.1
8200	194.6	187.8	179.0	170.1	161.5	153.3
8600		194.5	187.5	178.6	169.6	160.9
9000			193.8	186.9	177.7	168.5
9400				192.9	185.7	176.1
9800					189.9	182.3
10200					193.1	185.9
10600						189.4
11000						192.9

Decrease field limit weight 13300 lb when using manual speedbrakes.

Landing Field Limit Weight - Wet Runway

Based on anti-skid inoperative and manual speedbrakes

Flaps 40

Wind Corrected Field Length (FT)

FIELD LENGTH AVAILABLE (FT)	WIND COMPONENT (KTS)							
	-15	-10	-5	0	10	20	30	40
7000						8170	8770	9360
7400					7910	8590	9200	9810
7800				7800	8320	9010	9630	10260
8200				8200	8740	9430	10070	10710
8600			7680	8600	9160	9860	10500	11160
9000			8060	9000	9570	10280	10940	11610
9400			8450	9400	9990	10700	11370	12050
9800		7900	8830	9800	10400	11120	11810	12500
10200		8260	9210	10200	10820	11550	12240	12950
10600	7720	8630	9590	10600	11240	11970	12680	13400
11000	8070	8990	9970	11000	11650	12390	13110	13850
11400	8410	9350	10350	11400	12070	12810	13550	14300
11800	8750	9710	10730	11800	12480	13240	13980	14750
12200	9090	10080	11120	12200	12900	13660	14420	15200
12600	9430	10440	11500	12600	13310	14080	14850	15650
13000	9770	10800	11880	13000	13730	14500	15290	16090
13400	10110	11160	12260	13400	14150	14930	15720	16540
13800	10460	11530	12640	13800	14560	15350	16160	16990
14200	10800	11890	13020	14200	14980	15770	16590	17440
14600	11140	12250	13400	14600	15390	16190	17020	17890

Landing Field Limit Weight - Wet Runway

Based on anti-skid inoperative and manual speedbrakes

Flaps 40

Field Limit Weight (1000 LB)

WIND CORR/D FIELD LENGTH (FT)	AIRPORT PRESSURE ALTITUDE (FT)					
	0	2000	4000	6000	8000	10000
8200	86.8					
8600	92.6	86.3				
9000	98.3	91.7				
9400	104.1	97.2	89.5			
9800	109.8	102.6	94.7	88.3		
10200	115.6	108.1	99.8	93.2	86.7	
10600	121.5	113.6	105.0	98.1	91.4	
11000	127.3	119.1	110.2	103.0	96.0	89.2
11400	133.1	124.6	115.4	107.9	100.6	93.6
11800	139.0	130.1	120.7	112.8	105.3	98.0
12200	149.1	135.7	125.9	117.8	109.9	102.4
12600	156.0	141.3	131.1	122.7	114.6	106.8
13000	162.1	152.0	136.4	127.7	119.3	111.2
13400	168.2	157.7	141.8	132.6	123.9	115.6
13800	174.4	163.5	152.2	137.6	128.6	120.0
14200	180.5	169.3	157.6	142.7	133.3	124.4
14600	186.7	175.1	163.1	152.8	138.0	128.8
15000	192.8	180.9	168.6	158.0	142.9	133.3
15400		186.8	174.1	163.2	152.7	137.7
15800		192.6	179.6	168.4	157.6	142.2
16200			185.1	173.6	162.5	151.8
16600			190.6	178.8	167.4	156.4
17000				184.0	172.3	161.1
17400				189.2	177.2	165.7
17800				194.4	182.1	170.3
18200					187.1	175.0
18600					192.0	179.6

Landing Climb Limit Weight

Valid for approach with flaps 15 and landing with flaps 40

Based on engine bleed for packs on and anti-ice off

AIRPORT OAT (°C)	LANDING CLIMB LIMIT WEIGHT (1000 LB)						
	AIRPORT PRESSURE ALTITUDE (FT)						
	-2000	0	2000	4000	6000	8000	10000
54	149.7	140.0					
52	152.5	143.6					
50	155.2	148.1	135.8				
48	158.0	151.3	139.4				
46	161.0	154.0	142.8	131.5			
44	163.8	156.6	145.7	134.7			
42	166.6	159.4	148.9	138.0	126.5		
40	169.4	162.2	151.7	140.4	129.4		
38	172.2	165.0	154.3	142.8	132.3	120.4	
36	174.8	167.8	156.9	145.8	134.7	122.5	
34	177.4	170.7	159.8	149.0	137.0	124.6	114.5
32	177.7	173.6	162.4	151.6	139.0	126.9	116.8
30	177.8	176.5	164.7	153.3	141.0	129.1	119.0
28	178.0	176.7	166.7	155.0	142.9	131.0	120.8
26	178.2	176.8	168.6	156.4	144.0	132.8	122.6
24	178.4	177.0	168.7	157.6	145.2	134.4	123.9
22	178.5	177.1	168.8	158.7	146.5	135.3	125.0
20	178.7	177.2	168.9	158.8	147.8	136.2	125.9
18	178.8	177.4	169.0	158.9	148.9	137.0	126.7
16	179.0	177.5	169.1	159.0	148.9	137.8	127.4
14	179.1	177.6	169.2	159.0	149.0	138.6	128.2
12	179.3	177.7	169.2	159.1	149.1	138.6	129.0
10	179.4	177.9	169.3	159.2	149.2	138.7	129.7
-40	180.8	179.0	170.4	160.4	150.2	139.5	131.1

With engine bleed for packs off, increase weight by 2300 lb.
With engine anti-ice on, decrease weight by 600 lb.
With engine and wing anti-ice on, decrease weight by 2000 lb.
When operating in icing conditions during any part of the flight with forecast landing temperature below 10°C, decrease weight by 12300 lb.

ENGINE INOP

ADVISORY INFORMATION

Go-Around Climb Gradient

Flaps 15

Based on engine bleed for packs on and anti-ice off

OAT (°C)	REFERENCE GO-AROUND GRADIENT (%)					
	PRESSURE ALTITUDE (FT)					
	0	2000	4000	6000	8000	10000
54	2.88					
50	3.57	2.48				
46	4.08	3.14	2.08			
42	4.60	3.62	2.68	1.61		
38	5.13	4.11	3.14	2.14	1.03	
34	5.66	4.63	3.61	2.58	1.42	0.49
30	6.22	5.10	4.01	2.97	1.84	0.91
26	6.26	5.46	4.31	3.25	2.20	1.25
22	6.28	5.48	4.53	3.44	2.45	1.48
18	6.31	5.50	4.54	3.62	2.61	1.65
14	6.33	5.52	4.56	3.63	2.75	1.79
10	6.35	5.53	4.57	3.64	2.76	1.93

Gradient Adjustment for Weight (%)

WEIGHT (1000 LB)	REFERENCE GO-AROUND GRADIENT (%)							
	0	1	2	3	4	5	6	7
180	-2.85	-3.06	-3.37	-3.69	-3.99	-4.29	-4.57	-4.93
170	-2.42	-2.59	-2.86	-3.13	-3.38	-3.64	-3.88	-4.18
160	-1.92	-2.07	-2.29	-2.50	-2.70	-2.91	-3.10	-3.32
150	-1.35	-1.48	-1.64	-1.79	-1.93	-2.07	-2.21	-2.38
140	-0.73	-0.80	-0.88	-0.96	-1.04	-1.12	-1.19	-1.29
130	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
120	0.86	0.93	1.02	1.12	1.21	1.30	1.40	1.51
110	1.89	2.04	2.24	2.44	2.64	2.85	3.06	3.33

Gradient Adjustment for Speed (%)

SPEED (KIAS)	WEIGHT ADJUSTED GO-AROUND GRADIENT (%)							
	0	1	2	3	4	5	6	7
VREF40	-0.24	-0.24	-0.24	-0.25	-0.25	-0.25	-0.25	-0.25
VREF40+5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
VREF40+10	0.14	0.14	0.13	0.12	0.11	0.10	0.09	0.08
VREF40+20	0.27	0.24	0.20	0.16	0.12	0.08	0.05	0.03
VREF40+30	0.14	0.07	-0.01	-0.08	-0.15	-0.21	-0.26	-0.28

With engine bleed for packs off, increase gradient by 0.3%.
With engine anti-ice on, decrease gradient by 0.1%.
With engine and wing anti-ice on, decrease gradient by 0.3%.
Decrease gradient by 0.6% for ice accumulation when operating in icing conditions during any part of the flight with forecast landing temperatures below 10°C.

Quick Turnaround Limit Weight - Category G Steel Brakes

Flaps 40

OAT (°C)	PRESSURE ALTITUDE (FT)					
	0	2000	4000	6000	8000	10000
54	176.6					
50	177.7	171.2				
45	179.2	172.6	166.1			
40	180.7	174.1	167.5	161.1		
35	182.3	175.6	168.9	162.5	156.2	
30	183.8	177.1	170.4	163.9	157.5	151.3
25	185.4	178.6	171.8	165.3	158.9	152.6
20	187.1	180.2	173.3	166.8	160.3	154.0
15	188.9	181.8	174.9	168.3	161.7	155.4
10	190.0	183.4	176.5	169.8	163.2	156.8
5	190.0	185.1	178.2	171.4	164.7	158.2
0	190.0	186.9	179.8	173.0	166.3	159.8
-5	190.0	188.8	181.6	174.7	167.9	161.3
-10	190.0	190.0	183.3	176.4	169.6	162.9
-15	190.0	190.0	185.2	178.2	171.3	164.5
-20	190.0	190.0	187.1	180.0	173.0	166.2
-30	190.0	190.0	190.0	183.8	176.7	169.7
-40	190.0	190.0	190.0	187.9	180.6	173.5
-50	190.0	190.0	190.0	190.0	184.7	177.4
-54	190.0	190.0	190.0	190.0	186.4	179.1

**Increase weight by 1500 lb per 1% uphill slope. Decrease weight by 3100 lb per 1% downhill slope.
Increase weight by 4000 lb per 10 knots headwind. Decrease weight by 16600 lb per 10 knots tailwind.
After landing at weights exceeding those shown above, adjusted for slope and wind, wait at least 67 minutes and check that wheel thermal plugs have not melted before executing a subsequent takeoff.**

**As an alternate procedure, ensure that each brake pressure plate temperature, without artificial cooling, is less than 218°C as follows:
No sooner than 10 and no later than 15 minutes after parking, measure each brake pressure plate surface temperature at a minimum of two points per brake by an accurate method (using a Doric Microtemp 450 hand held thermometer or equivalent, hold temperature probe in place for 20 seconds or until reading stabilizes). If each measured temperature is less than 218°C, immediate dispatch is allowed; otherwise the required minimum ground wait period of 67 minutes applies.**

If a Brake Temperature Monitoring System (BTMS) is installed:

**No sooner than 10 and no later than 15 minutes after parking, check the BRAKE TEMP light. If the BRAKE TEMP light is not on, no ground waiting period is required. If the BRAKE TEMP light is on, do not dispatch until at least 67 minutes after landing, or until all the BTMS readings on the systems Display are below 3.5 and the BRAKE TEMP light is off. Check that wheel thermal plugs have not melted before making a subsequent takeoff.
Note: If any brake temperature display digit is blank or indicates 0.0 or 0.1, then this method cannot be used.**

GEAR DOWN

Gear Down

TO BE SUPPLIED

Intentionally
Blank

Performance Dispatch — Chapter PD
Text — Section 64

Introduction

This chapter contains self dispatch performance data intended primarily for use by flight crews in the event that information cannot be obtained from the airline dispatch office. The takeoff data provided is for a single takeoff flap at max takeoff thrust. The range of conditions covered is limited to those normally encountered in airline operation. In the event of conflict between the data presented in this chapter and that contained in the approved Airplane Flight Manual, the Flight Manual shall always take precedence.

Takeoff

The maximum allowable takeoff weight will be the least of the Field, Climb, Obstacle, Brake Energy and Tire Speed Limit Weights as determined from the tables shown.

Brake Energy or Tire Speed Limit Weight tables are only provided if they are limiting for the range of conditions covered in the FCOM Section PD.

Field Limit Weight - Slope and Wind Corrections

These tables for dry and wet runways provide corrections to the field length available for the effects of runway slope and wind component along the runway. Enter the appropriate table with the available field length and runway slope to determine the slope corrected field length. Next enter the appropriate table with slope corrected field length and wind component to determine the slope and wind corrected field length.

Field and Climb Limit Weight

Tables are presented for selected airport pressure altitudes and runway conditions and show both Field and Climb Limit Weights. Enter the appropriate table for pressure altitude and runway condition with “Slope and Wind Corrected Field Length” determined above and airport OAT to obtain Field Limit Weight. Also read Climb Limit Weight for the same OAT. Intermediate altitudes may be interpolated or use next higher altitude. When finding a maximum weight for a wet runway, the dry runway limit weight must also be determined and the lower of the two weights used.

Obstacle Limit Weight

The Reference Obstacle Limit Weight table provides obstacle limit weights for reference airport conditions based on obstacle height above the runway surface and distance from brake release. Enter the adjustment tables to adjust the reference Obstacle Limit Weight for the effects of OAT, pressure altitude and wind as indicated. In the case of multiple obstacles, enter the tables successively with each obstacle and determine the most limiting weight.

Tire Speed Limit

Tire Speed Limit Weight tables are only provided if they are limiting for the range of conditions covered in the FCOM Section PD.

Maximum tire speed limited weights are presented for 225 MPH tires. To determine the tire speed limit weight, enter the table with OAT and airport pressure altitude. Adjust the tire speed limit weight according to the notes below the table to account for wind.

Brake Energy Limit VMBE

Brake Energy Limit Weight tables are only provided if they are limiting for the range of conditions covered in the FCOM Section PD.

The Maximum Brake Energy Speed table provides the Reference VMBE for a variety of airport pressure altitudes and temperatures. Enter the Weight Adjusted VMBE table to adjust the Reference VMBE for the actual brake release gross weight. Correct VMBE for slope and wind. If V1 exceeds VMBE, decrease brake release weight as indicated for each knot that V1 exceeds VMBE and determine V1, VR, and V2 for the lower brake release weight.

Enroute

Long Range Cruise Maximum Operating Altitude

These tables provide the maximum operating altitude in the same manner as the FMC. Maximum altitudes are shown for a given cruise weight and maneuver capability. Note that this table considers both thrust and buffet limits, providing the more limiting of the two. Any data that is thrust limited is denoted by an asterisk and represents only a thrust limited condition in level flight with 100 ft/min residual rate of climb. Flying above these altitudes with sustained banks in excess of approximately 15° may cause the airplane to lose speed and/or altitude. The altitudes shown in the table are limited to the maximum certified altitude of 41000 ft.

Long Range Cruise Trip Fuel and Time

Long Range Cruise Trip Fuel and Time tables are provided to determine trip time and fuel required to destination.

To determine trip fuel and time for a constant altitude cruise, first enter the Ground to Air Miles Conversion table to convert ground distance and enroute wind to an equivalent still air distance for use with the Reference Fuel and Time tables. Next, enter the Reference Fuel and Time table with air distance from the Ground to Air Miles Conversion table and the desired altitude and read Reference Fuel and Time Required. Lastly, enter the Fuel Required Adjustment table with the Reference Fuel and the planned landing weight to obtain the adjustment to the fuel required at the planned landing weight.

Long Range Cruise Step Climb Trip Fuel and Time

The Long Range Cruise Step Climb Trip Fuel and Time tables are provided to determine trip time and fuel required to destination when flying a step climb profile. Step climb profiles are based on 4000 ft step climbs to keep the flight within 2000 ft of the optimum altitude for the current cruise weight. To determine trip fuel and time, enter the Ground to Air Miles Conversion table and determine air distance as discussed above. Then enter the Trip Fuel and Time Required table with air distance and planned landing weight to read trip fuel. Continue across the table to read trip time.

Short Trip Fuel and Time

These tables are provided to determine trip fuel and time for short distances or alternates. Obtain air distance from the table using the ground distance and wind component to the alternate. Enter the Trip Fuel and Time Required table with air distance and read trip fuel required for the expected landing weight, together with time to alternate at right. For distances greater than shown or other altitudes, use the Long Range Cruise Trip Fuel and Time tables.

Holding Planning

This table provides total fuel flow information necessary for planning flaps up holding and reserve fuel requirements. Data is based on the FMC holding speed schedule which is the higher of the maximum endurance and flaps up maneuver speeds. As noted, the fuel flow is based on flight in a racetrack holding pattern. For holding in straight and level flight, reduce table values by 5%.

Flight Crew Oxygen Requirements

This airplane is equipped with a chemical passenger oxygen system. Regulations require that sufficient oxygen be provided to the flight crew to account for the greater of supplemental breathing oxygen in the event of a cabin depressurization or protective breathing in the event of smoke or harmful fumes in the flight deck. The oxygen quantity associated with the above requirements is achieved with the minimum dispatch oxygen cylinder pressure.

To determine the minimum dispatch oxygen cylinder pressure enter the appropriate flight crew oxygen table with the number of crew plus observers using oxygen and read the minimum cylinder pressure required for the appropriate cylinder temperature.

Net Level Off Weight

The Net Level Off Weight table is provided to determine terrain clearance capability in straight and level flight following an engine failure. Regulations require terrain clearance planning based on net performance which is the gross (or actual) gradient performance degraded by 1.1%. In addition, the net level off pressure altitude must clear the terrain by 1000 ft.

To determine the maximum weight for terrain clearance, enter the table with required net level off pressure altitude and expected ISA deviation to obtain weight. Adjust weight for anti-ice operation as noted below the table.

Landing

Tables are provided for determining the maximum landing weight as limited by field length or climb requirements for a single landing flap.

Maximum landing weight is the lowest of the field length limit weight, climb limit weight, or maximum certified landing weight.

Landing Field Limit Weight

For the expected runway condition and anti-skid system configuration, obtain wind corrected field length by entering the Wind Corrected Field Length table with field length available and wind component along the runway. Now enter the Field Limit Weight table with wind corrected field length and pressure altitude to read field limit weight.

Landing Climb Limit Weight

Enter the table with airport OAT and pressure altitude to read landing climb limit weight. Apply the noted adjustments as required.

Go-Around Climb Gradient

Enter the Reference Go-Around Gradient table with airport OAT and pressure altitude to determine the reference go-around gradient. Then adjust the reference gradient for airplane weight and speed using the tables provided to determine the weight and speed adjusted go-around gradient. Apply the necessary corrections for engine bleed configuration and icing conditions as noted.

Quick Turnaround Limit Weight

Enter the appropriate table (Steel or Carbon Brakes) with airport pressure altitude and OAT to read maximum quick turnaround weight. Apply the noted adjustments as required.

If the landing weight exceeds the maximum quick turnaround weight, wait the specified time and then check that the wheel thermal plugs have not melted before executing a subsequent takeoff. For Steel Brakes, the alternate procedures on the charts can be used to ensure the brake temperature is within limits. These procedures cannot be used for carbon brakes.

Gear Down

This section provides flight planning data for revenue operation with gear down. Unless otherwise noted, the gear down tables in this section are identical in format and usage to the corresponding gear up tables previously described.

To eliminate erroneous displays the flight crew should enter only gross weight data on the PERF INIT page of the Control Display Unit (CDU). Omission of the cost index and cruise altitude entries on the PERF INIT page will render the VNAV function unavailable during flight. As a result, the following information will not be provided: VNAV guidance and speed schedules, trip fuel and ETA predictions, optimum and maximum altitude data, step climb and top of descent predictions, and the VNAV descent guidance path.

The gross weight entry allows the FMCS takeoff and approach speed schedules to be generated. In addition, the flap maneuver speed and VREF speed bugs will be available for display on the primary flight display speed tape. Except for VNAV, normal autopilot and autothrottle modes will remain available for use during the flight, as will the LNAV mode.

Takeoff/Landing Climb Limit Weight

Enter the appropriate table with airport OAT and pressure altitude to determine Takeoff/Landing Climb Limit Weight with gear down. Correct the weight obtained for engine bleed configuration as required.

Performance Dispatch — Chapter PD

Table of Contents — Section 70

737-900ERW CFM56-7B26 C KG M FAA CATH/P

General

The table below shows the airplanes that have been identified with the following performance package. Note, some airplanes may be identified with more than one performance package. This configuration table information reflects the Boeing delivered configuration updated for service bulletin incorporations in conformance with the policy stated in the introduction section of the FCOM. The performance data is prepared for the owner/operator named on the title page. The intent of this information is to assist flight crews and airlines in knowing which performance package is applicable to a given airplane. The performance package model identification information is based on Boeing's knowledge of the airline's fleet at a point in time approximately three months prior to the page date. Notice of Errata (NOE) will not be provided to airlines to identify airplanes that are moved between performance packages within this manual or airplanes added to the airline's fleet whose performance packages are already represented in this manual. These types of changes will be updated in the next block revision. Owners/operators are responsible for ensuring the operational documentation they are using is complete and matches the current configuration of their airplanes, and the accuracy and validity of all information furnished by the owner/operator or any other party. Owners/operators receiving active revision service are responsible to ensure that any modifications to the listed airplanes are properly reflected in this manual.

Serial and tabulation number are supplied by Boeing.

Registry Number	Serial Number	Tabulation Number
YX910	YX910	YX910

Intentionally
Blank

Performance Dispatch — Chapter PD
Takeoff — Section 70

Takeoff Field Corrections - Dry Runway
Slope Corrections

FIELD LENGTH AVAILABLE (M)	SLOPE CORRECTED FIELD LENGTH (M) RUNWAY SLOPE (%)								
	-2.0	-1.5	-1.0	-0.5	0.0	0.5	1.0	1.5	2.0
1200	1200	1200	1200	1200	1200	1180	1160	1150	1130
1400	1430	1420	1420	1410	1400	1370	1340	1310	1280
1600	1660	1650	1630	1620	1600	1560	1520	1470	1430
1800	1890	1870	1850	1820	1800	1750	1690	1640	1580
2000	2130	2090	2060	2030	2000	1930	1870	1800	1730
2200	2360	2320	2280	2240	2200	2120	2040	1960	1880
2400	2590	2540	2490	2450	2400	2310	2220	2120	2030
2600	2820	2760	2710	2650	2600	2500	2390	2290	2180
2800	3050	2990	2930	2860	2800	2680	2570	2450	2330
3000	3280	3210	3140	3070	3000	2870	2740	2610	2480
3200	3510	3430	3360	3280	3200	3060	2920	2780	2640
3400	3740	3660	3570	3490	3400	3250	3090	2940	2790
3600	3980	3880	3790	3690	3600	3430	3270	3100	2940
3800	4210	4110	4000	3900	3800	3620	3440	3270	3090
4000	4440	4330	4220	4110	4000	3810	3620	3430	3240
4200	4670	4550	4430	4320	4200	4000	3790	3590	3390
4400	4900	4780	4650	4530	4400	4180	3970	3750	3540
4600	5130	5000	4870	4730	4600	4370	4140	3920	3690
4800	5360	5220	5080	4940	4800	4560	4320	4080	3840
5000	5590	5450	5300	5150	5000	4750	4500	4240	3990

Wind Corrections

SLOPE CORR'D FIELD LENGTH (M)	SLOPE & WIND CORRECTED FIELD LENGTH (M) WIND COMPONENT (KTS)							
	-15	-10	-5	0	10	20	30	40
1200	900	1000	1100	1200	1260	1330	1390	1460
1400	1070	1180	1290	1400	1470	1540	1610	1680
1600	1230	1360	1480	1600	1680	1750	1830	1910
1800	1400	1530	1670	1800	1880	1970	2050	2130
2000	1570	1710	1860	2000	2090	2180	2270	2360
2200	1730	1890	2040	2200	2300	2390	2490	2580
2400	1900	2070	2230	2400	2500	2600	2710	2810
2600	2070	2240	2420	2600	2710	2820	2920	3030
2800	2230	2420	2610	2800	2910	3030	3140	3260
3000	2400	2600	2800	3000	3120	3240	3360	3480
3200	2560	2780	2990	3200	3330	3450	3580	3710
3400	2730	2950	3180	3400	3530	3670	3800	3930
3600	2900	3130	3370	3600	3740	3880	4020	4160
3800	3060	3310	3550	3800	3950	4090	4240	4380
4000	3230	3490	3740	4000	4150	4300	4460	4610
4200	3400	3660	3930	4200	4360	4520	4670	4830
4400	3560	3840	4120	4400	4560	4730	4890	5060
4600	3730	4020	4310	4600	4770	4940	5110	5280
4800	3900	4200	4500	4800	4980	5150	5330	5510
5000	4060	4380	4690	5000	5180	5370	5550	5730

Takeoff Field & Climb Limit Weights - Dry Runway

Flaps 5

Sea Level Pressure Altitude

CORR'D FIELD LENGTH (M)	FIELD LIMIT WEIGHT (1000 KG)										
	OAT (°C)										
	-40	0	10	14	18	22	26	30	38	40	50
1220	56.6	52.9	52.0	51.7	51.3	51.0	50.6	50.3	47.9	47.3	44.5
1400	61.5	57.6	56.7	56.3	55.9	55.5	55.1	54.8	52.3	51.6	48.5
1600	66.6	62.4	61.4	61.0	60.5	60.1	59.7	59.3	56.7	56.0	52.7
1800	71.3	66.8	65.7	65.2	64.8	64.4	64.0	63.5	60.7	59.9	56.4
2000	75.7	70.9	69.7	69.3	68.8	68.3	67.9	67.4	64.4	63.6	59.8
2200	79.9	74.9	73.6	73.1	72.6	72.1	71.7	71.2	68.0	67.2	63.2
2400	83.9	78.6	77.3	76.8	76.3	75.8	75.3	74.7	71.4	70.5	66.3
2600	86.1	81.9	80.5	80.0	79.5	78.9	78.4	77.9	74.4	73.5	69.1
2800	86.1	84.7	83.3	82.8	82.2	81.7	81.1	80.6	76.9	76.0	71.5
3000	86.1	86.1	85.6	85.0	84.5	83.9	83.3	82.8	79.1	78.1	73.5
3200	86.1	86.1	86.1	86.1	86.1	86.1	85.6	85.0	81.2	80.2	75.5
3400	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	83.3	82.3	77.4
3600	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	85.3	84.3	79.3
3800	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	81.1
4000	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	82.9
4200	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	84.6
4400	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1
4600	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1
CLIMB LIMIT WT (1000 KG)	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	81.1	79.8	73.1

2000 FT Pressure Altitude

CORR'D FIELD LENGTH (M)	FIELD LIMIT WEIGHT (1000 KG)										
	OAT (°C)										
	-40	0	10	14	18	22	26	30	38	40	50
1220	53.6	49.9	49.0	48.7	48.4	48.0	47.7	46.9	44.7	44.2	41.4
1400	58.3	54.4	53.4	53.1	52.7	52.4	52.0	51.1	48.8	48.3	45.3
1600	63.1	58.9	57.9	57.5	57.2	56.8	56.4	55.4	53.0	52.4	49.1
1800	67.6	63.1	62.0	61.6	61.2	60.8	60.4	59.4	56.7	56.1	52.6
2000	71.8	66.9	65.8	65.4	65.0	64.5	64.1	63.0	60.2	59.5	55.8
2200	75.7	70.7	69.5	69.0	68.6	68.1	67.7	66.5	63.6	62.8	58.9
2400	79.5	74.2	73.0	72.5	72.0	71.5	71.1	69.8	66.7	66.0	61.9
2600	82.9	77.3	76.0	75.5	75.0	74.5	74.1	72.8	69.5	68.7	64.5
2800	85.7	80.0	78.7	78.1	77.6	77.1	76.6	75.3	72.0	71.1	66.8
3000	86.1	82.2	80.8	80.3	79.8	79.2	78.7	77.4	74.0	73.1	68.6
3200	86.1	84.4	83.0	82.5	81.9	81.4	80.9	79.5	76.0	75.1	70.5
3400	86.1	86.1	85.2	84.6	84.0	83.5	83.0	81.5	77.9	77.0	72.3
3600	86.1	86.1	86.1	86.1	86.1	85.5	85.0	83.5	79.8	78.9	74.0
3800	86.1	86.1	86.1	86.1	86.1	86.1	86.1	85.4	81.6	80.7	75.7
4000	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	83.4	82.4	77.3
4200	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	85.2	84.2	79.0
4400	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	85.9	80.6
4600	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	82.1
CLIMB LIMIT WT (1000 KG)	84.0	83.6	83.4	83.4	83.3	83.2	83.1	81.1	75.9	74.6	68.4

With engine bleed for packs off, increase field limit weight by 400 kg and climb limit weight by 1500 kg.
With engine anti-ice on, decrease field limit weight by 200 kg and climb limit weight by 250 kg.
With engine and wing anti-ice on (optional system), decrease field limit weight by 900 kg and climb limit weight by 1500 kg.

Takeoff Field & Climb Limit Weights - Dry Runway

Flaps 5

4000 FT Pressure Altitude

CORR'D FIELD LENGTH (M)	FIELD LIMIT WEIGHT (1000 KG)										
	OAT (°C)										
	-40	0	10	14	18	22	26	30	38	40	50
1220	50.1	46.7	45.9	45.6	45.2	44.9	44.3	43.6	41.6	41.1	38.5
1400	54.6	50.9	50.1	49.7	49.4	49.1	48.4	47.6	45.5	44.9	42.1
1600	59.2	55.2	54.3	53.9	53.6	53.2	52.5	51.7	49.4	48.8	45.8
1800	63.3	59.1	58.1	57.7	57.4	57.0	56.2	55.4	52.9	52.2	49.0
2000	67.2	62.7	61.7	61.3	60.9	60.5	59.7	58.7	56.1	55.4	52.0
2200	71.0	66.2	65.1	64.7	64.3	63.8	63.0	62.0	59.2	58.5	54.9
2400	74.5	69.5	68.4	67.9	67.5	67.0	66.2	65.1	62.2	61.4	57.7
2600	77.7	72.4	71.2	70.8	70.3	69.9	68.9	67.9	64.8	64.0	60.1
2800	80.4	75.0	73.7	73.2	72.8	72.3	71.4	70.2	67.1	66.3	62.2
3000	82.6	77.0	75.8	75.3	74.8	74.3	73.3	72.2	69.0	68.1	64.0
3200	84.8	79.1	77.8	77.3	76.8	76.3	75.3	74.1	70.8	69.9	65.7
3400	86.1	81.2	79.8	79.3	78.8	78.3	77.2	76.0	72.6	71.7	67.3
3600	86.1	83.1	81.8	81.2	80.7	80.2	79.1	77.9	74.4	73.4	68.9
3800	86.1	85.0	83.6	83.1	82.5	82.0	80.9	79.6	76.1	75.1	70.5
4000	86.1	86.1	85.4	84.9	84.3	83.8	82.7	81.4	77.7	76.8	72.1
4200	86.1	86.1	86.1	86.1	86.1	85.5	84.4	83.1	79.4	78.4	73.6
4400	86.1	86.1	86.1	86.1	86.1	86.1	86.1	84.8	81.0	80.0	75.1
4600	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	82.6	81.5	76.5
CLIMB LIMIT WT (1000 KG)	79.0	78.6	78.5	78.4	78.3	78.2	77.1	75.5	70.8	69.6	64.0

6000 FT Pressure Altitude

CORR'D FIELD LENGTH (M)	FIELD LIMIT WEIGHT (1000 KG)										
	OAT (°C)										
	-40	0	10	14	18	22	26	30	38	40	50
1220	46.8	43.6	42.8	42.5	42.2	41.6	41.0	40.3	38.4	37.9	35.6
1400	51.0	47.6	46.8	46.5	46.1	45.5	44.9	44.1	42.1	41.5	39.1
1600	55.3	51.6	50.8	50.4	50.1	49.4	48.7	47.9	45.7	45.1	42.5
1800	59.2	55.3	54.4	54.0	53.6	52.9	52.2	51.3	49.0	48.4	45.5
2000	62.9	58.7	57.7	57.3	56.9	56.2	55.4	54.5	52.0	51.3	48.3
2200	66.4	62.0	60.9	60.5	60.1	59.3	58.5	57.5	54.8	54.1	51.0
2400	69.7	65.1	64.0	63.5	63.1	62.3	61.4	60.4	57.6	56.9	53.5
2600	72.6	67.8	66.7	66.2	65.8	64.9	64.0	62.9	60.0	59.3	55.8
2800	75.1	70.2	69.0	68.5	68.1	67.2	66.2	65.1	62.1	61.3	57.8
3000	77.2	72.1	70.9	70.4	70.0	69.0	68.1	66.9	63.9	63.1	59.4
3200	79.3	74.0	72.8	72.3	71.8	70.9	69.9	68.7	65.6	64.7	61.0
3400	81.3	75.9	74.7	74.2	73.7	72.7	71.7	70.4	67.2	66.4	62.5
3600	83.3	77.8	76.5	76.0	75.4	74.4	73.4	72.1	68.8	68.0	64.0
3800	85.2	79.6	78.2	77.7	77.2	76.1	75.1	73.8	70.4	69.5	65.4
4000	86.1	81.3	79.9	79.4	78.8	77.8	76.7	75.4	72.0	71.0	66.9
4200	86.1	83.0	81.6	81.1	80.5	79.4	78.3	77.0	73.5	72.5	68.3
4400	86.1	84.7	83.3	82.7	82.1	81.1	79.9	78.6	75.0	74.0	69.7
4600	86.1	86.1	84.9	84.3	83.7	82.6	81.5	80.1	76.4	75.4	71.0
CLIMB LIMIT WT (1000 KG)	74.1	73.8	73.7	73.6	73.6	72.6	71.5	70.0	65.6	64.4	59.4

With engine bleed for packs off, increase field limit weight by 400 kg and climb limit weight by 1500 kg.
With engine anti-ice on, decrease field limit weight by 200 kg and climb limit weight by 250 kg.
With engine and wing anti-ice on (optional system), decrease field limit weight by 900 kg and climb limit weight by 1500 kg.

Takeoff Field & Climb Limit Weights - Dry Runway

Flaps 5

8000 FT Pressure Altitude

CORR'D FIELD LENGTH (M)	FIELD LIMIT WEIGHT (1000 KG)										
	OAT (°C)										
	-40	0	10	14	18	22	26	30	38	40	50
1220	43.6	40.5	39.8	39.5	39.0	38.5	37.9	37.0	35.1	34.7	32.6
1400	47.6	44.3	43.5	43.2	42.7	42.1	41.5	40.6	38.5	38.1	35.8
1600	51.6	48.1	47.3	46.9	46.4	45.8	45.1	44.1	41.9	41.4	39.0
1800	55.3	51.5	50.6	50.3	49.7	49.1	48.3	47.3	44.9	44.4	41.8
2000	58.7	54.7	53.7	53.4	52.7	52.0	51.2	50.2	47.7	47.1	44.4
2200	61.9	57.7	56.7	56.3	55.6	54.9	54.1	52.9	50.3	49.7	46.8
2400	65.0	60.6	59.6	59.1	58.4	57.7	56.8	55.6	52.8	52.2	49.2
2600	67.8	63.2	62.1	61.6	60.9	60.1	59.2	57.9	55.1	54.4	51.3
2800	70.1	65.4	64.2	63.8	63.0	62.2	61.3	60.0	57.0	56.3	53.1
3000	72.1	67.2	66.0	65.6	64.8	64.0	63.0	61.7	58.6	57.9	54.6
3200	74.0	69.0	67.8	67.3	66.5	65.7	64.7	63.3	60.2	59.4	56.0
3400	75.9	70.7	69.5	69.0	68.2	67.3	66.3	64.9	61.6	60.9	57.4
3600	77.7	72.4	71.2	70.7	69.8	68.9	67.9	66.4	63.1	62.3	58.7
3800	79.5	74.1	72.8	72.3	71.4	70.5	69.4	68.0	64.6	63.8	60.1
4000	81.3	75.7	74.4	73.9	73.0	72.1	71.0	69.5	66.0	65.2	61.4
4200	83.0	77.3	76.0	75.5	74.5	73.6	72.5	70.9	67.4	66.6	62.7
4400	84.7	78.9	77.5	77.0	76.1	75.1	73.9	72.4	68.8	67.9	64.0
4600	86.1	80.4	79.0	78.5	77.5	76.5	75.4	73.8	70.1	69.2	65.2
CLIMB LIMIT WT (1000 KG)	69.4	69.1	69.0	69.0	68.1	67.3	66.0	64.0	59.7	58.7	54.3

10000 FT Pressure Altitude

CORR'D FIELD LENGTH (M)	FIELD LIMIT WEIGHT (1000 KG)										
	OAT (°C)										
	-40	0	10	14	18	22	26	30	38	40	50
1220	40.5	37.6	37.0	36.5	36.0	35.5	34.9	34.1	32.2	31.8	29.6
1400	44.3	41.2	40.5	40.0	39.5	38.9	38.3	37.4	35.5	35.0	32.6
1600	48.1	44.8	44.0	43.5	42.9	42.3	41.7	40.7	38.6	38.1	35.6
1800	51.5	48.0	47.2	46.6	46.0	45.4	44.7	43.7	41.4	40.9	38.2
2000	54.6	50.9	50.1	49.4	48.8	48.1	47.4	46.3	43.9	43.3	40.5
2200	57.7	53.7	52.8	52.2	51.5	50.8	50.0	48.9	46.3	45.7	42.7
2400	60.6	56.4	55.5	54.8	54.1	53.3	52.5	51.3	48.7	48.0	44.8
2600	63.1	58.8	57.8	57.1	56.4	55.6	54.7	53.5	50.7	50.1	46.7
2800	65.3	60.9	59.9	59.1	58.3	57.6	56.7	55.4	52.5	51.8	48.4
3000	67.2	62.6	61.6	60.8	60.0	59.2	58.3	57.0	54.1	53.3	49.8
3200	69.0	64.2	63.2	62.4	61.6	60.8	59.8	58.5	55.4	54.7	51.1
3400	70.7	65.8	64.8	63.9	63.1	62.3	61.3	59.9	56.8	56.0	52.3
3600	72.4	67.4	66.3	65.5	64.6	63.7	62.7	61.3	58.1	57.4	53.6
3800	74.1	69.0	67.9	67.0	66.1	65.2	64.2	62.7	59.5	58.7	54.8
4000	75.7	70.5	69.3	68.4	67.6	66.7	65.6	64.1	60.8	60.0	56.0
4200	77.3	72.0	70.8	69.9	69.0	68.1	67.0	65.5	62.1	61.3	57.2
4400	78.8	73.4	72.2	71.3	70.4	69.4	68.3	66.8	63.4	62.5	58.4
4600	80.4	74.9	73.6	72.7	71.8	70.8	69.7	68.1	64.6	63.7	59.5
CLIMB LIMIT WT (1000 KG)	65.1	64.7	64.5	63.8	63.0	62.1	60.8	59.0	54.9	54.0	49.2

With engine bleed for packs off, increase field limit weight by 400 kg and climb limit weight by 1500 kg.
With engine anti-ice on, decrease field limit weight by 200 kg and climb limit weight by 250 kg.
With engine and wing anti-ice on (optional system), decrease field limit weight by 900 kg and climb limit weight by 1500 kg.

Takeoff Field Corrections - Wet Runway

Slope Corrections

FIELD LENGTH AVAILABLE (M)	SLOPE CORRECTED FIELD LENGTH (M)								
	RUNWAY SLOPE (%)								
	-2.0	-1.5	-1.0	-0.5	0.0	0.5	1.0	1.5	2.0
1200	1200	1200	1200	1200	1200	1190	1170	1160	1150
1400	1420	1420	1410	1410	1400	1380	1360	1340	1310
1600	1650	1640	1620	1610	1600	1570	1540	1510	1480
1800	1870	1860	1840	1820	1800	1760	1720	1680	1640
2000	2100	2070	2050	2020	2000	1950	1900	1860	1810
2200	2320	2290	2260	2230	2200	2140	2090	2030	1970
2400	2550	2510	2470	2440	2400	2330	2270	2200	2140
2600	2770	2730	2690	2640	2600	2530	2450	2380	2300
2800	3000	2950	2900	2850	2800	2720	2630	2550	2460
3000	3220	3170	3110	3060	3000	2910	2810	2720	2630
3200	3450	3390	3320	3260	3200	3100	3000	2900	2790
3400	3670	3600	3540	3470	3400	3290	3180	3070	2960
3600	3900	3820	3750	3670	3600	3480	3360	3240	3120
3800	4120	4040	3960	3880	3800	3670	3540	3420	3290
4000	4350	4260	4170	4090	4000	3860	3730	3590	3450
4200	4570	4480	4390	4290	4200	4050	3910	3760	3620
4400	4800	4700	4600	4500	4400	4250	4090	3940	3780
4600	5020	4920	4810	4710	4600	4440	4270	4110	3940
4800	5250	5130	5020	4910	4800	4630	4450	4280	4110
5000	5470	5350	5240	5120	5000	4820	4640	4460	4270

Wind Corrections

SLOPE CORR'D FIELD LENGTH (M)	SLOPE & WIND CORRECTED FIELD LENGTH (M)							
	WIND COMPONENT (KTS)							
	-15	-10	-5	0	10	20	30	40
1200	870	980	1090	1200	1280	1350	1430	1500
1400	1040	1160	1280	1400	1480	1560	1650	1730
1600	1200	1340	1470	1600	1690	1780	1860	1950
1800	1370	1520	1660	1800	1890	1990	2080	2180
2000	1540	1700	1850	2000	2100	2200	2300	2400
2200	1710	1880	2040	2200	2310	2410	2520	2630
2400	1880	2060	2230	2400	2510	2630	2740	2850
2600	2050	2240	2420	2600	2720	2840	2960	3080
2800	2220	2420	2610	2800	2930	3050	3180	3300
3000	2390	2600	2800	3000	3130	3260	3400	3530
3200	2560	2780	2990	3200	3340	3480	3610	3750
3400	2730	2960	3180	3400	3540	3690	3830	3980
3600	2900	3140	3370	3600	3750	3900	4050	4200
3800	3070	3320	3560	3800	3960	4110	4270	4430
4000	3240	3500	3750	4000	4160	4330	4490	4650
4200	3410	3680	3940	4200	4370	4540	4710	4880
4400	3580	3860	4130	4400	4580	4750	4930	5100
4600	3750	4040	4320	4600	4780	4960	5150	5330
4800	3920	4220	4510	4800	4990	5180	5360	5550
5000	4090	4400	4700	5000	5190	5390	5580	5780

Takeoff Field & Climb Limit Weights - Wet Runway

Flaps 5

Sea Level Pressure Altitude

CORR'D FIELD LENGTH (M)	FIELD LIMIT WEIGHT (1000 KG)										
	OAT (°C)										
	-40	0	10	14	18	22	26	30	38	40	50
1220	56.8	53.0	52.1	51.7	51.3	50.9	50.6	50.2	47.9	47.3	44.4
1400	61.6	57.5	56.5	56.0	55.6	55.2	54.8	54.4	51.9	51.2	48.1
1600	66.6	62.1	61.0	60.5	60.1	59.7	59.2	58.8	56.0	55.3	52.0
1800	71.2	66.4	65.2	64.7	64.2	63.7	63.3	62.8	59.8	59.1	55.5
2000	75.4	70.3	69.0	68.5	68.0	67.5	67.0	66.5	63.4	62.6	58.8
2200	79.4	74.0	72.6	72.1	71.6	71.1	70.6	70.0	66.7	65.9	61.8
2400	83.1	77.5	76.1	75.5	74.9	74.4	73.9	73.3	69.8	68.9	64.7
2600	86.1	80.8	79.3	78.7	78.1	77.5	77.0	76.4	72.7	71.8	67.4
2800	86.1	83.9	82.3	81.7	81.1	80.5	80.0	79.4	75.5	74.6	70.0
3000	86.1	86.1	85.1	84.4	83.8	83.2	82.6	82.0	78.0	77.0	72.3
3200	86.1	86.1	86.1	86.1	86.1	85.7	85.1	84.4	80.4	79.4	74.4
3400	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	82.6	81.6	76.5
3600	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	84.8	83.8	78.5
3800	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	85.9	80.5
4000	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	82.4
4200	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	84.3
4400	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1
4600	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1
CLIMB LIMIT WT (1000 KG)	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	81.1	79.8	73.1

2000 FT Pressure Altitude

CORRD FIELD LENGTH (M)	FIELD LIMIT WEIGHT (1000 KG)										
	OAT (°C)										
	-40	0	10	14	18	22	26	30	38	40	50
1220	53.7	49.9	49.0	48.6	48.3	48.0	47.6	46.8	44.6	44.1	41.4
1400	58.3	54.1	53.1	52.7	52.3	52.0	51.6	50.7	48.3	47.7	44.9
1600	63.0	58.4	57.3	56.9	56.5	56.1	55.7	54.7	52.2	51.5	48.4
1800	67.3	62.4	61.3	60.8	60.4	60.0	59.5	58.5	55.7	55.1	51.7
2000	71.3	66.1	64.9	64.4	63.9	63.5	63.0	61.9	59.0	58.3	54.7
2200	75.0	69.5	68.3	67.8	67.3	66.8	66.3	65.1	62.1	61.3	57.5
2400	78.5	72.8	71.5	70.9	70.4	69.9	69.4	68.2	65.0	64.2	60.2
2600	81.9	75.9	74.5	73.9	73.4	72.9	72.4	71.0	67.7	66.8	62.7
2800	85.0	78.8	77.3	76.8	76.2	75.7	75.1	73.8	70.3	69.4	65.1
3000	86.1	81.4	79.9	79.3	78.7	78.2	77.6	76.2	72.6	71.7	67.2
3200	86.1	83.8	82.3	81.7	81.1	80.5	79.9	78.4	74.7	73.8	69.2
3400	86.1	86.1	84.6	84.0	83.4	82.8	82.2	80.7	76.8	75.8	71.1
3600	86.1	86.1	86.1	86.1	85.6	85.0	84.4	82.8	78.9	77.9	73.0
3800	86.1	86.1	86.1	86.1	86.1	86.1	86.1	84.9	80.8	79.8	74.8
4000	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	82.8	81.7	76.6
4200	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	84.7	83.6	78.3
4400	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	85.4	80.0
4600	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	81.7
CLIMB LIMIT WT (1000 KG)	84.0	83.6	83.4	83.4	83.3	83.2	83.1	81.1	75.9	74.6	68.4

With engine bleed for packs off, increase field limit weight by 350 kg and climb limit weight by 1500 kg.
With engine anti-ice on, decrease field limit weight by 200 kg and climb limit weight by 250 kg.
With engine and wing anti-ice on (optional system), decrease field limit weight by 750 kg and climb limit weight by 1500 kg.

Takeoff Field & Climb Limit Weights - Wet Runway

Flaps 5

4000 FT Pressure Altitude

CORR'D FIELD LENGTH (M)	FIELD LIMIT WEIGHT (1000 KG)										
	OAT (°C)										
	-40	0	10	14	18	22	26	30	38	40	50
1220	50.2	46.6	45.8	45.4	45.1	44.8	44.2	43.5	41.5	41.0	38.7
1400	54.4	50.5	49.6	49.2	48.9	48.5	47.9	47.1	45.0	44.4	41.9
1600	58.8	54.5	53.5	53.1	52.8	52.4	51.7	50.8	48.5	47.9	45.2
1800	62.8	58.2	57.2	56.8	56.4	56.0	55.2	54.3	51.8	51.2	48.3
2000	66.5	61.6	60.5	60.1	59.7	59.2	58.4	57.4	54.8	54.1	51.1
2200	70.0	64.8	63.7	63.2	62.8	62.3	61.4	60.4	57.7	56.9	53.7
2400	73.3	67.9	66.6	66.2	65.7	65.2	64.3	63.2	60.3	59.6	56.2
2600	76.4	70.7	69.4	68.9	68.4	68.0	67.0	65.9	62.8	62.1	58.5
2800	79.3	73.4	72.1	71.6	71.1	70.6	69.6	68.4	65.2	64.4	60.7
3000	81.9	75.9	74.5	73.9	73.4	72.9	71.8	70.6	67.3	66.5	62.6
3200	84.4	78.1	76.7	76.1	75.6	75.0	74.0	72.7	69.3	68.5	64.5
3400	86.1	80.3	78.8	78.3	77.7	77.1	76.0	74.7	71.3	70.4	66.2
3600	86.1	82.5	80.9	80.3	79.8	79.2	78.0	76.7	73.1	72.2	68.0
3800	86.1	84.5	83.0	82.4	81.8	81.2	80.0	78.6	74.9	74.0	69.6
4000	86.1	86.1	85.0	84.3	83.7	83.1	81.9	80.5	76.7	75.7	71.3
4200	86.1	86.1	86.1	86.1	85.7	85.0	83.8	82.3	78.5	77.5	72.9
4400	86.1	86.1	86.1	86.1	86.1	86.1	85.7	84.2	80.2	79.2	74.5
4600	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.0	81.9	80.8	76.0
CLIMB LIMIT WT (1000 KG)	79.0	78.6	78.5	78.4	78.3	78.2	77.1	75.5	70.8	69.6	64.0

6000 FT Pressure Altitude

CORR'D FIELD LENGTH (M)	FIELD LIMIT WEIGHT (1000 KG)										
	OAT (°C)										
	-40	0	10	14	18	22	26	30	38	40	50
1220	46.8	43.4	42.7	42.4	42.1	41.5	41.0	40.3	38.6	38.1	36.1
1400	50.7	47.0	46.2	45.9	45.6	45.0	44.3	43.6	41.7	41.2	39.0
1600	54.8	50.8	49.9	49.5	49.2	48.5	47.9	47.1	45.0	44.5	42.0
1800	58.5	54.2	53.3	52.9	52.5	51.8	51.1	50.3	48.1	47.5	44.9
2000	61.9	57.4	56.4	56.0	55.6	54.8	54.1	53.2	50.8	50.2	47.4
2200	65.2	60.4	59.3	58.9	58.4	57.7	56.9	55.9	53.4	52.8	49.9
2400	68.2	63.2	62.0	61.6	61.2	60.3	59.5	58.5	55.9	55.2	52.2
2600	71.1	65.8	64.6	64.2	63.7	62.8	62.0	60.9	58.2	57.5	54.3
2800	73.8	68.4	67.1	66.6	66.1	65.3	64.3	63.3	60.4	59.7	56.4
3000	76.2	70.6	69.3	68.8	68.3	67.4	66.4	65.3	62.4	61.6	58.1
3200	78.5	72.7	71.3	70.8	70.3	69.3	68.4	67.2	64.2	63.4	59.8
3400	80.7	74.7	73.3	72.8	72.2	71.3	70.3	69.1	65.9	65.1	61.5
3600	82.9	76.7	75.3	74.7	74.2	73.1	72.1	70.9	67.7	66.8	63.0
3800	84.9	78.6	77.1	76.6	76.0	75.0	73.9	72.6	69.3	68.5	64.6
4000	86.1	80.5	79.0	78.4	77.8	76.7	75.6	74.3	70.9	70.1	66.1
4200	86.1	82.3	80.8	80.2	79.6	78.5	77.4	76.0	72.5	71.6	67.5
4400	86.1	84.1	82.5	81.9	81.3	80.2	79.0	77.7	74.1	73.2	69.0
4600	86.1	85.9	84.3	83.7	83.1	81.9	80.7	79.3	75.7	74.7	70.4
CLIMB LIMIT WT (1000 KG)	74.1	73.8	73.7	73.6	73.6	72.6	71.5	70.0	65.6	64.4	59.4

With engine bleed for packs off, increase field limit weight by 350 kg and climb limit weight by 1500 kg.
With engine anti-ice on, decrease field limit weight by 200 kg and climb limit weight by 250 kg.
With engine and wing anti-ice on (optional system), decrease field limit weight by 750 kg and climb limit weight by 1500 kg.

Takeoff Field & Climb Limit Weights - Wet Runway

Flaps 5

8000 FT Pressure Altitude

CORR'D FIELD LENGTH (M)	FIELD LIMIT WEIGHT (1000 KG)										
	OAT (°C)										
	-40	0	10	14	18	22	26	30	38	40	50
1220	43.6	40.5	39.8	39.5	39.0	38.6	38.0	37.2	35.5	35.1	33.2
1400	47.2	43.8	43.1	42.8	42.2	41.7	41.1	40.3	38.4	38.0	35.9
1600	51.0	47.3	46.5	46.2	45.6	45.0	44.3	43.4	41.4	40.9	38.7
1800	54.5	50.5	49.6	49.3	48.7	48.0	47.3	46.4	44.2	43.7	41.3
2000	57.6	53.4	52.5	52.1	51.5	50.8	50.0	49.0	46.7	46.2	43.7
2200	60.6	56.2	55.2	54.8	54.1	53.4	52.6	51.5	49.1	48.5	45.9
2400	63.5	58.8	57.7	57.3	56.6	55.9	55.0	53.9	51.4	50.8	48.0
2600	66.1	61.2	60.1	59.7	59.0	58.2	57.3	56.1	53.5	52.8	49.9
2800	68.6	63.6	62.4	62.0	61.2	60.4	59.5	58.3	55.5	54.8	51.8
3000	70.9	65.6	64.4	64.0	63.2	62.4	61.4	60.1	57.2	56.6	53.4
3200	73.0	67.5	66.3	65.9	65.0	64.2	63.2	61.9	58.9	58.2	54.9
3400	75.0	69.4	68.2	67.7	66.8	65.9	64.9	63.6	60.5	59.8	56.4
3600	77.0	71.2	69.9	69.4	68.6	67.7	66.6	65.2	62.0	61.3	57.9
3800	78.9	73.0	71.7	71.1	70.2	69.3	68.2	66.8	63.5	62.8	59.2
4000	80.8	74.7	73.3	72.8	71.9	70.9	69.8	68.3	65.0	64.2	60.6
4200	82.7	76.4	75.0	74.5	73.5	72.5	71.4	69.9	66.4	65.7	61.9
4400	84.5	78.1	76.6	76.1	75.1	74.1	72.9	71.4	67.9	67.1	63.2
4600	86.1	79.7	78.3	77.7	76.7	75.7	74.4	72.9	69.3	68.4	64.5
CLIMB LIMIT WT (1000 KG)	69.4	69.1	69.0	69.0	68.1	67.3	66.0	64.0	59.7	58.7	54.3

10000 FT Pressure Altitude

CORR'D FIELD LENGTH (M)	FIELD LIMIT WEIGHT (1000 KG)										
	OAT (°C)										
	-40	0	10	14	18	22	26	30	38	40	50
1220	40.7	37.8	37.1	36.7	36.2	35.8	35.2	34.5	32.8	32.4	30.5
1400	44.0	40.9	40.2	39.7	39.2	38.7	38.1	37.3	35.5	35.1	32.9
1600	47.5	44.1	43.3	42.8	42.2	41.7	41.1	40.2	38.3	37.8	35.4
1800	50.7	47.1	46.3	45.7	45.1	44.5	43.8	42.9	40.8	40.3	37.8
2000	53.7	49.8	48.9	48.3	47.7	47.0	46.3	45.3	43.1	42.6	39.9
2200	56.5	52.3	51.4	50.8	50.1	49.4	48.7	47.6	45.3	44.7	41.9
2400	59.1	54.8	53.8	53.1	52.4	51.7	50.9	49.8	47.4	46.8	43.8
2600	61.5	57.0	56.0	55.3	54.6	53.8	53.0	51.9	49.3	48.7	45.6
2800	63.9	59.2	58.1	57.4	56.6	55.9	55.0	53.8	51.2	50.5	47.3
3000	65.9	61.1	60.0	59.2	58.4	57.6	56.7	55.5	52.7	52.1	48.7
3200	67.9	62.8	61.7	60.9	60.1	59.3	58.4	57.1	54.3	53.6	50.1
3400	69.7	64.6	63.4	62.6	61.8	60.9	60.0	58.6	55.7	55.0	51.5
3600	71.6	66.2	65.1	64.2	63.4	62.5	61.5	60.1	57.1	56.4	52.8
3800	73.3	67.9	66.6	65.8	64.9	64.0	63.0	61.6	58.5	57.7	54.0
4000	75.1	69.4	68.2	67.3	66.4	65.5	64.4	63.0	59.8	59.0	55.2
4200	76.8	71.0	69.7	68.8	67.9	66.9	65.9	64.4	61.1	60.3	56.4
4400	78.5	72.5	71.2	70.3	69.3	68.4	67.3	65.8	62.4	61.6	57.5
4600	80.1	74.1	72.7	71.7	70.8	69.8	68.7	67.1	63.7	62.8	58.7
CLIMB LIMIT WT (1000 KG)	65.1	64.7	64.5	63.8	63.0	62.1	60.8	59.0	54.9	54.0	49.2

With engine bleed for packs off, increase field limit weight by 350 kg and climb limit weight by 1500 kg.
With engine anti-ice on, decrease field limit weight by 200 kg and climb limit weight by 250 kg.
With engine and wing anti-ice on (optional system), decrease field limit weight by 750 kg and climb limit weight by 1500 kg.

Takeoff Obstacle Limit Weight

Flaps 5

Sea Level, 30°C & Below, Zero Wind

Based on engine bleed for packs on and anti-ice off

Reference Obstacle Limit Weight (1000 KG)

OBSTACLE HEIGHT (M)	DISTANCE FROM BRAKE RELEASE (100 M)										
	25	30	35	40	45	50	55	60	65	70	75
5	72.8	79.5									
20	67.6	73.8	78.8	83.0							
40	62.7	68.5	73.3	77.2	80.5	83.2	85.4				
60	58.9	64.4	69.1	73.0	76.2	79.0	81.3	83.3			
80	55.7	61.1	65.6	69.4	72.7	75.5	77.9	80.0	81.8	83.3	84.7
100	53.0	58.2	62.6	66.4	69.7	72.5	75.0	77.1	78.9	80.6	82.0
120	50.5	55.7	60.0	63.7	67.0	69.9	72.4	74.5	76.4	78.1	79.6
140	48.4	53.4	57.7	61.4	64.6	67.5	70.0	72.2	74.2	75.9	77.5
160	46.4	51.4	55.6	59.3	62.5	65.3	67.8	70.1	72.1	73.9	75.5
180	44.6	49.5	53.7	57.3	60.5	63.3	65.8	68.1	70.2	72.0	73.6
200	43.0	47.8	51.9	55.5	58.7	61.5	64.0	66.3	68.3	70.2	71.9
220	41.4	46.2	50.3	53.9	57.0	59.8	62.3	64.6	66.7	68.5	70.2
240		44.7	48.8	52.3	55.4	58.2	60.8	63.0	65.1	66.9	68.7
260		43.3	47.3	50.9	54.0	56.8	59.3	61.5	63.6	65.5	67.2
280		42.1	46.0	49.5	52.6	55.4	57.9	60.1	62.2	64.1	65.8
300			44.8	48.2	51.3	54.0	56.5	58.8	60.9	62.7	64.5

Obstacle height must be calculated from lowest point of the runway to conservatively account for runway slope.

OAT Adjustments

OAT (°C)	REFERENCE OBSTACLE LIMIT WEIGHT (1000 KG)									
	40	45	50	55	60	65	70	75	80	85
30 & BELOW	0	0	0	0	0	0	0	0	0	0
32	-0.6	-0.7	-0.8	-0.8	-0.9	-1.0	-1.1	-1.2	-1.2	-1.3
34	-1.2	-1.3	-1.5	-1.7	-1.8	-2.0	-2.2	-2.3	-2.5	-2.6
36	-1.8	-2.0	-2.3	-2.5	-2.7	-3.0	-3.2	-3.5	-3.7	-4.0
38	-2.4	-2.7	-3.0	-3.3	-3.7	-4.0	-4.3	-4.6	-5.0	-5.3
40	-2.9	-3.3	-3.8	-4.2	-4.6	-5.0	-5.4	-5.8	-6.2	-6.6
42	-3.5	-4.0	-4.5	-5.0	-5.4	-5.9	-6.4	-6.9	-7.4	-7.9
44	-4.1	-4.6	-5.2	-5.7	-6.3	-6.9	-7.4	-8.0	-8.5	-9.1
46	-4.6	-5.3	-5.9	-6.5	-7.2	-7.8	-8.4	-9.1	-9.7	-10.4
48	-5.2	-5.9	-6.6	-7.3	-8.0	-8.8	-9.5	-10.2	-10.9	-11.6
50	-5.7	-6.5	-7.3	-8.1	-8.9	-9.7	-10.5	-11.3	-12.1	-12.9

Pressure Altitude Adjustments

ALT (FT)	OAT ADJUSTED OBSTACLE LIMIT WEIGHT (1000 KG)									
	40	45	50	55	60	65	70	75	80	85
S.L. & BELOW	0	0	0	0	0	0	0	0	0	0
1000	-1.5	-1.6	-1.8	-2.0	-2.1	-2.3	-2.5	-2.6	-2.8	-3.0
2000	-2.9	-3.2	-3.6	-3.9	-4.3	-4.6	-5.0	-5.3	-5.6	-6.0
3000	-4.2	-4.8	-5.3	-5.8	-6.3	-6.8	-7.3	-7.8	-8.3	-8.8
4000	-5.6	-6.3	-6.9	-7.6	-8.3	-9.0	-9.6	-10.3	-11.0	-11.7
5000	-6.9	-7.7	-8.6	-9.4	-10.2	-11.1	-11.9	-12.8	-13.6	-14.4
6000	-8.2	-9.2	-10.2	-11.2	-12.2	-13.2	-14.2	-15.2	-16.2	-17.2
7000	-9.3	-10.5	-11.7	-12.9	-14.0	-15.2	-16.4	-17.5	-18.7	-19.9
8000	-10.5	-11.8	-13.2	-14.5	-15.9	-17.2	-18.6	-19.9	-21.3	-22.6
9000	-11.6	-13.1	-14.6	-16.1	-17.6	-19.1	-20.6	-22.1	-23.5	-25.0
10000	-12.8	-14.4	-16.0	-17.7	-19.3	-20.9	-22.6	-24.2	-25.8	-27.5

Takeoff Obstacle Limit Weight
Flaps 5
Sea Level, 30°C & Below, Zero Wind
Wind Adjustments

WIND (KTS)	OAT & ALT ADJUSTED OBSTACLE LIMIT WEIGHT (1000 KG)									
	40	45	50	55	60	65	70	75	80	85
15 TW	-8.7	-8.6	-8.6	-8.5	-8.4	-8.3	-8.2	-8.2	-8.1	-8.0
10 TW	-5.8	-5.8	-5.7	-5.7	-5.6	-5.6	-5.5	-5.4	-5.4	-5.3
5 TW	-2.9	-2.9	-2.9	-2.8	-2.8	-2.8	-2.7	-2.7	-2.7	-2.7
0	0	0	0	0	0	0	0	0	0	0
10 HW	1.1	1.1	1.0	1.0	0.9	0.9	0.9	0.8	0.8	0.8
20 HW	2.2	2.1	2.0	2.0	1.9	1.8	1.8	1.7	1.6	1.6
30 HW	3.4	3.3	3.2	3.0	2.9	2.8	2.7	2.6	2.5	2.3
40 HW	4.6	4.4	4.3	4.1	3.9	3.8	3.6	3.5	3.3	3.1

With engine bleed for packs off, increase weight by 600 kg.
With engine anti-ice on, decrease weight by 300 kg.
With engine and wing anti-ice on, decrease weight by 1650 kg (optional system).

Performance Dispatch — Chapter PD
Enroute — Section 71

Long Range Cruise Maximum Operating Altitude
Max Cruise Thrust
ISA + 10°C and Below

WEIGHT (1000 KG)	OPTIMUM ALT (FT)	TAT (°C)	MARGIN TO INITIAL BUFFET 'G' (BANK ANGLE)				
			1.20 (33°)	1.25 (36°)	1.30 (39°)	1.40 (44°)	1.50 (48°)
85	31200	-7	33400*	33400*	33400	31800	30400
80	32500	-10	35000*	35000*	34700	33100	31700
75	33900	-13	36400*	36400*	36100	34500	33100
70	35400	-16	37800*	37800*	37500	36000	34600
65	36900	-18	39200*	39200*	39000	37500	36100
60	38600	-18	40700*	40700*	40700	39200	37800
55	40400	-18	41000	41000	41000	41000	39600
50	41000	-18	41000	41000	41000	41000	41000
45	41000	-18	41000	41000	41000	41000	41000
40	41000	-18	41000	41000	41000	41000	41000

ISA + 15°C

WEIGHT (1000 KG)	OPTIMUM ALT (FT)	TAT (°C)	MARGIN TO INITIAL BUFFET 'G' (BANK ANGLE)				
			1.20 (33°)	1.25 (36°)	1.30 (39°)	1.40 (44°)	1.50 (48°)
85	31200	-1	31400*	31400*	31400*	31400*	30400
80	32500	-4	33600*	33600*	33600*	33100	31700
75	33900	-7	35400*	35400*	35400*	34500	33100
70	35400	-11	36800*	36800*	36800*	36000	34600
65	36900	-12	38200*	38200*	38200*	37500	36100
60	38600	-12	39600*	39600*	39600*	39200	37800
55	40400	-12	41000	41000	41000	41000	39600
50	41000	-12	41000	41000	41000	41000	41000
45	41000	-12	41000	41000	41000	41000	41000
40	41000	-12	41000	41000	41000	41000	41000

ISA + 20°C

WEIGHT (1000 KG)	OPTIMUM ALT (FT)	TAT (°C)	MARGIN TO INITIAL BUFFET 'G' (BANK ANGLE)				
			1.20 (33°)	1.25 (36°)	1.30 (39°)	1.40 (44°)	1.50 (48°)
85	31200	4	27900*	27900*	27900*	27900*	27900*
80	32500	1	30400*	30400*	30400*	30400*	30400*
75	33900	-2	33200*	33200*	33200*	33200*	33100
70	35400	-5	35400*	35400*	35400*	35400*	34600
65	36900	-7	36900*	36900*	36900*	36900*	36100
60	38600	-7	38300*	38300*	38300*	38300*	37800
55	40400	-7	39800*	39800*	39800*	39800*	39600
50	41000	-7	41000	41000	41000	41000	41000
45	41000	-7	41000	41000	41000	41000	41000
40	41000	-7	41000	41000	41000	41000	41000

***Denotes altitude thrust limited in level flight, 100 fpm residual rate of climb.**

Long Range Cruise Trip Fuel and Time

Ground to Air Miles Conversion

AIR DISTANCE (NM)					GROUND DISTANCE (NM)	AIR DISTANCE (NM)				
HEADWIND COMPONENT (KTS)						TAILWIND COMPONENT (KTS)				
100	80	60	40	20		20	40	60	80	100
277	257	240	225	212	200	190	181	173	166	159
547	510	477	448	423	400	381	364	348	334	321
815	761	713	671	634	600	573	548	524	503	484
1083	1013	949	894	845	800	764	731	700	672	647
1350	1263	1185	1116	1055	1000	956	914	876	842	810
1616	1513	1420	1338	1266	1200	1147	1098	1053	1011	974
1882	1762	1655	1560	1476	1400	1339	1282	1229	1181	1137
2146	2011	1889	1782	1687	1600	1530	1466	1406	1351	1301
2410	2260	2124	2004	1897	1800	1722	1649	1582	1520	1464
2673	2507	2357	2225	2107	2000	1913	1833	1759	1690	1628
2935	2754	2590	2446	2317	2200	2105	2017	1935	1860	1792
3196	3000	2823	2667	2527	2400	2296	2200	2111	2030	1956
3457	3247	3055	2887	2737	2600	2488	2384	2288	2200	2120
3718	3493	3288	3108	2947	2800	2680	2568	2465	2370	2284
3978	3738	3521	3329	3157	3000	2872	2752	2642	2540	2448
4238	3984	3753	3549	3367	3200	3063	2936	2819	2711	2613
4497	4229	3985	3769	3576	3400	3255	3120	2996	2881	2777
4755	4473	4216	3989	3786	3600	3447	3304	3173	3051	2941
5013	4717	4447	4209	3996	3800	3639	3489	3349	3222	3105
5271	4961	4679	4429	4205	4000	3830	3673	3526	3392	3269
5528	5205	4910	4649	4415	4200	4022	3857	3703	3562	3434
5786	5448	5141	4869	4624	4400	4214	4041	3880	3733	3598
6042	5691	5372	5088	4833	4600	4406	4225	4057	3903	3762
6299	5934	5602	5307	5043	4800	4597	4408	4233	4073	3926
6555	6176	5832	5526	5252	5000	4789	4592	4410	4243	4090

Long Range Cruise Trip Fuel and Time

Reference Fuel and Time Required

AIR DIST (NM)	PRESSURE ALTITUDE (1000 FT)									
	27		29		31		33		35	
	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)
200	1.7	0:38	1.7	0:38	1.7	0:38	1.7	0:38	1.7	0:38
400	2.8	1:08	2.8	1:07	2.8	1:06	2.8	1:05	2.8	1:05
600	4.0	1:38	4.0	1:35	3.9	1:34	3.9	1:33	3.8	1:31
800	5.2	2:07	5.1	2:04	5.0	2:02	5.0	2:00	4.9	1:58
1000	6.4	2:37	6.3	2:32	6.2	2:30	6.1	2:27	6.0	2:25
1200	7.6	3:05	7.5	3:00	7.3	2:57	7.2	2:54	7.1	2:52
1400	8.9	3:34	8.7	3:28	8.5	3:24	8.3	3:21	8.2	3:18
1600	10.1	4:02	9.9	3:56	9.7	3:52	9.4	3:48	9.3	3:45
1800	11.4	4:30	11.1	4:23	10.9	4:19	10.6	4:14	10.4	4:11
2000	12.6	4:58	12.3	4:51	12.0	4:46	11.8	4:41	11.5	4:38
2200	13.9	5:26	13.6	5:18	13.3	5:12	12.9	5:07	12.7	5:04
2400	15.2	5:54	14.8	5:45	14.5	5:39	14.1	5:34	13.9	5:30
2600	16.5	6:21	16.1	6:13	15.7	6:06	15.3	6:00	15.1	5:57
2800	17.8	6:49	17.4	6:39	17.0	6:32	16.6	6:26	16.3	6:23
3000	19.2	7:16	18.7	7:06	18.2	6:59	17.8	6:53	17.5	6:49
3200	20.5	7:43	20.0	7:33	19.5	7:25	19.1	7:19	18.8	7:16
3400	21.9	8:10	21.3	7:59	20.8	7:51	20.3	7:45	20.1	7:42
3600	23.2	8:37	22.7	8:26	22.1	8:17	21.6	8:11	21.4	8:09
3800	24.6	9:04	24.0	8:52	23.4	8:43	23.0	8:37	22.8	8:35
4000	26.0	9:30	25.4	9:18	24.8	9:09	24.3	9:03	24.1	9:01
4200	27.5	9:57	26.8	9:44	26.1	9:35	25.7	9:30		
4400	28.9	10:23	28.2	10:10	27.5	10:01	27.0	9:56		
4600	30.3	10:49	29.6	10:36	28.9	10:27	28.4	10:22		
4800	31.8	11:15	31.0	11:02	30.3	10:53	29.9	10:48		
5000	33.3	11:41	32.5	11:28	31.8	11:19	31.3	11:14		

Fuel Required Adjustments (1000 KG)

REFERENCE FUEL REQUIRED (1000 KG)	LANDING WEIGHT (1000 KG)				
	40	50	60	70	80
4	-0.7	-0.4	0.0	0.4	0.9
8	-1.3	-0.7	0.0	0.8	1.9
12	-2.0	-1.0	0.0	1.3	3.2
16	-2.6	-1.4	0.0	1.9	4.5
20	-3.3	-1.7	0.0	2.5	6.1
24	-4.0	-2.1	0.0	3.2	7.8
28	-4.7	-2.4	0.0	4.0	9.7
32	-5.4	-2.8	0.0	4.8	11.7

Based on 280/.78 climb, Long Range Cruise and .78/280/250 descent.

Long Range Cruise Step Climb

Ground to Air Miles Conversion

AIR DISTANCE (NM)					GROUND DISTANCE (NM)	AIR DISTANCE (NM)				
HEADWIND COMPONENT (KTS)						TAILWIND COMPONENT (KTS)				
100	80	60	40	20		20	40	60	80	100
1316	1238	1168	1106	1050	1000	954	912	874	839	806
1829	1724	1630	1545	1469	1400	1337	1280	1227	1179	1134
2343	2209	2091	1984	1887	1800	1720	1647	1580	1519	1461
2855	2695	2551	2422	2306	2200	2103	2015	1934	1859	1789
3368	3180	3012	2861	2724	2600	2487	2383	2287	2199	2117
3880	3665	3473	3299	3143	3000	2870	2750	2641	2539	2445
4392	4150	3933	3738	3561	3400	3253	3118	2994	2880	2774
4904	4634	4393	4176	3979	3800	3636	3486	3348	3220	3102
5415	5119	4853	4614	4397	4200	4020	3854	3702	3561	3430
5926	5603	5313	5052	4816	4600	4403	4222	4055	3902	3759
6437	6087	5773	5490	5234	5000	4786	4590	4409	4242	4087

Trip Fuel and Time Required

AIR DIST (NM)	TRIP FUEL (1000 KG)								TIME (HRS:MIN)
	LANDING WEIGHT (1000 KG)								
	40	45	50	55	60	65	70	75	
1000	4.5	4.8	5.2	5.6	5.9	6.3	6.7	7.1	2:24
1400	6.1	6.5	7.1	7.6	8.1	8.7	9.2	9.7	3:17
1800	7.8	8.3	9.0	9.7	10.4	11.1	11.8	12.5	4:10
2200	9.5	10.1	11.0	11.9	12.7	13.6	14.4	15.3	5:03
2600	11.2	12.0	13.0	14.1	15.1	16.1	17.1	18.2	5:56
3000	13.0	14.0	15.2	16.4	17.5	18.8	20.0	21.2	6:48
3400	14.8	16.0	17.3	18.7	20.1	21.5	22.9	24.2	7:41
3800	16.7	18.0	19.5	21.2	22.7	24.3	25.8	27.4	8:33
4200	18.6	20.1	21.8	23.6	25.3	27.2	28.9	30.7	9:25
4600	20.6	22.3	24.2	26.2	28.1	30.1	32.1	34.1	10:18
5000	22.6	24.5	26.7	28.8	31.0	33.2	35.3	37.5	11:10

Based on 280/.78 climb, Long Range Cruise, and .78/280/250 descent.
Valid for all pressure altitudes with 4000 ft step climb to 2000 ft above optimum altitude.

Short Trip Fuel and Time
Ground to Air Miles Conversion

AIR DISTANCE (NM)					GROUND DISTANCE (NM)	AIR DISTANCE (NM)				
HEADWIND COMPONENT (KTS)						TAILWIND COMPONENT (KTS)				
100	80	60	40	20		20	40	60	80	100
95	81	70	62	55	50	46	42	39	36	34
161	144	130	118	108	100	93	87	81	77	72
227	206	188	174	161	150	140	132	125	118	112
292	267	246	229	213	200	188	178	168	160	152
355	328	304	284	266	250	236	224	212	202	193
418	387	361	338	318	300	284	270	257	245	234
481	447	418	393	370	350	332	316	301	287	275
544	508	476	447	422	400	380	362	345	330	316
608	568	533	502	475	450	428	408	389	372	357
674	630	592	558	527	500	475	453	433	414	397

Trip Fuel and Time Required

AIR DIST (NM)		LANDING WEIGHT (1000 KG)					TIME (HRS:MIN)
		40	50	60	70	80	
50	FUEL (1000 KG)	0.5	0.6	0.7	0.8	0.8	0:14
	ALT (FT)	11000	11000	9000	7000	7000	
100	FUEL (1000 KG)	0.9	1.0	1.1	1.2	1.3	0:23
	ALT (FT)	19000	17000	17000	15000	15000	
150	FUEL (1000 KG)	1.1	1.3	1.4	1.5	1.6	0:31
	ALT (FT)	25000	25000	23000	21000	19000	
200	FUEL (1000 KG)	1.4	1.5	1.7	1.8	2.0	0:38
	ALT (FT)	33000	27000	25000	25000	23000	
250	FUEL (1000 KG)	1.6	1.8	2.0	2.2	2.4	0:44
	ALT (FT)	39000	35000	31000	29000	27000	
300	FUEL (1000 KG)	1.8	2.0	2.2	2.5	2.7	0:51
	ALT (FT)	41000	39000	35000	33000	29000	
350	FUEL (1000 KG)	2.0	2.2	2.5	2.8	3.0	0:57
	ALT (FT)	41000	39000	35000	33000	31000	
400	FUEL (1000 KG)	2.1	2.4	2.7	3.1	3.4	1:04
	ALT (FT)	41000	41000	37000	33000	31000	
450	FUEL (1000 KG)	2.3	2.7	3.0	3.3	3.7	1:10
	ALT (FT)	41000	41000	37000	35000	31000	
500	FUEL (1000 KG)	2.5	2.9	3.3	3.6	4.0	1:17
	ALT (FT)	41000	41000	37000	35000	31000	

Based on 280/.78 climb, Long Range Cruise, and .78/280/250 descent.

Holding Planning

Flaps Up

WEIGHT (1000 KG)	TOTAL FUEL FLOW (KG/HR)								
	PRESSURE ALTITUDE (FT)								
	1500	5000	10000	15000	20000	25000	30000	35000	41000
90	3160	3110	3100	3080	3060	3090	3210		
85	3000	2950	2930	2910	2880	2900	2990		
80	2840	2790	2760	2740	2700	2710	2790		
75	2690	2640	2600	2580	2530	2530	2590	2720	
70	2530	2480	2440	2410	2370	2340	2400	2480	
65	2380	2320	2280	2240	2210	2160	2220	2270	
60	2220	2170	2130	2080	2050	2000	2030	2070	
55	2070	2010	1970	1930	1890	1840	1850	1890	2040
50	1920	1860	1810	1770	1730	1730	1700	1730	1830
45	1760	1710	1690	1640	1600	1570	1550	1550	1630
40	1650	1600	1540	1490	1450	1420	1400	1380	1440

This table includes 5% additional fuel for holding in a racetrack pattern.

Flight Crew Oxygen Requirements

Required Pressure (PSI) for 76 Cubic FT Cylinder

BOTTLE TEMPERATURE		NUMBER OF CREW USING OXYGEN		
°C	°F	2	3	4
50	122	735	1055	1360
45	113	725	1040	1340
40	104	715	1020	1320
35	95	700	1005	1300
30	86	690	990	1280
25	77	680	975	1255
20	68	670	960	1240
15	59	655	940	1215
10	50	645	925	1195
5	41	635	910	1175
0	32	620	890	1150
-5	23	610	875	1130
-10	14	600	860	1110

Required Pressure (PSI) for 114/115 Cubic FT Cylinder

BOTTLE TEMPERATURE		NUMBER OF CREW USING OXYGEN		
°C	°F	2	3	4
50	122	530	735	945
45	113	520	725	930
40	104	510	715	915
35	95	505	700	900
30	86	495	690	885
25	77	485	680	870
20	68	480	670	860
15	59	470	655	840
10	50	460	645	830
5	41	455	635	815
0	32	445	620	800
-5	23	440	610	785
-10	14	430	600	770

ENGINE INOP

MAX CONTINUOUS THRUST

Net Level Off Weight

PRESSURE ALTITUDE (1000 FT)	LEVEL OFF WEIGHT (1000 KG)		
	ISA + 10°C & BELOW	ISA + 15°C	ISA + 20°C
30	43.8	42.5	41.0
28	47.5	45.9	44.5
26	51.3	49.6	48.1
24	55.6	53.8	52.1
22	60.6	58.5	56.4
20	65.9	63.5	61.1
18	70.8	68.2	65.3
16	75.6	73.0	70.0
14	80.0	77.5	75.0
12	84.8	81.9	78.8

Anti-Ice Adjustments

ANTI-ICE CONFIGURATION	LEVEL OFF WEIGHT ADJUSTMENT (1000 KG)								
	PRESSURE ALITITUDE (1000 FT)								
	12	14	16	18	20	22	24	26	28
ENGINE ONLY	-2.0	-1.8	-1.8	-1.8	-1.6	-1.5	-1.4	-1.3	-1.1
ENGINE & WING	-7.6	-7.1	-6.7	-6.7	-6.4	-5.9	-5.3	-4.9	

Performance Dispatch — Chapter PD
Landing — Section 72

Landing Field Limit Weight - Dry Runway

Based on anti-skid operative and automatic speedbrakes

Flaps 40

Wind Corrected Field Length (M)

FIELD LENGTH AVAILABLE (M)	WIND COMPONENT (KTS)							
	-15	-10	-5	0	10	20	30	40
1000		810	910	1000	1070	1140	1210	1280
1200	880	990	1100	1200	1270	1350	1420	1490
1400	1050	1170	1290	1400	1480	1550	1630	1710
1600	1220	1350	1470	1600	1680	1760	1840	1920
1800	1390	1530	1660	1800	1880	1970	2050	2140
2000	1560	1710	1850	2000	2090	2180	2270	2360
2200	1730	1880	2040	2200	2290	2390	2480	2570
2400	1900	2060	2220	2400	2500	2590	2690	2790
2600	2050	2210	2380	2600	2700	2800	2900	3000
2800	2160	2310	2480	2800	2900	3010	3110	3220
3000	2260	2410	2580	3000	3110	3220	3330	
3200	2370	2510	2680	3200	3310			
3400	2480	2610	2780	3400				
3600	2580	2710	2880					
3800	2690	2810	2980					
4000	2800	2910	3080					

Field Limit Weight (1000 KG)

WIND CORR'D FIELD LENGTH (M)	AIRPORT PRESSURE ALTITUDE (FT)					
	0	2000	4000	6000	8000	10000
1200	49.3	46.4	43.5	40.8	38.2	
1400	60.5	57.7	54.9	52.3	49.0	45.9
1600	71.1	67.5	64.0	60.8	57.8	54.9
1800	80.1	76.6	72.7	68.8	65.1	61.6
2000	85.9	83.3	80.5	76.5	72.4	68.4
2200			85.7	82.9	79.5	75.1
2400				87.8	84.8	81.5
2600						84.7
2800						87.1

Decrease field limit weight by 5800 kg when using manual speedbrakes.

Landing Field Limit Weight - Dry Runway

Based on anti-skid inoperative and manual speedbrakes

Flaps 40

Wind Corrected Field Length (M)

FIELD LENGTH AVAILABLE (M)	WIND COMPONENT (KTS)							
	-15	-10	-5	0	10	20	30	40
1600				1600	1750	1890	2040	2190
1800			1560	1800	1950	2100	2260	2410
2000		1500	1750	2000	2160	2310	2470	2630
2200	1430	1680	1940	2200	2360	2520	2690	2850
2400	1600	1870	2130	2400	2570	2730	2900	3070
2600	1780	2050	2330	2600	2770	2940	3120	3290
2800	1960	2240	2520	2800	2980	3150	3330	3510
3000	2140	2420	2710	3000	3180	3360	3550	3730
3200	2310	2610	2900	3200	3390	3570	3760	3950
3400	2490	2790	3100	3400	3590	3780	3980	4170
3600	2670	2980	3290	3600	3800	3990	4190	4390
3800	2850	3160	3480	3800	4000	4200	4410	4610
4000	3020	3350	3670	4000	4210	4410	4620	4830
4200	3200	3530	3870	4200	4410	4620	4840	5050
4400	3380	3720	4060	4400	4620	4830	5050	5270
4600	3560	3900	4250	4600	4820	5040	5270	5490
4800	3730	4090	4440	4800	5030	5250	5480	5710
5000	3910	4270	4640	5000	5230	5460	5700	
5200	4090	4460	4830	5200	5440	5670		
5400	4270	4640	5020	5400	5640			

Field Limit Weight (1000 KG)

WIND CORR'D FIELD LENGTH (M)	AIRPORT PRESSURE ALTITUDE (FT)					
	0	2000	4000	6000	8000	10000
2000	38.6					
2200	44.5	41.5	38.1			
2400	50.4	47.1	43.4	40.4		
2600	56.3	52.7	48.7	45.4	42.2	39.2
2800	62.1	58.1	53.8	50.3	46.9	43.5
3000	68.1	63.5	58.9	55.1	51.4	47.8
3200	74.0	69.2	64.0	59.8	55.8	52.0
3400	79.2	74.6	69.2	64.5	60.3	56.2
3600	83.8	79.5	74.2	69.2	64.4	60.1
3800		83.9	79.0	73.9	68.8	64.0
4000			83.3	78.4	73.2	68.1
4200			87.4	82.7	77.5	72.2
4400				86.9	81.8	76.2
4600					86.0	80.3
4800						84.3

Landing Field Limit Weight - Wet Runway

Based on anti-skid operative and automatic speedbrakes

Flaps 40

Wind Corrected Field Length (M)

FIELD LENGTH AVAILABLE (M)	WIND COMPONENT (KTS)							
	-15	-10	-5	0	10	20	30	40
1000				1000	1080	1150	1230	1300
1200		980	1090	1200	1280	1360	1440	1520
1400	1030	1160	1280	1400	1480	1570	1650	1740
1600	1200	1340	1470	1600	1690	1780	1860	1950
1800	1370	1510	1660	1800	1890	1980	2080	2170
2000	1540	1690	1840	2000	2100	2190	2290	2380
2200	1710	1870	2030	2200	2300	2400	2500	2600
2400	1880	2050	2220	2400	2500	2610	2710	2820
2600	2050	2230	2410	2600	2710	2820	2920	3030
2800	2220	2410	2600	2800	2910	3020	3140	3250
3000	2360	2550	2740	3000	3120	3230	3350	3460
3200	2470	2650	2840	3200	3320	3440	3560	3680
3400	2580	2750	2940	3400	3520	3650	3770	3900
3600	2680	2850	3040	3600	3730	3860		
3800	2790	2950	3140	3800				
4000	2900	3050	3240					
4200	3000	3150	3340					
4400	3110	3250	3440					
4600	3220	3350	3540					
4800	3320	3450	3640					

Field Limit Weight (1000 KG)

WIND CORR'D FIELD LENGTH (M)	AIRPORT PRESSURE ALTITUDE (FT)					
	0	2000	4000	6000	8000	10000
1200	38.5					
1400	50.5	47.6	44.6	41.8	39.2	
1600	60.1	57.3	54.5	51.8	48.6	45.4
1800	69.2	65.7	62.4	59.4	56.4	53.6
2000	77.7	74.1	70.2	66.5	62.9	59.6
2200	83.5	80.9	77.3	73.2	69.2	65.4
2400		85.5	82.8	79.7	75.5	71.3
2600			87.2	84.3	81.4	77.2
2800					85.6	82.3
3000						84.8
3200						86.9

Decrease field limit weight by 5800 kg when using manual speedbrakes.

Landing Field Limit Weight - Wet Runway

Based on anti-skid inoperative and manual speedbrakes

Flaps 40

Wind Corrected Field Length (M)

FIELD LENGTH AVAILABLE (M)	WIND COMPONENT (KTS)							
	-15	-10	-5	0	10	20	30	40
1600					1760	1930	2090	2250
1800				1800	1970	2140	2300	2470
2000			1720	2000	2170	2350	2520	2690
2200		1630	1920	2200	2380	2560	2730	2910
2400		1820	2110	2400	2580	2770	2950	3130
2600	1700	2000	2300	2600	2790	2980	3160	3350
2800	1880	2190	2490	2800	2990	3190	3380	3570
3000	2060	2370	2690	3000	3200	3400	3590	3790
3200	2240	2560	2880	3200	3400	3610	3810	4010
3400	2410	2740	3070	3400	3610	3820	4020	4230
3600	2590	2930	3260	3600	3810	4030	4240	4450
3800	2770	3110	3460	3800	4020	4240	4450	4670
4000	2950	3300	3650	4000	4220	4450	4670	4890
4200	3120	3480	3840	4200	4430	4660	4880	5110
4400	3300	3670	4030	4400	4630	4870	5100	5330
4600	3480	3850	4230	4600	4840	5080	5310	5550
4800	3660	4040	4420	4800	5040	5290	5530	5770
5000	3830	4220	4610	5000	5250	5500	5740	5990
5200	4010	4410	4800	5200	5450	5710	5960	6210
5400	4190	4590	5000	5400	5660	5920	6170	6430

Field Limit Weight (1000 KG)

WIND CORR'D FIELD LENGTH (M)	AIRPORT PRESSURE ALTITUDE (FT)					
	0	2000	4000	6000	8000	10000
2400	41.2	38.4				
2600	46.3	43.2	39.7			
2800	51.5	48.1	44.3	41.3	38.4	
3000	56.6	52.9	48.9	45.6	42.4	39.4
3200	61.6	57.6	53.4	49.8	46.5	43.2
3400	66.8	62.4	57.8	54.0	50.4	46.9
3600	72.0	67.2	62.2	58.2	54.3	50.6
3800	76.8	72.1	66.7	62.3	58.2	54.2
4000	81.0	76.6	71.2	66.4	61.9	57.7
4200	85.0	80.6	75.4	70.4	65.6	61.1
4400		84.4	79.6	74.5	69.4	64.5
4600			83.3	78.4	73.2	68.1
4800			86.9	82.2	77.0	71.6
5000				85.8	80.7	75.2
5200					84.3	78.7
5400					88.0	82.2
5600						85.7

Landing Climb Limit Weight

Valid for approach with flaps 15 and landing with flaps 40

Based on engine bleed for packs on and anti-ice off

AIRPORT OAT		AIRPORT LANDING CLIMB LIMIT WEIGHT (1000 KG)						
		AIRPORT PRESSURE ALTITUDE (FT)						
°C	°F	-2000	0	2000	4000	6000	8000	10000
54	129	67.5	63.6					
52	126	68.8	65.3					
50	122	70.0	66.9	61.8				
48	118	71.3	68.2	63.4				
46	115	72.7	69.5	64.9	59.8			
44	111	74.0	70.7	66.1	61.3			
42	108	75.3	72.0	67.3	62.7	57.6		
40	104	76.7	73.3	68.5	63.9	58.9		
38	100	78.0	74.6	69.7	65.0	60.2	54.9	
36	97	79.3	75.9	70.9	66.2	61.3	55.8	
34	93	80.2	77.2	72.2	67.4	62.4	56.8	52.2
32	90	80.6	78.7	73.5	68.4	63.3	57.8	53.2
30	86	80.7	79.7	74.5	69.3	64.3	58.8	54.2
28	82	80.8	80.1	75.5	70.1	65.0	59.7	55.1
26	79	80.9	80.2	76.2	70.8	65.6	60.6	55.9
24	75	81.0	80.3	76.4	71.3	66.1	61.2	56.5
22	72	81.0	80.3	76.5	71.7	66.6	61.7	57.0
20	68	81.1	80.4	76.5	71.9	67.1	62.2	57.5
18	64	81.2	80.5	76.6	71.9	67.4	62.5	57.8
16	61	81.2	80.5	76.6	72.0	67.5	62.9	58.2
14	57	81.3	80.6	76.6	72.0	67.5	63.2	58.5
12	54	81.4	80.6	76.7	72.0	67.6	63.3	58.9
10	50	81.5	80.7	76.7	72.1	67.6	63.3	59.2
-40	-40	82.1	81.3	77.2	72.6	68.0	63.7	59.8

With engine bleed for packs off, increase weight by 1250 kg.
With engine anti-ice on, decrease weight by 250 kg.
With engine and wing anti-ice on, decrease weight by 1400 kg.
When operating in icing conditions during any part of the flight with forecast landing temperature below 10°C, decrease weight by 7300 kg.

ENGINE INOP

ADVISORY INFORMATION

Go-Around Climb Gradient

Flaps 15

Based on engine bleed for packs on and anti-ice off

OAT (°C)	REFERENCE GO-AROUND GRADIENT (%) PRESSURE ALTITUDE (FT)					
	0	2000	4000	6000	8000	10000
54	2.85					
50	3.53	2.47				
46	4.03	3.12	2.08			
42	4.55	3.59	2.67	1.62		
38	5.07	4.07	3.12	2.15	1.07	
34	5.59	4.57	3.59	2.59	1.45	0.54
30	6.14	5.04	3.98	2.96	1.87	0.96
26	6.18	5.40	4.27	3.24	2.21	1.29
22	6.20	5.42	4.49	3.43	2.45	1.52
18	6.23	5.44	4.50	3.60	2.61	1.68
14	6.25	5.45	4.52	3.62	2.76	1.82
10	6.27	5.47	4.53	3.63	2.77	1.96
6	6.29	5.48	4.54	3.64	2.78	1.97
2	6.31	5.50	4.55	3.65	2.79	1.98

Gradient Adjustment for Weight (%)

WEIGHT (1000 KG)	REFERENCE GO-AROUND GRADIENT (%)							
	0	1	2	3	4	5	6	7
80	-2.35	-2.64	-2.93	-3.21	-3.49	-3.75	-4.01	-4.26
75	-1.89	-2.13	-2.37	-2.60	-2.82	-3.04	-3.24	-3.43
70	-1.36	-1.53	-1.70	-1.87	-2.03	-2.19	-2.33	-2.47
65	-0.74	-0.84	-0.93	-1.02	-1.11	-1.19	-1.27	-1.34
60	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
55	0.85	0.96	1.06	1.17	1.28	1.39	1.50	1.61
50	1.87	2.12	2.36	2.60	2.83	3.08	3.32	3.58

Gradient Adjustment for Speed (%)

SPEED (KIAS)	WEIGHT ADJUSTED GO-AROUND GRADIENT (%)										
	0	1	2	3	4	5	6	7	8	9	10
VREF40	-0.17	-0.17	-0.18	-0.18	-0.18	-0.18	-0.18	-0.18	-0.17	-0.17	-0.17
VREF40+5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
VREF40+10	0.11	0.10	0.10	0.10	0.10	0.11	0.12	0.13	0.15	0.17	0.20
VREF40+15	0.20	0.19	0.17	0.17	0.17	0.18	0.19	0.21	0.24	0.27	0.31
VREF40+20	0.27	0.24	0.22	0.21	0.20	0.20	0.21	0.23	0.25	0.28	0.32
VREF40+25	0.31	0.27	0.24	0.22	0.20	0.19	0.19	0.19	0.20	0.21	0.24
VREF40+30	0.33	0.28	0.23	0.20	0.16	0.13	0.11	0.09	0.08	0.07	0.06

With engine bleed for packs off, increase gradient by 0.4%.
With engine anti-ice on, decrease gradient by 0.1%.
With engine and wing anti-ice on, decrease gradient by 0.3%.
With operating in icing conditions during any part of the flight with forecast landing temperature below 10°C, decrease gradient by 1.2%.

Quick Turnaround Limit Weight - Category H Steel Brakes

Flaps 40

		QUICK TURNAROUND LIMIT WEIGHT (1000 KG)						
OAT		AIRPORT PRESSURE ALTITUDE (FT)						
°C	°F	-2000	0	2000	4000	6000	8000	10000
54	129	84.0	81.2	78.5				
50	122	84.5	81.7	79.0	76.0	72.9		
45	113	85.1	82.4	79.6	76.6	73.5	70.5	
40	104	85.9	83.0	80.2	77.3	74.2	71.1	
35	95	86.1	83.7	80.8	77.9	74.8	71.7	
30	86	86.1	84.3	81.4	78.5	75.4	72.3	69.2
25	77	86.1	85.0	82.1	79.2	76.0	72.9	69.8
20	68	86.1	85.8	82.8	79.8	76.7	73.5	70.4
15	59	86.1	86.1	83.5	80.5	77.4	74.2	71.1
10	50	86.1	86.1	84.2	81.1	78.1	74.9	71.7
5	41	86.1	86.1	84.9	81.9	78.8	75.6	72.4
0	32	86.1	86.1	85.6	82.6	79.5	76.3	73.0
-5	23	86.1	86.1	86.1	83.3	80.2	77.0	73.7
-10	14	86.1	86.1	86.1	84.1	80.9	77.7	74.4
-15	5	86.1	86.1	86.1	84.8	81.7	78.5	75.2
-20	-4	86.1	86.1	86.1	85.7	82.5	79.3	75.9
-30	-22	86.1	86.1	86.1	86.1	84.2	80.9	77.5
-40	-40	86.1	86.1	86.1	86.1	86.0	82.7	79.2
-50	-58	86.1	86.1	86.1	86.1	86.1	84.6	80.9
-54	-65	86.1	86.1	86.1	86.1	86.1	85.4	81.7

Increase weight by 750 kg per 1% uphill slope. Decrease weight by 1200 kg per 1% downhill slope. Increase weight by 1850 kg per 10 knots headwind. Decrease weight by 7750 kg per 10 knots tailwind. After landing at weights exceeding those shown above, adjusted for slope and wind, wait at least 67 minutes and check that wheel thermal plugs have not melted before executing a subsequent takeoff.

As an alternate procedure, ensure that each brake pressure plate temperature, without artificial cooling, is less than 218°C as follows:
No sooner than 10 and no later than 15 minutes after parking, measure each brake pressure plate surface temperature at a minimum of two points per brake by an accurate method (using a Doric Microtemp 450 hand held thermometer or equivalent, hold temperature probe in place for 20 seconds or until reading stabilizes). If each measured temperature is less than 218°C, immediate dispatch is allowed; otherwise the required minimum ground wait period of 67 minutes applies.

If a Brake Temperature Monitoring System (BTMS) is installed:

No sooner than 10 and no later than 15 minutes after parking, check the BRAKE TEMP light. If the BRAKE TEMP light is not on, no ground waiting period is required. If the BRAKE TEMP light is on, do not dispatch until at least 67 minutes after landing, or until all the BTMS readings on the systems Display are below 3.5 and the BRAKE TEMP light is off. Check that wheel thermal plugs have not melted before making a subsequent takeoff.
Note: If any brake temperature display digit is blank or indicates 0.0 or 0.1, then this method cannot be used.

Quick Turnaround Limit Weight - Category P Carbon Brakes

Flaps 40

OAT		LIMIT WEIGHT (1000 KG)					
		AIRPORT PRESSURE ALTITUDE (FT)					
°C	°F	0	2000	4000	6000	8000	10000
54	129	75.7					
50	122	76.1	73.4				
45	113	76.7	73.9	71.0			
40	104	77.3	74.5	71.6	68.7		
35	95	77.9	75.1	72.2	69.2	66.4	
30	86	78.5	75.8	72.8	69.8	66.9	64.1
25	77	79.2	76.4	73.4	70.4	67.5	64.6
20	68	79.8	77.0	74.0	71.0	68.1	65.2
15	59	80.4	77.7	74.7	71.7	68.7	65.8
10	50	81.1	78.3	75.3	72.3	69.3	66.4
5	41	81.8	79.0	76.0	73.0	70.0	67.0
0	32	82.5	79.7	76.7	73.6	70.6	67.6
-5	23	83.2	80.4	77.4	74.3	71.3	68.3
-10	14	83.9	81.1	78.2	75.1	72.0	68.9
-15	5	84.7	81.8	78.9	75.8	72.7	69.6
-20	-4	85.5	82.6	79.7	76.5	73.4	70.3
-30	-22	86.1	84.1	81.2	78.1	74.9	71.8
-40	-40	86.1	85.9	82.9	79.8	76.6	73.3
-50	-58	86.1	86.1	84.6	81.5	78.3	75.0
-54	-65	86.1	86.1	85.3	82.2	79.0	75.7

Increase weight by 650 kg per 1% uphill slope. Decrease weight by 1200 kg per 1% downhill slope. Increase weight by 1700 kg per 10 knots headwind. Decrease weight by 8350 kg per 10 knots tailwind. After landing at weights exceeding those shown above, adjusted for slope and wind, wait at least 48 minutes and check that wheel thermal plugs have not melted before executing a takeoff.

If a Brake Temperature Monitoring System (BTMS) is installed:

No sooner than 10 and no later than 15 minutes after parking, check the BRAKE TEMP light. If the BRAKE TEMP light is not on, no ground waiting period is required. If the BRAKE TEMP light is on, do not dispatch until at least 48 minutes after landing, or until all the BTMS readings on the systems Display are below 3.0 and the BRAKE TEMP light is off. Check that wheel thermal plugs have not melted before making a subsequent takeoff.
Note: If any brake temperature display digit is blank or indicates 0.0 or 0.1, then this method cannot be used.

Performance Dispatch
Chapter PD
Gear Down
Section 73

GEAR DOWN

Takeoff Climb Limit Weight
Flaps 5
Based on engine bleed for packs on and anti-ice off

AIRPORT OAT		TAKEOFF CLIMB WEIGHT (1000 KG)					
		AIRPORT PRESSURE ALTITUDE (FT)					
°C	°F	0	2000	4000	6000	8000	10000
54	129	62.3	58.4	54.7	50.8	46.3	
52	126	63.4	58.8	55.5	51.7	47.1	
50	122	64.6	59.1	55.5	52.1	47.9	43.4
48	118	65.8	60.5	55.4	52.1	48.5	44.3
46	115	67.0	61.8	55.8	52.1	48.5	45.1
44	111	68.1	63.2	57.1	52.0	48.5	45.6
42	108	69.3	64.5	58.4	52.4	48.5	45.6
40	104	70.6	65.8	59.7	53.7	48.4	45.5
38	100	71.8	67.1	61.0	54.9	48.8	45.5
36	97	73.0	68.2	62.2	56.2	50.1	45.5
34	93	74.3	69.5	63.4	57.4	51.3	45.9
32	90	75.6	70.7	64.6	58.6	52.5	47.1
30	86	76.9	71.7	65.9	59.8	53.7	48.3
28	82	77.0	72.6	67.2	61.1	54.9	49.5
26	79	77.0	73.4	68.1	62.3	56.1	50.7
24	75	77.1	73.5	68.6	63.5	57.4	52.0
22	72	77.2	73.5	69.1	64.0	58.6	53.2
20	68	77.2	73.6	69.1	64.5	59.7	54.4
18	64	77.3	73.6	69.2	64.9	60.1	55.5
16	61	77.3	73.7	69.2	64.9	60.5	55.9
14	57	77.4	73.7	69.2	64.9	60.8	56.2
12	54	77.4	73.7	69.3	64.9	60.8	56.6
10	50	77.5	73.8	69.3	65.0	60.8	56.9
-40	-40	78.0	74.2	69.8	65.4	61.2	57.4

With engine bleeds for packs off, increase weight by 300 kg.
With engine anti-ice on, decrease weight by 250 kg.
With engine and wing anti-ice on, decrease weight by 3550 kg (optional system).

GEAR DOWN

Landing Climb Limit Weight

Valid for approach with Flaps 15 and landing with Flaps 40

Based on engine bleed for packs on and anti-ice off

AIRPORT OAT		LANDING CLIMB LIMIT WEIGHT (1000 KG)					
		AIRPORT PRESSURE ALTITUDE (FT)					
°C	°F	0	2000	4000	6000	8000	10000
54	129	57.9					
52	126	59.4					
50	122	60.9	56.1				
48	118	62.0	57.6				
46	115	63.1	59.0	54.4			
44	111	64.2	60.1	55.7			
42	108	65.4	61.1	57.0	52.3		
40	104	66.5	62.2	58.0	53.5		
38	100	67.7	63.3	59.0	54.7	49.8	
36	97	68.9	64.3	60.1	55.7	50.6	
34	93	70.1	65.5	61.2	56.6	51.5	47.3
32	90	71.4	66.7	62.1	57.5	52.5	48.3
30	86	72.6	67.6	62.9	58.3	53.4	49.2
28	82	72.6	68.5	63.6	59.1	54.2	50.0
26	79	72.7	69.3	64.1	59.5	54.9	50.7
24	75	72.8	69.3	64.6	59.9	55.6	51.2
22	72	72.8	69.3	65.1	60.4	56.0	51.7
20	68	72.9	69.4	65.2	60.8	56.3	52.1
18	64	72.9	69.4	65.2	61.1	56.7	52.4
16	61	73.0	69.5	65.2	61.2	57.0	52.7
14	57	73.0	69.5	65.3	61.2	57.3	53.0
12	54	73.1	69.5	65.3	61.2	57.3	53.4
10	50	73.1	69.6	65.3	61.2	57.4	53.7
-40	-40	73.6	70.1	65.8	61.6	57.7	54.2

With engine bleed for packs off, increase weight by 1200 kg.
With engine anti-ice on, decrease weight by 200 kg.
With engine and wing anti-ice on, decrease weight by 1250 kg.
When operating in icing conditions during any part of the flight with forecast landing temperature below 10°C, decrease weight by 7650 kg.

GEAR DOWN

Takeoff Obstacle Limit Weight

Flaps 5

Sea Level, 30°C & Below, Zero Wind

Based on engine bleed for packs on and anti-ice off

Reference Obstacle Limit Weight (1000 KG)

OBSTACLE HEIGHT (M)	REFERENCE OBSTACLE LIMIT WEIGHT (1000 KG) DISTANCE FROM BRAKE RELEASE (100 M)										
	25	30	35	40	45	50	55	60	65	70	
5	71.8	77.2									
20	65.9	70.9	74.7	77.4							
40	60.7	65.5	69.3	72.3	74.6	76.4	77.8	78.8	79.8		
60	56.9	61.5	65.2	68.3	70.8	72.8	74.5	75.8	77.0	77.9	78.7
80	53.8	58.3	62.0	65.1	67.6	69.8	71.6	73.1	74.4	75.5	76.4
100	51.1	55.6	59.3	62.3	64.9	67.2	69.1	70.7	72.1	73.3	74.3
120	48.7	53.2	56.8	59.9	62.6	64.8	66.8	68.5	69.9	71.2	72.4
140	46.6	51.0	54.7	57.8	60.4	62.7	64.7	66.5	68.0	69.3	70.5
160	44.7	49.1	52.7	55.9	58.5	60.8	62.8	64.6	66.2	67.6	68.8
180	43.0	47.3	51.0	54.1	56.7	59.1	61.1	62.9	64.5	66.0	67.3
200		45.7	49.3	52.4	55.1	57.5	59.5	61.4	63.0	64.4	65.8
220		44.2	47.8	50.9	53.6	56.0	58.0	59.9	61.5	63.0	64.4
240		42.8	46.4	49.5	52.2	54.5	56.6	58.5	60.2	61.7	63.0
260			45.1	48.1	50.8	53.2	55.3	57.2	58.9	60.4	61.8
280			43.8	46.9	49.6	51.9	54.1	56.0	57.7	59.2	60.6
300			42.7	45.7	48.4	50.8	52.9	54.8	56.5	58.1	59.5

Obstacle height must be calculated from lowest point of the runway to conservatively account for runway slope.

OAT Adjustments

OAT (°C)	REFERENCE OBSTACLE LIMIT WEIGHT (1000 KG)								
	40	45	50	55	60	65	70	75	80
30 & BELOW	0	0	0	0	0	0	0	0	0
32	-0.6	-0.7	-0.8	-0.9	-1.0	-1.0	-1.1	-1.2	-1.3
34	-1.2	-1.4	-1.6	-1.7	-1.9	-2.1	-2.3	-2.4	-2.6
36	-1.8	-2.1	-2.4	-2.6	-2.9	-3.1	-3.4	-3.7	-3.9
38	-2.4	-2.8	-3.1	-3.5	-3.8	-4.2	-4.5	-4.9	-5.3
40	-3.0	-3.5	-3.9	-4.4	-4.8	-5.2	-5.7	-6.1	-6.6
42	-3.5	-4.0	-4.6	-5.1	-5.6	-6.2	-6.7	-7.2	-7.8
44	-4.0	-4.6	-5.2	-5.9	-6.5	-7.1	-7.7	-8.3	-8.9
46	-4.5	-5.2	-5.9	-6.6	-7.3	-8.0	-8.7	-9.4	-10.1
48	-5.0	-5.8	-6.5	-7.3	-8.1	-8.9	-9.7	-10.5	-11.3
50	-5.4	-6.3	-7.2	-8.1	-9.0	-9.9	-10.7	-11.6	-12.5

GEAR DOWN

Takeoff Obstacle Limit Weight

Flaps 5

Pressure Altitude Adjustments

ALT (FT)	OAT ADJUSTED OBSTACLE LIMIT WEIGHT (1000 KG)								
	40	45	50	55	60	65	70	75	80
S.L. & BELOW	0	0	0	0	0	0	0	0	0
1000	-1.2	-1.4	-1.6	-1.8	-2.0	-2.2	-2.4	-2.6	-2.8
2000	-2.5	-2.9	-3.2	-3.6	-4.0	-4.4	-4.8	-5.1	-5.5
3000	-3.9	-4.4	-5.0	-5.5	-6.0	-6.5	-7.0	-7.6	-8.1
4000	-5.3	-6.0	-6.7	-7.3	-8.0	-8.7	-9.3	-10.0	-10.7
5000	-6.7	-7.5	-8.3	-9.2	-10.0	-10.8	-11.7	-12.5	-13.3
6000	-8.0	-9.0	-10.0	-11.0	-12.0	-13.0	-14.0	-15.0	-16.0
7000	-9.2	-10.4	-11.6	-12.8	-14.0	-15.1	-16.3	-17.5	-18.7
8000	-10.5	-11.8	-13.2	-14.5	-15.9	-17.3	-18.6	-20.0	-21.4
9000	-11.5	-13.0	-14.5	-16.0	-17.5	-19.1	-20.6	-22.1	-23.6
10000	-12.5	-14.2	-15.8	-17.5	-19.2	-20.8	-22.5	-24.2	-25.8

Wind Adjustments

WIND (KTS)	OAT & ALT ADJUSTED OBSTACLE LIMIT WEIGHT (1000 KG)								
	40	45	50	55	60	65	70	75	80
15 TW	-9.4	-9.1	-8.9	-8.6	-8.4	-8.2	-7.9	-7.7	-7.5
10 TW	-6.2	-6.1	-5.9	-5.8	-5.6	-5.4	-5.3	-5.1	-5.0
5 TW	-3.1	-3.0	-3.0	-2.9	-2.8	-2.7	-2.6	-2.6	-2.5
0	0	0	0	0	0	0	0	0	0
10 HW	1.2	1.1	1.0	0.9	0.8	0.7	0.6	0.5	0.4
20 HW	2.3	2.1	2.0	1.8	1.6	1.4	1.2	1.1	0.9
30 HW	3.5	3.2	2.9	2.7	2.4	2.1	1.9	1.6	1.3
40 HW	4.6	4.3	3.9	3.6	3.2	2.9	2.5	2.2	1.8

With engine bleed for packs off, increase weight by 250 kg.
With engine anti-ice on, decrease weight by 550 kg.
With engine and wing anti-ice on, decrease weight by 5950 kg (optional system).

GEAR DOWN

Long Range Cruise Altitude Capability

Max Cruise Thrust, 100 ft/min residual rate of climb

WEIGHT (1000 KG)	PRESSURE ALTITUDE (FT)		
	ISA + 10°C & BELOW	ISA + 15°C	ISA + 20°C
85	15100	12000	8900
80	17900	15100	12100
75	20800	18000	15300
70	23300	20900	18200
65	25800	24000	21300
60	28300	26800	24900
55	30600	29400	27800
50	32700	31700	30400
45	34900	33900	32700
40	37300	36300	35200

GEAR DOWN

Long Range Cruise Trip Fuel and Time

Ground to Air Miles Conversion

AIR DISTANCE (NM)					GROUND DISTANCE (NM)	AIR DISTANCE (NM)				
HEADWIND COMPONENT (KTS)						TAILWIND COMPONENT(KTS)				
100	80	60	40	20		20	40	60	80	100
323	288	259	236	217	200	187	175	165	156	148
483	432	389	354	325	300	280	263	247	234	222
642	575	518	471	433	400	374	351	330	312	296
800	718	646	589	542	500	468	438	412	390	370
957	859	774	706	650	600	561	526	495	468	444
1113	1000	902	823	758	700	655	615	578	546	519
1268	1140	1029	940	865	800	749	703	661	625	593
1422	1280	1156	1056	973	900	843	791	745	704	668
1576	1419	1283	1173	1081	1000	937	879	828	783	743
1729	1558	1410	1289	1189	1100	1031	968	911	862	818
1881	1697	1536	1405	1296	1200	1125	1056	995	941	894
2033	1835	1662	1521	1404	1300	1218	1145	1079	1020	969
2184	1972	1788	1637	1511	1400	1313	1233	1162	1100	1045
2334	2109	1913	1753	1619	1500	1407	1322	1246	1179	1121
2483	2245	2038	1868	1726	1600	1501	1411	1330	1259	1197
2632	2381	2163	1984	1833	1700	1595	1500	1414	1339	1273
2780	2517	2287	2099	1940	1800	1689	1589	1499	1419	1349
2927	2652	2411	2214	2047	1900	1784	1678	1583	1499	1426
3074	2786	2535	2328	2154	2000	1878	1767	1668	1579	1502

Reference Fuel and Time Required

AIR DIST (NM)	PRESSURE ALTITUDE (1000 FT)							
	10		14		20		24	
	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)
200	2.9	0:50	2.7	0:49	2.6	0:47	2.6	0:46
300	4.2	1:12	4.0	1:10	3.8	1:06	3.7	1:04
400	5.6	1:35	5.3	1:31	4.9	1:25	4.7	1:23
500	7.0	1:57	6.6	1:52	6.1	1:45	5.8	1:41
600	8.4	2:18	7.9	2:12	7.3	2:04	7.0	1:59
700	9.9	2:40	9.3	2:32	8.5	2:22	8.1	2:17
800	11.3	3:01	10.6	2:53	9.7	2:41	9.3	2:35
900	12.7	3:23	12.0	3:13	10.9	3:00	10.4	2:53
1000	14.2	3:44	13.3	3:33	12.2	3:18	11.6	3:11
1100	15.7	4:05	14.7	3:53	13.4	3:36		
1200	17.2	4:25	16.2	4:12	14.7	3:55		
1300	18.7	4:45	17.6	4:32	16.0	4:13		
1400	20.2	5:06	19.0	4:51	17.3	4:31		
1500	21.7	5:26	20.4	5:11	18.6	4:49		
1600	23.3	5:46	21.9	5:29				
1700	24.9	6:06	23.4	5:48				
1800	26.5	6:25	24.9	6:07				
1900	28.1	6:45	26.4	6:25				
2000	29.8	7:04	27.9	6:44				

GEAR DOWN

Long Range Cruise Trip Fuel and Time

Fuel Required Adjustments (1000 KG)

REFERENCE FUEL REQUIRED (1000 KG)	LANDING WEIGHT (1000 KG)				
	40	50	60	70	80
2	-0.4	-0.2	0.0	0.2	0.4
4	-0.7	-0.4	0.0	0.4	0.8
6	-1.1	-0.5	0.0	0.6	1.2
8	-1.4	-0.7	0.0	0.8	1.5
10	-1.7	-0.9	0.0	0.9	1.9
12	-2.1	-1.0	0.0	1.1	2.3
14	-2.4	-1.2	0.0	1.3	2.6
16	-2.7	-1.4	0.0	1.5	3.0
18	-3.1	-1.5	0.0	1.7	3.3
20	-3.4	-1.7	0.0	1.8	3.7
22	-3.8	-1.9	0.0	2.0	4.1
24	-4.1	-2.0	0.0	2.2	4.4
26	-4.4	-2.2	0.0	2.4	4.8
28	-4.8	-2.4	0.0	2.6	5.2
30	-5.1	-2.6	0.0	2.7	5.5

Based on VREF40 + 70 climb, Long Range Cruise and VREF40 + 70 descent.

GEAR DOWN

Holding Planning

Flaps Up

WEIGHT (1000 KG)	TOTAL FUEL FLOW (KG/HR)							
	PRESSURE ALTITUDE (FT)							
	1500	5000	10000	15000	20000	25000	30000	35000
90	4780	4760	4760	4810				
85	4520	4490	4480	4510				
80	4260	4230	4210	4230	4250			
75	4010	3980	3950	3950	3960			
70	3770	3730	3690	3680	3680	3760		
65	3530	3480	3450	3420	3410	3440		
60	3300	3240	3200	3170	3140	3160	3340	
55	3060	3010	2960	2920	2880	2890	2970	
50	2830	2780	2730	2690	2640	2630	2680	
45	2600	2560	2500	2460	2400	2380	2410	2510
40	2380	2340	2300	2240	2190	2140	2170	2200

This table includes 5% additional fuel for holding in a racetrack pattern.

GEAR DOWN

ENGINE INOP

MAX CONTINUOUS THRUST

Net Level Off Weight

PRESSURE ALTITUDE (1000 FT)	LEVEL OFF WEIGHT (1000 KG)		
	ISA + 10°C & BELOW	ISA + 15°C	ISA + 20°C
22	42.5	41.3	
20	45.9	44.6	43.3
18	49.6	48.0	46.2
16	53.2	51.3	49.4
14	56.2	54.8	53.0
12	60.0	58.0	55.8
10	63.5	61.4	58.6
8	67.4	64.9	61.9
6	71.1	68.4	65.2
4	74.9	71.8	68.3
2	78.4	75.0	71.6
0	81.7	78.2	74.8

Anti-Ice Adjustments

ANTI-ICE CONFIGURATION	LEVEL OFF WEIGHT ADJUSTMENT (1000 KG)										
	PRESSURE ALTITUDE (1000 FT)										
	0	2	4	6	8	10	12	14	16	18	20
ENGINE ONLY	-1.3	-1.3	-1.3	-1.3	-1.4	-1.3	-1.5	-1.4	-1.3	-1.2	-1.0
ENGINE AND WING	-6.3	-6.3	-6.2	-5.9	-5.8	-5.4	-5.3	-5.2	-5.0	-4.5	

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Performance Dispatch — Chapter PD
Text — Section 74

Introduction

This chapter contains self dispatch performance data intended primarily for use by flight crews in the event that information cannot be obtained from the airline dispatch office. The takeoff data provided is for a single takeoff flap at max takeoff thrust. The range of conditions covered is limited to those normally encountered in airline operation. In the event of conflict between the data presented in this chapter and that contained in the approved Airplane Flight Manual, the Flight Manual shall always take precedence.

Takeoff

The maximum allowable takeoff weight will be the least of the Field, Climb, Obstacle, Brake Energy and Tire Speed Limit Weights as determined from the tables shown.

Brake Energy or Tire Speed Limit Weight tables are only provided if they are limiting for the range of conditions covered in the FCOM Section PD.

Field Limit Weight - Slope and Wind Corrections

These tables for dry and wet runways provide corrections to the field length available for the effects of runway slope and wind component along the runway. Enter the appropriate table with the available field length and runway slope to determine the slope corrected field length. Next enter the appropriate table with slope corrected field length and wind component to determine the slope and wind corrected field length.

Field and Climb Limit Weight

Tables are presented for selected airport pressure altitudes and runway conditions and show both Field and Climb Limit Weights. Enter the appropriate table for pressure altitude and runway condition with “Slope and Wind Corrected Field Length” determined above and airport OAT to obtain Field Limit Weight. Also read Climb Limit Weight for the same OAT. Intermediate altitudes may be interpolated or use next higher altitude. When finding a maximum weight for a wet runway, the dry runway limit weight must also be determined and the lower of the two weights used.

Obstacle Limit Weight

The Reference Obstacle Limit Weight table provides obstacle limit weights for reference airport conditions based on obstacle height above the runway surface and distance from brake release. Enter the adjustment tables to adjust the reference Obstacle Limit Weight for the effects of OAT, pressure altitude and wind as indicated. In the case of multiple obstacles, enter the tables successively with each obstacle and determine the most limiting weight.

Tire Speed Limit

Tire Speed Limit Weight tables are only provided if they are limiting for the range of conditions covered in the FCOM Section PD.

Maximum tire speed limited weights are presented for 225 MPH tires. To determine the tire speed limit weight, enter the table with OAT and airport pressure altitude. Adjust the tire speed limit weight according to the notes below the table to account for wind.

Brake Energy Limit VMBE

Brake Energy Limit Weight tables are only provided if they are limiting for the range of conditions covered in the FCOM Section PD.

The Maximum Brake Energy Speed table provides the Reference VMBE for a variety of airport pressure altitudes and temperatures. Enter the Weight Adjusted VMBE table to adjust the Reference VMBE for the actual brake release gross weight. Correct VMBE for slope and wind. If V1 exceeds VMBE, decrease brake release weight as indicated for each knot that V1 exceeds VMBE and determine V1, VR, and V2 for the lower brake release weight.

Enroute

Long Range Cruise Maximum Operating Altitude

These tables provide the maximum operating altitude in the same manner as the FMC. Maximum altitudes are shown for a given cruise weight and maneuver capability. Note that this table considers both thrust and buffet limits, providing the more limiting of the two. Any data that is thrust limited is denoted by an asterisk and represents only a thrust limited condition in level flight with 100 ft/min residual rate of climb. Flying above these altitudes with sustained banks in excess of approximately 15° may cause the airplane to lose speed and/or altitude. The altitudes shown in the table are limited to the maximum certified altitude of 41000 ft.

Long Range Cruise Trip Fuel and Time

Long Range Cruise Trip Fuel and Time tables are provided to determine trip time and fuel required to destination.

To determine trip fuel and time for a constant altitude cruise, first enter the Ground to Air Miles Conversion table to convert ground distance and enroute wind to an equivalent still air distance for use with the Reference Fuel and Time tables. Next, enter the Reference Fuel and Time table with air distance from the Ground to Air Miles Conversion table and the desired altitude and read Reference Fuel and Time Required. Lastly, enter the Fuel Required Adjustment table with the Reference Fuel and the planned landing weight to obtain the adjustment to the fuel required at the planned landing weight.

Long Range Cruise Step Climb Trip Fuel and Time

The Long Range Cruise Step Climb Trip Fuel and Time tables are provided to determine trip time and fuel required to destination when flying a step climb profile. Step climb profiles are based on 4000 ft step climbs to keep the flight within 2000 ft of the optimum altitude for the current cruise weight. To determine trip fuel and time, enter the Ground to Air Miles Conversion table and determine air distance as discussed above. Then enter the Trip Fuel and Time Required table with air distance and planned landing weight to read trip fuel. Continue across the table to read trip time.

Short Trip Fuel and Time

These tables are provided to determine trip fuel and time for short distances or alternates. Obtain air distance from the table using the ground distance and wind component to the alternate. Enter the Trip Fuel and Time Required table with air distance and read trip fuel required for the expected landing weight, together with time to alternate at right. For distances greater than shown or other altitudes, use the Long Range Cruise Trip Fuel and Time tables.

Holding Planning

This table provides total fuel flow information necessary for planning flaps up holding and reserve fuel requirements. Data is based on the FMC holding speed schedule which is the higher of the maximum endurance and flaps up maneuver speeds. As noted, the fuel flow is based on flight in a racetrack holding pattern. For holding in straight and level flight, reduce table values by 5%.

Flight Crew Oxygen Requirements

This airplane is equipped with a chemical passenger oxygen system. Regulations require that sufficient oxygen be provided to the flight crew to account for the greater of supplemental breathing oxygen in the event of a cabin depressurization or protective breathing in the event of smoke or harmful fumes in the flight deck. The oxygen quantity associated with the above requirements is achieved with the minimum dispatch oxygen cylinder pressure.

To determine the minimum dispatch oxygen cylinder pressure enter the appropriate flight crew oxygen table with the number of crew plus observers using oxygen and read the minimum cylinder pressure required for the appropriate cylinder temperature.

Net Level Off Weight

The Net Level Off Weight table is provided to determine terrain clearance capability in straight and level flight following an engine failure. Regulations require terrain clearance planning based on net performance which is the gross (or actual) gradient performance degraded by 1.1%. In addition, the net level off pressure altitude must clear the terrain by 1000 ft.

To determine the maximum weight for terrain clearance, enter the table with required net level off pressure altitude and expected ISA deviation to obtain weight. Adjust weight for anti-ice operation as noted below the table.

Landing

Tables are provided for determining the maximum landing weight as limited by field length or climb requirements for a single landing flap.

Maximum landing weight is the lowest of the field length limit weight, climb limit weight, or maximum certified landing weight.

Landing Field Limit Weight

For the expected runway condition and anti-skid system configuration, obtain wind corrected field length by entering the Wind Corrected Field Length table with field length available and wind component along the runway. Now enter the Field Limit Weight table with wind corrected field length and pressure altitude to read field limit weight.

Landing Climb Limit Weight

Enter the table with airport OAT and pressure altitude to read landing climb limit weight. Apply the noted adjustments as required.

Go-Around Climb Gradient

Enter the Reference Go-Around Gradient table with airport OAT and pressure altitude to determine the reference go-around gradient. Then adjust the reference gradient for airplane weight and speed using the tables provided to determine the weight and speed adjusted go-around gradient. Apply the necessary corrections for engine bleed configuration and icing conditions as noted.

Quick Turnaround Limit Weight

Enter the appropriate table (Steel or Carbon Brakes) with airport pressure altitude and OAT to read maximum quick turnaround weight. Apply the noted adjustments as required.

If the landing weight exceeds the maximum quick turnaround weight, wait the specified time and then check that the wheel thermal plugs have not melted before executing a subsequent takeoff. For Steel Brakes, the alternate procedures on the charts can be used to ensure the brake temperature is within limits. These procedures cannot be used for carbon brakes.

Gear Down

This section provides flight planning data for revenue operation with gear down. Unless otherwise noted, the gear down tables in this section are identical in format and usage to the corresponding gear up tables previously described.

To eliminate erroneous displays the flight crew should enter only gross weight data on the PERF INIT page of the Control Display Unit (CDU). Omission of the cost index and cruise altitude entries on the PERF INIT page will render the VNAV function unavailable during flight. As a result, the following information will not be provided: VNAV guidance and speed schedules, trip fuel and ETA predictions, optimum and maximum altitude data, step climb and top of descent predictions, and the VNAV descent guidance path.

The gross weight entry allows the FMCS takeoff and approach speed schedules to be generated. In addition, the flap maneuver speed and VREF speed bugs will be available for display on the primary flight display speed tape. Except for VNAV, normal autopilot and autothrottle modes will remain available for use during the flight, as will the LNAV mode.

Takeoff/Landing Climb Limit Weight

Enter the appropriate table with airport OAT and pressure altitude to determine Takeoff/Landing Climb Limit Weight with gear down. Correct the weight obtained for engine bleed configuration as required.

Performance Dispatch — Chapter PD
Table of Contents — Section 80

737-900ERW CFM56-7B27 C FT LB FAA CATH/P

Performance Dispatch — Chapter PD
Pkg Model Identification — Section 80

General

The table below shows the airplanes that have been identified with the following performance package. Note, some airplanes may be identified with more than one performance package. This configuration table information reflects the Boeing delivered configuration updated for service bulletin incorporations in conformance with the policy stated in the introduction section of the FCOM. The performance data is prepared for the owner/operator named on the title page. The intent of this information is to assist flight crews and airlines in knowing which performance package is applicable to a given airplane. The performance package model identification information is based on Boeing's knowledge of the airline's fleet at a point in time approximately three months prior to the page date. Notice of Errata (NOE) will not be provided to airlines to identify airplanes that are moved between performance packages within this manual or airplanes added to the airline's fleet whose performance packages are already represented in this manual. These types of changes will be updated in the next block revision. Owners/operators are responsible for ensuring the operational documentation they are using is complete and matches the current configuration of their airplanes, and the accuracy and validity of all information furnished by the owner/operator or any other party. Owners/operators receiving active revision service are responsible to ensure that any modifications to the listed airplanes are properly reflected in this manual.

Serial and tabulation number are supplied by Boeing.

Registry Number	Serial Number	Tabulation Number
YX910	YX910	YX910

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Performance Dispatch — Chapter PD
Takeoff — Section 80

Takeoff Field Corrections - Dry Runway
Slope Corrections

FIELD LENGTH AVAILABLE (FT)	SLOPE CORRECTED FIELD LENGTH (FT)								
	RUNWAY SLOPE (%)								
	-2.0	-1.5	-1.0	-0.5	0.0	0.5	1.0	1.5	2.0
4200	4290	4270	4250	4220	4200	4140	4080	4020	3960
4600	4730	4700	4670	4630	4600	4510	4430	4340	4260
5000	5170	5130	5090	5040	5000	4890	4780	4660	4550
5400	5610	5560	5510	5450	5400	5260	5120	4990	4850
5800	6050	5990	5930	5860	5800	5640	5470	5310	5150
6200	6490	6420	6350	6270	6200	6010	5820	5630	5440
6600	6930	6850	6770	6680	6600	6380	6170	5950	5740
7000	7370	7280	7190	7090	7000	6760	6520	6270	6030
7400	7810	7710	7610	7500	7400	7130	6860	6600	6330
7800	8250	8140	8030	7910	7800	7510	7210	6920	6630
8200	8690	8570	8450	8320	8200	7880	7560	7240	6920
8600	9130	9000	8870	8730	8600	8250	7910	7560	7220
9000	9570	9430	9290	9140	9000	8630	8260	7880	7510
9400	10010	9860	9710	9550	9400	9000	8600	8210	7810
9800	10450	10290	10130	9960	9800	9380	8950	8530	8110
10200	10890	10720	10550	10370	10200	9750	9300	8850	8400
10600	11330	11150	10970	10780	10600	10120	9650	9170	8700
11000	11770	11580	11390	11190	11000	10500	10000	9490	8990
11400	12210	12010	11810	11600	11400	10870	10340	9820	9290
11800	12650	12440	12230	12010	11800	11250	10690	10140	9590

Wind Corrections

SLOPE CORR'D FIELD LENGTH (FT)	SLOPE & WIND CORRECTED FIELD LENGTH (FT)							
	WIND COMPONENT (KTS)							
	-15	-10	-5	0	10	20	30	40
4200	3170	3510	3860	4200	4420	4640	4860	5080
4600	3500	3870	4230	4600	4830	5060	5300	5530
5000	3830	4220	4610	5000	5240	5490	5730	5970
5400	4170	4580	4990	5400	5650	5910	6160	6420
5800	4500	4930	5370	5800	6070	6330	6600	6860
6200	4830	5290	5740	6200	6480	6750	7030	7300
6600	5170	5640	6120	6600	6890	7170	7460	7750
7000	5500	6000	6500	7000	7300	7600	7900	8190
7400	5830	6360	6880	7400	7710	8020	8330	8640
7800	6170	6710	7260	7800	8120	8440	8760	9080
8200	6500	7070	7630	8200	8530	8860	9200	9530
8600	6830	7420	8010	8600	8940	9290	9630	9970
9000	7170	7780	8390	9000	9350	9710	10060	10420
9400	7500	8130	8770	9400	9770	10130	10500	10860
9800	7830	8490	9140	9800	10180	10550	10930	11300
10200	8160	8840	9520	10200	10590	10970	11360	11750
10600	8500	9200	9900	10600	11000	11400	11800	12190
11000	8830	9550	10280	11000	11410	11820	12230	12640
11400	9160	9910	10650	11400	11820	12240	12660	13080
11800	9500	10260	11030	11800	12230	12660	13100	13530

Takeoff Field & Climb Limit Weights - Dry Runway

Flaps 5

Sea Level Pressure Altitude

CORR'D FIELD LENGTH (FT)	FIELD LIMIT WEIGHT (1000 LB)										
	OAT (°C)										
	-40	10	14	18	22	26	30	34	42	46	50
4000	127.1	116.9	116.2	115.4	114.6	113.8	113.1	110.4	105.1	102.5	100.0
4200	130.9	120.5	119.7	118.9	118.1	117.3	116.5	113.8	108.3	105.7	103.1
4600	138.4	127.4	126.6	125.8	124.9	124.1	123.3	120.4	114.7	112.0	109.2
5000	145.5	134.1	133.2	132.3	131.4	130.6	129.7	126.7	120.7	117.9	115.0
5400	152.1	140.2	139.3	138.4	137.5	136.6	135.7	132.6	126.3	123.3	120.4
5800	158.6	146.2	145.2	144.2	143.3	142.4	141.4	138.2	131.7	128.5	125.5
6200	164.8	151.9	150.9	149.9	148.9	147.9	146.9	143.6	136.8	133.6	130.4
6600	170.7	157.4	156.3	155.3	154.3	153.3	152.2	148.8	141.7	138.4	135.0
7000	176.4	162.6	161.5	160.4	159.4	158.3	157.3	153.7	146.4	142.9	139.5
7400	181.8	167.5	166.4	165.3	164.2	163.2	162.1	158.4	150.8	147.3	143.7
7800	187.0	172.3	171.1	170.0	168.9	167.8	166.7	162.9	155.1	151.5	147.8
8200	189.9	177.0	175.8	174.7	173.5	172.4	171.3	167.3	159.4	155.7	151.9
8600	189.9	181.5	180.3	179.2	178.0	176.8	175.6	171.6	163.5	159.7	155.8
9000	189.9	185.6	184.4	183.2	182.0	180.8	179.6	175.5	167.2	163.3	159.4
9400	189.9	189.3	188.1	186.8	185.6	184.4	183.2	179.0	170.5	166.5	162.5
9800	189.9	189.9	189.9	189.9	189.0	187.7	186.5	182.2	173.6	169.5	165.4
10200	189.9	189.9	189.9	189.9	189.9	189.9	189.6	185.3	176.5	172.3	168.2
10600	189.9	189.9	189.9	189.9	189.9	189.9	189.9	188.1	179.2	175.0	170.7
CLIMB LIMIT WT (1000 LB)	189.9	189.9	189.9	189.9	189.9	189.9	189.9	189.9	179.2	173.1	167.0

2000 FT Pressure Altitude

CORR'D FIELD LENGTH (FT)	FIELD LIMIT WEIGHT (1000 LB)										
	OAT (°C)										
	-40	10	14	18	22	26	30	34	42	46	50
4000	119.7	109.6	108.8	108.1	107.4	106.7	105.1	102.9	97.9	95.5	92.2
4200	123.3	112.9	112.2	111.4	110.7	110.0	108.3	106.1	100.9	98.5	95.1
4600	130.4	119.5	118.7	118.0	117.2	116.4	114.7	112.3	107.0	104.4	100.9
5000	137.1	125.8	125.0	124.2	123.3	122.5	120.8	118.3	112.6	110.0	106.3
5400	143.4	131.6	130.7	129.9	129.0	128.2	126.3	123.7	117.9	115.1	111.2
5800	149.5	137.2	136.3	135.4	134.5	133.6	131.7	129.0	122.9	119.9	116.0
6200	155.3	142.5	141.6	140.7	139.8	138.8	136.8	134.0	127.7	124.6	120.5
6600	161.0	147.7	146.7	145.7	144.8	143.8	141.7	138.8	132.2	129.1	124.8
7000	166.3	152.6	151.6	150.6	149.6	148.6	146.4	143.4	136.6	133.3	128.9
7400	171.4	157.2	156.2	155.1	154.1	153.1	150.9	147.8	140.7	137.4	132.8
7800	176.2	161.7	160.6	159.5	158.5	157.5	155.2	152.0	144.7	141.3	136.6
8200	181.1	166.1	165.0	163.9	162.9	161.8	159.5	156.2	148.8	145.2	140.4
8600	185.7	170.4	169.3	168.2	167.1	166.0	163.6	160.2	152.6	149.0	144.0
9000	189.9	174.2	173.1	172.0	170.8	169.7	167.3	163.8	156.1	152.4	147.3
9400	189.9	177.7	176.5	175.3	174.2	173.1	170.5	167.1	159.1	155.3	150.2
9800	189.9	180.9	179.7	178.5	177.4	176.2	173.6	170.1	162.0	158.1	152.9
10200	189.9	183.9	182.7	181.5	180.3	179.1	176.5	172.9	164.7	160.7	155.4
10600	189.9	186.7	185.5	184.3	183.1	181.9	179.2	175.6	167.2	163.2	157.8
CLIMB LIMIT WT (1000 LB)	189.9	189.6	189.5	189.3	189.1	188.9	184.9	179.4	166.8	161.2	153.5

With engine bleed for packs off, increase field limit weight by 800 lb and climb limit weight by 3300 lb.
With engine anti-ice on, decrease field limit weight by 500 lb and climb limit weight by 600 lb.
With engine and wing anti-ice on (optional system), decrease field limit weight by 2000 lb and climb limit weight by 3500 lb.

Takeoff Field & Climb Limit Weights - Dry Runway

Flaps 5

4000 FT Pressure Altitude

CORR'D FIELD LENGTH (FT)	FIELD LIMIT WEIGHT (1000 LB)										
	OAT (°C)										
	-40	10	14	18	22	26	30	34	42	46	50
4000	111.8	102.3	101.6	100.9	100.3	99.2	97.7	95.8	90.9	88.1	85.9
4200	115.2	105.5	104.8	104.1	103.4	102.3	100.8	98.8	93.8	91.0	88.7
4600	121.9	111.7	111.0	110.3	109.6	108.4	106.8	104.7	99.4	96.5	94.1
5000	128.3	117.6	116.9	116.1	115.4	114.1	112.5	110.3	104.8	101.7	99.2
5400	134.2	123.1	122.3	121.5	120.7	119.4	117.7	115.4	109.7	106.5	103.8
5800	139.9	128.3	127.5	126.6	125.8	124.5	122.7	120.4	114.3	111.0	108.3
6200	145.4	133.3	132.4	131.6	130.7	129.3	127.5	125.0	118.8	115.3	112.5
6600	150.6	138.1	137.2	136.3	135.4	134.0	132.0	129.5	123.0	119.4	116.5
7000	155.6	142.7	141.7	140.8	139.9	138.4	136.4	133.8	127.1	123.4	120.3
7400	160.3	147.0	146.0	145.1	144.1	142.6	140.5	137.8	130.9	127.1	123.9
7800	164.9	151.2	150.2	149.2	148.2	146.6	144.5	141.8	134.6	130.7	127.5
8200	169.4	155.4	154.3	153.3	152.3	150.7	148.6	145.7	138.4	134.4	131.1
8600	173.8	159.4	158.3	157.3	156.3	154.6	152.4	149.5	142.0	137.9	134.5
9000	177.7	163.0	161.9	160.9	159.8	158.1	155.8	152.9	145.2	141.0	137.5
9400	181.2	166.2	165.1	164.0	162.9	161.2	158.9	155.9	148.0	143.7	140.2
9800	184.5	169.2	168.1	167.0	165.9	164.1	161.8	158.7	150.7	146.3	142.7
10200	187.6	172.0	170.8	169.7	168.6	166.8	164.4	161.3	153.2	148.7	145.0
10600	189.9	174.6	173.5	172.3	171.2	169.4	167.0	163.8	155.5	151.0	147.2
CLIMB LIMIT WT (1000 LB)	178.6	177.5	177.4	177.2	177.0	175.1	171.8	167.0	155.4	149.1	144.1

6000 FT Pressure Altitude

CORR'D FIELD LENGTH (FT)	FIELD LIMIT WEIGHT (1000 LB)										
	OAT (°C)										
	-40	10	14	18	22	26	30	34	42	46	50
4000	104.4	95.4	94.7	94.0	93.0	91.8	90.3	88.2	83.8	81.7	79.6
4200	107.7	98.4	97.7	97.0	95.9	94.7	93.2	91.1	86.5	84.3	82.2
4600	114.0	104.3	103.6	102.9	101.7	100.5	98.9	96.6	91.9	89.6	87.3
5000	120.0	109.9	109.1	108.4	107.1	105.9	104.2	101.8	96.9	94.4	92.1
5400	125.6	115.0	114.2	113.4	112.1	110.8	109.0	106.6	101.4	98.9	96.4
5800	130.9	119.9	119.0	118.2	116.9	115.5	113.7	111.1	105.7	103.1	100.5
6200	136.0	124.5	123.7	122.8	121.4	120.0	118.1	115.5	109.8	107.1	104.4
6600	140.9	129.0	128.1	127.2	125.8	124.3	122.3	119.6	113.7	110.9	108.1
7000	145.6	133.3	132.3	131.4	129.9	128.4	126.3	123.5	117.5	114.6	111.7
7400	150.0	137.3	136.3	135.4	133.9	132.3	130.1	127.2	121.0	118.0	115.1
7800	154.2	141.2	140.2	139.2	137.7	136.0	133.8	130.9	124.5	121.4	118.3
8200	158.5	145.1	144.1	143.1	141.5	139.8	137.6	134.5	128.0	124.8	121.7
8600	162.6	148.9	147.9	146.8	145.2	143.5	141.2	138.0	131.3	128.1	124.9
9000	166.3	152.3	151.2	150.2	148.5	146.7	144.4	141.2	134.3	131.0	127.7
9400	169.5	155.2	154.2	153.1	151.4	149.6	147.2	143.9	136.9	133.5	130.2
9800	172.6	158.0	156.9	155.8	154.1	152.2	149.8	146.5	139.3	135.8	132.5
10200	175.5	160.6	159.5	158.4	156.6	154.7	152.3	148.9	141.6	138.1	134.6
10600	178.2	163.1	162.0	160.8	159.0	157.1	154.6	151.2	143.8	140.2	136.7
CLIMB LIMIT WT (1000 LB)	167.5	166.1	165.9	165.7	164.1	162.2	158.9	153.7	143.2	138.5	133.9

With engine bleed for packs off, increase field limit weight by 800 lb and climb limit weight by 3300 lb.
With engine anti-ice on, decrease field limit weight by 500 lb and climb limit weight by 600 lb.
With engine and wing anti-ice on (optional system), decrease field limit weight by 2000 lb and climb limit weight by 3500 lb.

Takeoff Field & Climb Limit Weights - Dry Runway

Flaps 5

8000 FT Pressure Altitude

CORR'D FIELD LENGTH (FT)	FIELD LIMIT WEIGHT (1000 LB) OAT (°C)										
	-40	10	14	18	22	26	30	34	42	46	50
4000	97.3	88.5	87.9	86.9	85.9	84.6	82.8	80.6	76.3	74.3	72.3
4200	100.4	91.3	90.7	89.7	88.7	87.4	85.5	83.2	78.9	76.8	74.8
4600	106.4	96.9	96.2	95.2	94.1	92.7	90.8	88.4	83.9	81.7	79.5
5000	112.0	102.1	101.4	100.3	99.2	97.8	95.7	93.2	88.5	86.2	84.0
5400	117.2	106.9	106.1	105.0	103.8	102.3	100.2	97.6	92.7	90.3	87.9
5800	122.2	111.4	110.7	109.5	108.3	106.7	104.5	101.8	96.6	94.1	91.7
6200	127.0	115.8	115.0	113.7	112.5	110.9	108.5	105.7	100.4	97.8	95.3
6600	131.5	119.9	119.1	117.8	116.5	114.8	112.4	109.5	103.9	101.2	98.6
7000	135.9	123.8	123.0	121.7	120.3	118.6	116.1	113.1	107.3	104.6	101.8
7400	140.0	127.6	126.7	125.3	123.9	122.2	119.6	116.5	110.5	107.7	104.9
7800	144.0	131.2	130.3	128.9	127.5	125.6	123.0	119.8	113.7	110.8	107.9
8200	148.0	134.9	134.0	132.5	131.1	129.2	126.5	123.2	116.9	113.9	111.0
8600	151.8	138.4	137.5	136.0	134.5	132.5	129.8	126.4	120.0	116.9	113.9
9000	155.2	141.5	140.6	139.0	137.5	135.5	132.7	129.3	122.7	119.6	116.5
9400	158.3	144.3	143.3	141.7	140.2	138.2	135.3	131.8	125.1	121.9	118.7
9800	161.1	146.9	145.9	144.3	142.7	140.6	137.7	134.1	127.3	124.0	120.8
10200	163.8	149.3	148.3	146.6	145.0	142.9	139.9	136.3	129.4	126.0	122.8
10600	166.3	151.6	150.5	148.9	147.2	145.1	142.1	138.4	131.3	127.9	124.6
CLIMB LIMIT WT (1000 LB)	156.7	155.1	154.9	153.4	151.9	149.2	144.4	139.3	129.6	125.2	120.8

10000 FT Pressure Altitude

CORR'D FIELD LENGTH (FT)	FIELD LIMIT WEIGHT (1000 LB) OAT (°C)										
	-40	10	14	18	22	26	30	34	42	46	50
4000	89.2	81.5	80.4	79.4	78.3	77.0	75.0	73.0	69.1	67.3	65.4
4200	92.1	84.2	83.1	82.0	80.9	79.5	77.5	75.5	71.5	69.6	67.6
4600	97.7	89.4	88.3	87.1	85.9	84.5	82.4	80.3	76.1	74.1	72.1
5000	102.9	94.3	93.1	91.9	90.6	89.2	87.0	84.7	80.4	78.3	76.2
5400	107.7	98.7	97.5	96.2	94.9	93.4	91.1	88.7	84.2	82.0	79.8
5800	112.3	102.9	101.6	100.3	99.0	97.4	95.0	92.5	87.8	85.5	83.2
6200	116.7	106.9	105.6	104.2	102.8	101.2	98.7	96.1	91.2	88.8	86.4
6600	120.9	110.7	109.3	107.9	106.4	104.7	102.2	99.5	94.4	91.9	89.4
7000	124.9	114.4	112.9	111.4	109.9	108.2	105.5	102.8	97.5	94.9	92.4
7400	128.6	117.8	116.3	114.8	113.2	111.4	108.7	105.9	100.4	97.8	95.1
7800	132.3	121.2	119.6	118.1	116.5	114.6	111.8	108.9	103.3	100.6	97.8
8200	136.0	124.6	123.0	121.4	119.8	117.9	115.0	112.0	106.2	103.5	100.7
8600	139.5	127.9	126.2	124.6	122.9	121.0	118.0	115.0	109.1	106.2	103.4
9000	142.7	130.8	129.1	127.4	125.7	123.7	120.7	117.6	111.5	108.6	105.7
9400	145.5	133.3	131.6	129.9	128.1	126.1	123.0	119.8	113.7	110.7	107.7
9800	148.1	135.6	133.9	132.2	130.4	128.3	125.1	121.9	115.6	112.6	109.6
10200	150.5	137.9	136.1	134.3	132.5	130.4	127.2	123.9	117.5	114.4	111.3
10600	152.8	140.0	138.2	136.4	134.5	132.4	129.1	125.8	119.3	116.2	113.0
CLIMB LIMIT WT (1000 LB)	143.5	142.3	140.6	138.9	136.9	134.1	129.6	125.0	116.6	112.5	108.4

With engine bleed for packs off, increase field limit weight by 800 lb and climb limit weight by 3300 lb.
With engine anti-ice on, decrease field limit weight by 500 lb and climb limit weight by 600 lb.
With engine and wing anti-ice on (optional system), decrease field limit weight by 2000 lb and climb limit weight by 3500 lb.

Takeoff Field Corrections - Wet Runway

Slope Corrections

FIELD LENGTH AVAILABLE (FT)	SLOPE CORRECTED FIELD LENGTH (FT)								
	RUNWAY SLOPE (%)								
	-2.0	-1.5	-1.0	-0.5	0.0	0.5	1.0	1.5	2.0
4200	4300	4280	4250	4230	4200	4160	4130	4090	4050
4600	4750	4710	4670	4640	4600	4550	4490	4440	4390
5000	5190	5140	5090	5050	5000	4930	4860	4790	4720
5400	5630	5570	5520	5460	5400	5320	5230	5150	5060
5800	6080	6010	5940	5870	5800	5700	5600	5500	5400
6200	6520	6440	6360	6280	6200	6080	5970	5850	5730
6600	6970	6870	6780	6690	6600	6470	6330	6200	6070
7000	7410	7310	7200	7100	7000	6850	6700	6550	6400
7400	7850	7740	7630	7510	7400	7240	7070	6910	6740
7800	8300	8170	8050	7920	7800	7620	7440	7260	7080
8200	8740	8610	8470	8340	8200	8000	7810	7610	7410
8600	9190	9040	8890	8750	8600	8390	8170	7960	7750
9000	9630	9470	9310	9160	9000	8770	8540	8310	8080
9400	10070	9900	9740	9570	9400	9160	8910	8670	8420
9800	10520	10340	10160	9980	9800	9540	9280	9020	8760
10200	10960	10770	10580	10390	10200	9920	9650	9370	9090
10600	11410	11200	11000	10800	10600	10310	10010	9720	9430
11000	11850	11640	11420	11210	11000	10690	10380	10070	9760
11400	12290	12070	11850	11620	11400	11080	10750	10430	10100
11800	12740	12500	12270	12030	11800	11460	11120	10780	10440

Wind Corrections

SLOPE CORR'D FIELD LENGTH (FT)	SLOPE & WIND CORRECTED FIELD LENGTH (FT)							
	WIND COMPONENT (KTS)							
	-15	-10	-5	0	10	20	30	40
4200	3070	3440	3820	4200	4450	4710	4960	5220
4600	3410	3800	4200	4600	4870	5140	5400	5670
5000	3750	4160	4580	5000	5280	5560	5840	6130
5400	4090	4520	4960	5400	5690	5990	6280	6580
5800	4430	4880	5340	5800	6110	6420	6720	7030
6200	4770	5240	5720	6200	6520	6840	7160	7490
6600	5110	5600	6100	6600	6930	7270	7600	7940
7000	5450	5960	6480	7000	7350	7700	8040	8390
7400	5790	6320	6860	7400	7760	8120	8480	8850
7800	6130	6680	7240	7800	8170	8550	8920	9300
8200	6460	7040	7620	8200	8590	8980	9360	9750
8600	6800	7400	8000	8600	9000	9400	9800	10210
9000	7140	7760	8380	9000	9410	9830	10240	10660
9400	7480	8120	8760	9400	9830	10260	10680	11110
9800	7820	8480	9140	9800	10240	10680	11120	11570
10200	8160	8840	9520	10200	10650	11110	11560	12020
10600	8500	9200	9900	10600	11070	11540	12000	12470
11000	8840	9560	10280	11000	11480	11960	12440	12930
11400	9180	9920	10660	11400	11890	12390	12880	13380
11800	9520	10280	11040	11800	12310	12820	13320	13830

Takeoff Field & Climb Limit Weights - Wet Runway

Flaps 5

Sea Level Pressure Altitude

CORR'D FIELD LENGTH (FT)	FIELD LIMIT WEIGHT (1000 LB) OAT (°C)										
	-40	10	14	18	22	26	30	34	42	46	50
4000	127.5	116.9	116.1	115.3	114.5	113.7	112.9	110.2	104.8	102.3	99.8
4200	131.2	120.3	119.5	118.6	117.8	117.0	116.1	113.4	107.8	105.2	102.6
4600	138.6	127.0	126.1	125.2	124.3	123.5	122.6	119.7	113.8	111.0	108.2
5000	145.6	133.4	132.4	131.5	130.5	129.6	128.7	125.6	119.4	116.5	113.6
5400	152.1	139.3	138.3	137.3	136.4	135.4	134.4	131.2	124.7	121.7	118.6
5800	158.4	145.0	144.0	143.0	142.0	141.0	139.9	136.6	129.8	126.6	123.4
6200	164.4	150.5	149.4	148.3	147.3	146.2	145.2	141.7	134.7	131.3	128.0
6600	170.1	155.7	154.6	153.5	152.4	151.3	150.2	146.6	139.3	135.8	132.4
7000	175.7	160.8	159.7	158.5	157.4	156.3	155.1	151.4	143.8	140.2	136.7
7400	181.1	165.8	164.6	163.4	162.2	161.0	159.9	156.0	148.2	144.5	140.8
7800	186.3	170.5	169.2	168.0	166.8	165.6	164.4	160.4	152.4	148.6	144.8
8200	189.9	175.1	173.8	172.6	171.3	170.1	168.9	164.8	156.5	152.6	148.7
8600	189.9	179.5	178.2	176.9	175.7	174.4	173.1	168.9	160.4	156.4	152.4
9000	189.9	183.6	182.3	181.0	179.7	178.4	177.1	172.8	164.1	160.0	155.9
9400	189.9	187.5	186.1	184.8	183.4	182.1	180.8	176.3	167.5	163.2	159.0
9800	189.9	189.9	189.8	188.4	187.0	185.7	184.3	179.8	170.7	166.4	162.1
10200	189.9	189.9	189.9	189.9	189.9	189.2	187.8	183.2	173.9	169.5	165.1
10600	189.9	189.9	189.9	189.9	189.9	189.9	189.9	186.5	177.0	172.5	168.0
CLIMB LIMIT WT (1000 LB)	189.9	189.9	189.9	189.9	189.9	189.9	189.9	189.9	179.2	173.1	167.0

2000 FT Pressure Altitude

CORR'D FIELD LENGTH (FT)	FIELD LIMIT WEIGHT (1000 LB) OAT (°C)										
	-40	10	14	18	22	26	30	34	42	46	50
4000	119.9	109.4	108.6	107.9	107.1	106.4	104.8	102.6	97.5	95.2	92.2
4200	123.4	112.5	111.7	110.9	110.2	109.4	107.8	105.5	100.3	97.9	94.8
4600	130.3	118.7	117.9	117.1	116.3	115.5	113.7	111.3	105.8	103.2	99.9
5000	136.8	124.7	123.8	122.9	122.0	121.2	119.3	116.8	111.0	108.3	104.8
5400	143.0	130.2	129.3	128.4	127.5	126.6	124.6	122.0	115.9	113.1	109.4
5800	148.8	135.5	134.6	133.6	132.7	131.7	129.7	126.9	120.6	117.6	113.9
6200	154.5	140.6	139.6	138.6	137.6	136.7	134.6	131.7	125.1	122.0	118.0
6600	159.8	145.5	144.4	143.4	142.4	141.4	139.2	136.2	129.4	126.2	122.1
7000	165.1	150.2	149.1	148.0	147.0	146.0	143.7	140.6	133.5	130.2	126.0
7400	170.1	154.8	153.7	152.6	151.5	150.4	148.1	144.9	137.6	134.1	129.8
7800	175.0	159.2	158.0	156.9	155.8	154.7	152.3	149.0	141.5	137.9	133.4
8200	179.7	163.5	162.3	161.1	160.0	158.8	156.4	153.0	145.3	141.6	137.0
8600	184.3	167.6	166.4	165.2	164.0	162.8	160.3	156.8	148.9	145.1	140.4
9000	188.5	171.4	170.2	168.9	167.7	166.6	163.9	160.4	152.3	148.4	143.5
9400	189.9	175.0	173.7	172.4	171.2	170.0	167.3	163.6	155.3	151.4	146.4
9800	189.9	178.4	177.1	175.8	174.5	173.3	170.6	166.8	158.3	154.3	149.2
10200	189.9	181.7	180.4	179.1	177.8	176.5	173.7	169.9	161.2	157.1	151.9
10600	189.9	185.0	183.6	182.3	181.0	179.7	176.8	172.9	164.1	159.9	154.6
CLIMB LIMIT WT (1000 LB)	189.9	189.6	189.5	189.3	189.1	188.9	184.9	179.4	166.8	161.2	153.5

With engine bleed for packs off, increase field limit weight by 800 lb and climb limit weight by 3300 lb.
With engine anti-ice on, decrease field limit weight by 400 lb and climb limit weight by 600 lb.
With engine and wing anti-ice on (optional system), decrease field limit weight by 1700 lb and climb limit weight by 3500 lb.

Takeoff Field & Climb Limit Weights - Wet Runway

Flaps 5

4000 FT Pressure Altitude

CORR'D FIELD LENGTH (FT)	FIELD LIMIT WEIGHT (1000 LB)										
	OAT (°C)										
	-40	10	14	18	22	26	30	34	42	46	50
4000	111.9	102.0	101.3	100.6	99.9	98.8	97.3	95.4	90.7	88.3	86.3
4200	115.1	104.9	104.2	103.4	102.7	101.6	100.1	98.1	93.3	90.8	88.7
4600	121.5	110.7	109.9	109.1	108.4	107.1	105.5	103.4	98.3	95.7	93.5
5000	127.6	116.2	115.3	114.5	113.7	112.4	110.7	108.5	103.2	100.4	98.1
5400	133.2	121.3	120.4	119.6	118.8	117.4	115.6	113.3	107.7	104.8	102.4
5800	138.7	126.2	125.3	124.5	123.6	122.2	120.3	117.9	112.1	109.0	106.5
6200	143.9	130.9	130.0	129.1	128.2	126.7	124.8	122.3	116.2	113.0	110.4
6600	148.9	135.4	134.5	133.5	132.6	131.0	129.0	126.4	120.1	116.8	114.1
7000	153.7	139.8	138.8	137.8	136.8	135.2	133.2	130.5	124.0	120.5	117.7
7400	158.4	144.1	143.0	142.0	141.0	139.4	137.2	134.5	127.7	124.2	121.3
7800	162.9	148.1	147.1	146.0	145.0	143.3	141.1	138.2	131.3	127.6	124.6
8200	167.3	152.1	151.0	149.9	148.9	147.1	144.9	141.9	134.8	131.0	128.0
8600	171.6	155.9	154.8	153.7	152.6	150.8	148.5	145.5	138.1	134.3	131.2
9000	175.5	159.5	158.3	157.2	156.0	154.2	151.9	148.8	141.2	137.3	134.1
9400	179.1	162.7	161.5	160.4	159.2	157.4	154.9	151.8	144.1	140.0	136.7
9800	182.7	165.9	164.7	163.5	162.3	160.4	157.9	154.7	146.8	142.7	139.3
10200	186.1	168.9	167.7	166.5	165.3	163.3	160.8	157.5	149.4	145.2	141.8
10600	189.4	172.0	170.7	169.5	168.2	166.2	163.7	160.3	152.1	147.8	144.2
CLIMB LIMIT WT (1000 LB)	178.6	177.5	177.4	177.2	177.0	175.1	171.8	167.0	155.4	149.1	144.1

6000 FT Pressure Altitude

CORR'D FIELD LENGTH (FT)	FIELD LIMIT WEIGHT (1000 LB)										
	OAT (°C)										
	-40	10	14	18	22	26	30	34	42	46	50
4000	104.4	95.0	94.3	93.7	92.6	91.5	90.1	88.3	84.2	82.3	80.4
4200	107.4	97.7	97.0	96.3	95.2	94.1	92.7	90.7	86.5	84.5	82.6
4600	113.3	103.0	102.3	101.6	100.4	99.2	97.7	95.7	91.2	89.1	87.0
5000	118.9	108.1	107.3	106.6	105.4	104.1	102.5	100.3	95.6	93.4	91.3
5400	124.2	112.9	112.0	111.2	110.0	108.7	107.0	104.7	99.8	97.5	95.2
5800	129.3	117.4	116.6	115.7	114.4	113.1	111.3	109.0	103.8	101.4	99.0
6200	134.1	121.8	120.9	120.0	118.7	117.2	115.4	112.9	107.6	105.1	102.6
6600	138.7	125.9	125.0	124.1	122.7	121.2	119.3	116.8	111.2	108.6	106.1
7000	143.2	129.9	129.0	128.1	126.6	125.1	123.1	120.5	114.7	112.0	109.4
7400	147.6	133.9	132.9	132.0	130.4	128.9	126.8	124.1	118.2	115.4	112.7
7800	151.7	137.6	136.6	135.7	134.1	132.5	130.4	127.6	121.5	118.6	115.8
8200	155.8	141.3	140.3	139.3	137.7	136.0	133.9	131.0	124.7	121.7	118.9
8600	159.7	144.9	143.8	142.8	141.1	139.4	137.2	134.2	127.8	124.8	121.8
9000	163.4	148.1	147.0	146.0	144.3	142.5	140.3	137.2	130.6	127.5	124.5
9400	166.7	151.1	150.0	148.9	147.2	145.4	143.1	140.0	133.2	130.0	126.9
9800	170.0	154.0	152.9	151.7	150.0	148.1	145.8	142.6	135.7	132.4	129.2
10200	173.1	156.8	155.7	154.5	152.7	150.8	148.4	145.2	138.1	134.8	131.5
10600	176.2	159.6	158.4	157.2	155.4	153.5	151.0	147.7	140.5	137.1	133.8
CLIMB LIMIT WT (1000 LB)	167.5	166.1	165.9	165.7	164.1	162.2	158.9	153.7	143.2	138.5	133.9

With engine bleed for packs off, increase field limit weight by 800 lb and climb limit weight by 3300 lb.
With engine anti-ice on, decrease field limit weight by 400 lb and climb limit weight by 600 lb.
With engine and wing anti-ice on (optional system), decrease field limit weight by 1700 lb and climb limit weight by 3500 lb.

Takeoff Field & Climb Limit Weights - Wet Runway

Flaps 5

8000 FT Pressure Altitude

CORR'D FIELD LENGTH (FT)	FIELD LIMIT WEIGHT (1000 LB)										
	OAT (°C)										
	-40	10	14	18	22	26	30	34	42	46	50
4000	97.3	88.5	87.9	86.9	86.0	84.8	83.1	81.1	77.3	75.5	73.7
4200	100.0	90.9	90.3	89.4	88.4	87.1	85.4	83.3	79.4	77.6	75.7
4600	105.5	95.9	95.2	94.2	93.2	91.9	90.0	87.8	83.7	81.7	79.7
5000	110.7	100.6	99.9	98.8	97.7	96.3	94.4	92.1	87.7	85.6	83.6
5400	115.6	105.0	104.3	103.1	102.0	100.5	98.5	96.1	91.5	89.3	87.2
5800	120.3	109.2	108.5	107.3	106.1	104.6	102.4	99.9	95.2	92.9	90.6
6200	124.7	113.2	112.4	111.2	110.0	108.4	106.2	103.5	98.6	96.2	93.9
6600	129.0	117.1	116.2	115.0	113.7	112.0	109.7	107.0	101.9	99.4	97.0
7000	133.1	120.8	119.9	118.6	117.3	115.6	113.2	110.4	105.1	102.5	100.0
7400	137.2	124.4	123.5	122.2	120.8	119.1	116.6	113.7	108.2	105.6	103.0
7800	141.0	127.9	127.0	125.6	124.2	122.4	119.8	116.8	111.2	108.5	105.8
8200	144.8	131.3	130.4	128.9	127.5	125.6	123.0	119.9	114.1	111.3	108.6
8600	148.4	134.6	133.6	132.1	130.7	128.8	126.1	122.9	116.9	114.1	111.3
9000	151.8	137.6	136.6	135.1	133.6	131.6	128.9	125.6	119.5	116.6	113.7
9400	154.9	140.3	139.3	137.8	136.2	134.2	131.4	128.1	121.8	118.8	115.9
9800	157.8	143.0	141.9	140.3	138.8	136.7	133.8	130.4	124.0	121.0	117.9
10200	160.7	145.5	144.5	142.9	141.2	139.2	136.2	132.7	126.2	123.1	120.0
10600	163.6	148.1	147.0	145.3	143.7	141.6	138.5	135.0	128.3	125.1	122.0
CLIMB LIMIT WT (1000 LB)	156.7	155.1	154.9	153.4	151.9	149.2	144.4	139.3	129.6	125.2	120.8

10000 FT Pressure Altitude

CORR'D FIELD LENGTH (FT)	FIELD LIMIT WEIGHT (1000 LB)										
	OAT (°C)										
	-40	10	14	18	22	26	30	34	42	46	50
4000	89.7	81.9	80.9	79.9	78.9	77.7	75.9	74.1	70.7	69.0	67.3
4200	92.2	84.2	83.1	82.1	81.0	79.8	78.0	76.2	72.6	70.9	69.1
4600	97.2	88.7	87.6	86.5	85.4	84.1	82.2	80.2	76.4	74.6	72.7
5000	102.0	93.0	91.8	90.7	89.5	88.1	86.1	84.1	80.1	78.1	76.2
5400	106.4	97.1	95.8	94.6	93.4	92.0	89.9	87.7	83.5	81.5	79.4
5800	110.7	100.9	99.7	98.4	97.1	95.6	93.4	91.2	86.8	84.7	82.6
6200	114.8	104.6	103.3	102.0	100.6	99.1	96.8	94.4	89.9	87.7	85.5
6600	118.7	108.1	106.7	105.4	104.0	102.4	100.0	97.6	92.9	90.6	88.3
7000	122.5	111.5	110.1	108.7	107.3	105.6	103.1	100.6	95.7	93.4	91.0
7400	126.2	114.9	113.4	111.9	110.5	108.7	106.2	103.6	98.6	96.1	93.7
7800	129.7	118.0	116.5	115.0	113.5	111.7	109.1	106.4	101.2	98.7	96.2
8200	133.2	121.2	119.6	118.1	116.5	114.7	112.0	109.2	103.9	101.3	98.7
8600	136.5	124.2	122.6	121.0	119.4	117.5	114.8	111.9	106.5	103.8	101.1
9000	139.5	126.9	125.3	123.7	122.0	120.1	117.3	114.4	108.8	106.1	103.3
9400	142.3	129.4	127.7	126.1	124.4	122.4	119.5	116.6	110.8	108.0	105.2
9800	145.0	131.8	130.1	128.4	126.7	124.6	121.7	118.6	112.8	109.9	107.1
10200	147.6	134.1	132.4	130.7	128.9	126.8	123.8	120.7	114.7	111.8	108.9
10600	150.2	136.5	134.7	132.9	131.1	129.0	125.9	122.7	116.6	113.7	110.7
CLIMB LIMIT WT (1000 LB)	143.5	142.3	140.6	138.9	136.9	134.1	129.6	125.0	116.6	112.5	108.4

With engine bleed for packs off, increase field limit weight by 800 lb and climb limit weight by 3300 lb.
With engine anti-ice on, decrease field limit weight by 400 lb and climb limit weight by 600 lb.
With engine and wing anti-ice on (optional system), decrease field limit weight by 1700 lb and climb limit weight by 3500 lb.

Takeoff Obstacle Limit Weight

Flaps 5

Sea Level, 30°C & Below, Zero Wind

Based on engine bleed for packs on and anti-ice off

Reference Obstacle Limit Weight (1000 LB)

OBSTACLE HEIGHT (FT)	DISTANCE FROM BRAKE RELEASE (1000 FT)								
	8	10	12	14	16	18	20	22	24
10	164.0	183.0							
50	154.1	171.8	185.9						
100	144.9	161.8	175.0	185.5					
150	137.6	153.7	166.7	176.9	185.2				
200	131.5	147.0	159.7	169.9	178.2	185.0			
250	126.1	141.1	153.6	163.8	172.1	179.0	184.8	189.7	
300	121.2	136.0	148.1	158.3	166.7	173.7	179.6	184.6	188.9
350	116.8	131.3	143.3	153.4	161.8	168.9	174.9	180.1	184.5
400	112.8	127.1	138.9	148.9	157.3	164.5	170.6	175.8	180.4
450	109.1	123.2	134.9	144.7	153.2	160.4	166.6	171.9	176.5
500	105.7	119.6	131.2	140.9	149.3	156.6	162.8	168.3	173.0
550	102.5	116.2	127.7	137.4	145.7	153.0	159.3	164.8	169.6
600	99.5	113.1	124.4	134.1	142.3	149.6	156.0	161.5	166.4
650	96.6	110.1	121.4	130.9	139.2	146.4	152.8	158.4	163.3
700	94.0	107.4	118.5	128.0	136.2	143.4	149.8	155.4	160.4
750	91.5	104.7	115.8	125.2	133.4	140.6	146.9	152.6	157.6
800		102.2	113.2	122.6	130.7	137.9	144.2	149.9	155.0
850		99.8	110.7	120.0	128.2	135.3	141.6	147.3	152.4
900		97.6	108.4	117.6	125.7	132.8	139.2	144.8	149.9
950		95.4	106.1	115.3	123.4	130.5	136.8	142.5	147.6
1000		93.3	104.0	113.1	121.2	128.2	134.5	140.2	145.3

Obstacle height must be calculated from lowest point of the runway to conservatively account for runway slope.

OAT Adjustments

OAT (°C)	REFERENCE OBSTACLE LIMIT WEIGHT (1000 LB)					
	90	110	130	150	170	190
30 & BELOW	0	0	0	0	0	0
32	-1.3	-1.6	-2.0	-2.3	-2.7	-3.0
34	-2.6	-3.3	-4.0	-4.7	-5.4	-6.0
36	-3.9	-4.9	-6.0	-7.0	-8.0	-9.1
38	-5.2	-6.6	-7.9	-9.3	-10.7	-12.1
40	-6.5	-8.2	-9.9	-11.7	-13.4	-15.1
42	-7.8	-9.8	-11.9	-13.9	-15.9	-17.9
44	-9.1	-11.4	-13.8	-16.1	-18.4	-20.8
46	-10.4	-13.1	-15.7	-18.3	-21.0	-23.6
48	-11.7	-14.7	-17.6	-20.6	-23.5	-26.4
50	-13.1	-16.3	-19.5	-22.8	-26.0	-29.3

Takeoff Obstacle Limit Weight

Flaps 5

Pressure Altitude Adjustments

ALT (FT)	OAT ADJUSTED OBSTACLE LIMIT WEIGHT (1000 LB)					
	90	110	130	150	170	190
S.L. & BELOW	0	0	0	0	0	0
1000	-3.3	-4.1	-4.8	-5.6	-6.3	-7.1
2000	-6.7	-8.2	-9.7	-11.2	-12.7	-14.2
3000	-9.7	-11.9	-14.1	-16.3	-18.5	-20.7
4000	-12.7	-15.6	-18.5	-21.4	-24.3	-27.1
5000	-15.6	-19.1	-22.7	-26.2	-29.8	-33.3
6000	-18.4	-22.6	-26.8	-31.0	-35.3	-39.5
7000	-21.6	-26.5	-31.4	-36.4	-41.3	-46.3
8000	-24.7	-30.4	-36.0	-41.7	-47.4	-53.0
9000	-27.6	-34.0	-40.4	-46.8	-53.2	-59.6
10000	-30.6	-37.7	-44.8	-52.0	-59.1	-66.3

Wind Adjustments

WIND (KTS)	OAT & ALT ADJUSTED OBSTACLE LIMIT WEIGHT (1000 LB)					
	90	110	130	150	170	190
15 TW	-19.7	-19.4	-19.0	-18.7	-18.4	-18.1
10 TW	-13.1	-12.9	-12.7	-12.5	-12.3	-12.1
5 TW	-6.6	-6.5	-6.3	-6.2	-6.1	-6.0
0	0	0	0	0	0	0
10 HW	2.5	2.4	2.3	2.1	2.0	1.9
20 HW	5.1	4.8	4.5	4.3	4.0	3.7
30 HW	7.8	7.4	6.9	6.5	6.0	5.6
40 HW	10.6	9.9	9.3	8.7	8.1	7.4

With engine bleed for packs off, increase weight by 1300 lb.
With engine anti-ice on, decrease weight by 650 lb.
With engine and wing anti-ice on, decrease weight by 3750 lb (optional system).

Brake Energy Limits VMBE

Maximum Brake Energy Speed

OAT (°C)	REFERENCE VMBE (KIAS)						
	PRESSURE ALTITUDE (FT)						
	-2000	0	2000	4000	6000	8000	10000
54	187	180					
50	188	181	174				
46	188	181	175	169			
42	189	182	176	169	163		
38	190	183	176	170	164	158	
34	191	184	177	171	165	159	153
30	192	184	178	172	165	160	154
26	194	186	179	173	167	160	155
22	196	187	181	174	168	161	156
18	197	189	182	175	169	163	157
14	199	190	184	177	170	164	158
10	200	192	185	178	172	165	159
6	202	194	187	180	173	167	160
2	204	195	188	181	175	168	162
-2	206	197	190	183	176	169	163
-6	208	199	192	185	178	171	164
-10	210	201	193	186	179	172	166

Weight Adjusted VMBE

WEIGHT (1000 LB)	REFERENCE VMBE (KIAS)														
	140	145	150	155	160	165	170	175	180	185	190	195	200	205	210
90	181	188	194	201	207	210	210	210	210	210	210	210	210	210	210
100	170	176	182	189	195	201	207	210	210	210	210	210	210	210	210
110	161	167	172	178	184	190	195	201	207	210	210	210	210	210	210
120	152	158	163	169	174	180	185	191	196	202	207	210	210	210	210
130	146	151	156	161	167	172	177	182	188	193	198	203	209	210	210
140	140	145	150	155	160	165	170	175	180	185	190	195	200	205	210
150	135	140	144	149	154	159	164	168	173	178	183	187	192	197	202
160	130	135	140	144	149	153	158	162	167	171	176	181	185	190	194
170	126	131	135	140	144	148	153	157	161	166	170	174	179	183	188
180	123	127	132	136	140	144	148	152	157	161	165	169	173	177	181
190	121	125	129	133	137	141	144	148	152	156	160	164	168	172	176

Increase VMBE by 1 knot per 1% uphill runway slope. Decrease VMBE by 4 knots per 1% downhill runway slope.
Increase VMBE by 3 knots per 10 knots headwind. Decrease VMBE by 20 knots per 10 knots tailwind.
Decrease brake release weight by 1150 lb for each knot V1 exceeds VMBE.
Determine normal V1, VR, V2 speeds for lower brake release weight.

Intentionally
Blank

Performance Dispatch — Chapter PD
Enroute — Section 81

Long Range Cruise Maximum Operating Altitude
Max Cruise Thrust
ISA + 10°C and Below

WEIGHT (1000 LB)	OPTIMUM ALT (FT)	TAT (°C)	MARGIN TO INITIAL BUFFET 'G' (BANK ANGLE)				
			1.20 (33°)	1.25 (36°)	1.30 (39°)	1.40 (44°)	1.50 (48°)
190	30900	-6	33000*	33000*	33000*	31500	30100
180	32100	-9	34500*	34500*	34300	32700	31300
170	33300	-12	35800*	35800*	35500	33900	32500
160	34600	-14	37100*	37100*	36800	35200	33800
150	35900	-18	38300*	38300*	38100	36500	35200
140	37400	-18	39600*	39600*	39500	38000	36600
130	38900	-18	41000	41000	41000	39500	38100
120	40600	-18	41000	41000	41000	41000	39800
110	41000	-18	41000	41000	41000	41000	41000
100	41000	-18	41000	41000	41000	41000	41000
90	41000	-18	41000	41000	41000	41000	41000

ISA + 15°C

WEIGHT (1000 LB)	OPTIMUM ALT (FT)	TAT (°C)	MARGIN TO INITIAL BUFFET 'G' (BANK ANGLE)				
			1.20 (33°)	1.25 (36°)	1.30 (39°)	1.40 (44°)	1.50 (48°)
190	30900	-1	30800*	30800*	30800*	30800*	30100
180	32100	-3	32900*	32900*	32900*	32700	31300
170	33300	-6	34700*	34700*	34700*	33900	32500
160	34600	-9	36100*	36100*	36100*	35200	33800
150	35900	-12	37400*	37400*	37400*	36500	35200
140	37400	-12	38600*	38600*	38600*	38000	36600
130	38900	-12	40000*	40000*	40000*	39500	38100
120	40600	-12	41000	41000	41000	41000	39800
110	41000	-12	41000	41000	41000	41000	41000
100	41000	-12	41000	41000	41000	41000	41000
90	41000	-12	41000	41000	41000	41000	41000

ISA + 20°C

WEIGHT (1000 LB)	OPTIMUM ALT (FT)	TAT (°C)	MARGIN TO INITIAL BUFFET 'G' (BANK ANGLE)				
			1.20 (33°)	1.25 (36°)	1.30 (39°)	1.40 (44°)	1.50 (48°)
190	30900	5	27400*	27400*	27400*	27400*	27400*
180	32100	2	29500*	29500*	29500*	29500*	29500*
170	33300	0	32100*	32100*	32100*	32100*	32100*
160	34600	-3	34300*	34300*	34300*	34300*	33800
150	35900	-6	36000*	36000*	36000*	36000*	35200
140	37400	-7	37300*	37300*	37300*	37300*	36600
130	38900	-7	38600*	38600*	38600*	38600*	38100
120	40600	-7	40000*	40000*	40000*	40000*	39800
110	41000	-7	41000	41000	41000	41000	41000
100	41000	-7	41000	41000	41000	41000	41000
90	41000	-7	41000	41000	41000	41000	41000

***Denotes altitude thrust limited in level flight, 100 fpm residual rate of climb.**

Long Range Cruise Trip Fuel and Time

Ground to Air Miles Conversion

AIR DISTANCE (NM)					GROUND DISTANCE (NM)	AIR DISTANCE (NM)				
HEADWIND COMPONENT (KTS)						TAILWIND COMPONENT (KTS)				
100	80	60	40	20		20	40	60	80	100
277	257	240	225	212	200	190	181	173	166	159
547	510	477	448	423	400	381	364	348	334	321
815	761	713	671	634	600	573	548	524	503	484
1083	1013	949	894	845	800	764	731	700	672	647
1350	1263	1185	1116	1055	1000	956	914	876	842	810
1616	1513	1420	1338	1266	1200	1147	1098	1053	1011	974
1882	1762	1655	1560	1476	1400	1339	1282	1229	1181	1137
2146	2011	1889	1782	1687	1600	1530	1466	1406	1351	1301
2410	2260	2124	2004	1897	1800	1722	1649	1582	1520	1464
2673	2507	2357	2225	2107	2000	1913	1833	1759	1690	1628
2935	2754	2590	2446	2317	2200	2105	2017	1935	1860	1792
3196	3000	2823	2667	2527	2400	2296	2200	2111	2030	1956
3457	3247	3055	2887	2737	2600	2488	2384	2288	2200	2120
3718	3493	3288	3108	2947	2800	2680	2568	2465	2370	2284
3978	3738	3521	3329	3157	3000	2872	2752	2642	2540	2448
4238	3984	3753	3549	3367	3200	3063	2936	2819	2711	2613
4497	4229	3985	3769	3576	3400	3255	3120	2996	2881	2777
4755	4473	4216	3989	3786	3600	3447	3304	3173	3051	2941
5013	4717	4447	4209	3996	3800	3639	3489	3349	3222	3105
5271	4961	4679	4429	4205	4000	3830	3673	3526	3392	3269
5528	5205	4910	4649	4415	4200	4022	3857	3703	3562	3434
5786	5448	5141	4869	4624	4400	4214	4041	3880	3733	3598
6042	5691	5372	5088	4833	4600	4406	4225	4057	3903	3762
6299	5934	5602	5307	5043	4800	4597	4408	4233	4073	3926
6555	6176	5832	5526	5252	5000	4789	4592	4410	4243	4090

Long Range Cruise Trip Fuel and Time

Reference Fuel and Time Required

AIR DIST (NM)	PRESSURE ALTITUDE (1000 FT)									
	27		29		31		33		35	
	FUEL (1000 LB)	TIME (HR:MIN)	FUEL (1000 LB)	TIME (HR:MIN)	FUEL (1000 LB)	TIME (HR:MIN)	FUEL (1000 LB)	TIME (HR:MIN)	FUEL (1000 LB)	TIME (HR:MIN)
200	3.7	0:38	3.7	0:38	3.7	0:38	3.7	0:38	3.7	0:37
400	6.2	1:09	6.2	1:07	6.1	1:06	6.1	1:05	6.0	1:05
600	8.8	1:38	8.7	1:36	8.5	1:34	8.4	1:33	8.3	1:32
800	11.4	2:08	11.2	2:04	11.0	2:02	10.8	2:00	10.6	1:59
1000	14.0	2:38	13.8	2:33	13.5	2:30	13.2	2:28	13.0	2:25
1200	16.7	3:07	16.4	3:01	16.0	2:58	15.7	2:55	15.4	2:52
1400	19.4	3:35	19.0	3:29	18.5	3:25	18.1	3:22	17.8	3:19
1600	22.1	4:04	21.6	3:57	21.1	3:53	20.6	3:49	20.2	3:45
1800	24.8	4:32	24.3	4:25	23.7	4:20	23.1	4:15	22.7	4:12
2000	27.6	5:01	26.9	4:53	26.3	4:47	25.7	4:42	25.1	4:38
2200	30.4	5:28	29.7	5:20	28.9	5:14	28.3	5:09	27.7	5:05
2400	33.2	5:56	32.4	5:47	31.6	5:41	30.8	5:35	30.3	5:31
2600	36.1	6:24	35.2	6:14	34.3	6:07	33.5	6:01	32.9	5:58
2800	38.9	6:51	38.0	6:41	37.0	6:34	36.1	6:28	35.5	6:24
3000	41.8	7:19	40.8	7:08	39.8	7:01	38.8	6:54	38.2	6:50
3200	44.8	7:46	43.7	7:35	42.6	7:27	41.6	7:20	40.9	7:17
3400	47.8	8:13	46.6	8:02	45.4	7:53	44.3	7:46	43.7	7:43
3600	50.8	8:40	49.5	8:28	48.2	8:19	47.2	8:13	46.5	8:09
3800	53.8	9:07	52.5	8:55	51.1	8:45	50.0	8:39	49.4	8:36
4000	56.8	9:34	55.4	9:21	54.0	9:12	52.9	9:05	52.3	9:02
4200	60.0	10:00	58.5	9:47	57.0	9:38	55.9	9:31		
4400	63.1	10:27	61.5	10:13	60.0	10:04	58.8	9:57		
4600	66.2	10:53	64.6	10:39	63.1	10:30	61.9	10:23		
4800	69.4	11:19	67.7	11:05	66.1	10:56	65.0	10:50		
5000	72.6	11:45	70.9	11:31	69.2	11:22	68.1	11:16		

Fuel Required Adjustments (1000 LB)

REFERENCE FUEL REQUIRED (1000 LB)	LANDING WEIGHT (1000 LB)				
	90	110	130	150	170
5	-0.8	-0.4	0.0	0.5	1.0
10	-1.6	-0.9	0.0	1.0	2.3
15	-2.4	-1.3	0.0	1.6	3.9
20	-3.2	-1.7	0.0	2.3	5.6
25	-4.1	-2.1	0.0	3.0	7.5
30	-4.9	-2.5	0.0	3.8	9.6
35	-5.7	-2.9	0.0	4.6	11.9
40	-6.5	-3.4	0.0	5.6	14.3
45	-7.3	-3.8	0.0	6.6	17.0
50	-8.1	-4.2	0.0	7.6	19.9
55	-9.0	-4.6	0.0	8.7	22.9
60	-9.8	-5.0	0.0	9.9	26.1

Based on 280/.78 climb, Long Range Cruise and .78/280/250 descent.

Long Range Cruise Step Climb
Ground to Air Miles Conversion

AIR DISTANCE (NM)					GROUND DISTANCE (NM)	AIR DISTANCE (NM)				
HEADWIND COMPONENT (KTS)						TAILWIND COMPONENT (KTS)				
100	80	60	40	20		20	40	60	80	100
1316	1238	1168	1106	1050	1000	954	912	874	839	806
1829	1724	1630	1545	1469	1400	1337	1280	1227	1179	1134
2343	2209	2091	1984	1887	1800	1720	1647	1580	1519	1461
2855	2695	2551	2422	2306	2200	2103	2015	1934	1859	1789
3368	3180	3012	2861	2724	2600	2487	2383	2287	2199	2117
3880	3665	3473	3299	3143	3000	2870	2750	2641	2539	2445
4392	4150	3933	3738	3561	3400	3253	3118	2994	2880	2774
4904	4634	4393	4176	3979	3800	3636	3486	3348	3220	3102
5415	5119	4853	4614	4397	4200	4020	3854	3702	3561	3430
5926	5603	5313	5052	4816	4600	4403	4222	4055	3902	3759
6437	6087	5773	5490	5234	5000	4786	4590	4409	4242	4087

Trip Fuel and Time Required

AIR DIST (NM)	TRIP FUEL (1000 LB)								TIME (HRS:MIN)
	LANDING WEIGHT (1000 LB)								
	90	100	110	120	130	140	150	160	
1000	10.1	10.7	11.4	12.2	12.9	13.6	14.5	15.1	2:24
1400	13.7	14.5	15.5	16.7	17.6	18.7	19.9	20.8	3:17
1800	17.4	18.4	19.8	21.2	22.5	24.0	25.4	26.7	4:10
2200	21.1	22.5	24.2	25.9	27.6	29.3	31.1	32.7	5:03
2600	25.0	26.7	28.7	30.8	32.8	34.9	37.0	39.0	5:56
3000	28.9	31.0	33.4	35.8	38.1	40.6	43.0	45.4	6:48
3400	33.0	35.4	38.1	40.9	43.6	46.4	49.3	52.0	7:41
3800	37.2	40.0	43.0	46.2	49.3	52.5	55.7	58.8	8:33
4200	41.5	44.6	48.1	51.7	55.1	58.7	62.3	65.8	9:26
4600	46.0	49.4	53.3	57.3	61.1	65.1	69.1	72.9	10:18
5000	50.6	54.4	58.7	63.0	67.2	71.7	76.1	80.4	11:10

Based on 280/.78 climb, Long Range Cruise, and .78/280/250 descent.
Valid for all pressure altitudes with 4000 ft step climb to 2000 ft above optimum altitude.

Short Trip Fuel and Time

Ground to Air Miles Conversion

AIR DISTANCE (NM)					GROUND DISTANCE (NM)	AIR DISTANCE (NM)				
HEADWIND COMPONENT (KTS)						TAILWIND COMPONENT (KTS)				
100	80	60	40	20		20	40	60	80	100
95	81	70	62	55	50	46	42	39	36	34
161	144	130	118	108	100	93	87	81	77	72
227	206	188	174	161	150	140	132	125	118	112
292	267	246	229	213	200	188	178	168	160	152
355	328	304	284	266	250	236	224	212	202	193
418	387	361	338	318	300	284	270	257	245	234
481	447	418	393	370	350	332	316	301	287	275
544	508	476	447	422	400	380	362	345	330	316
608	568	533	502	475	450	428	408	389	372	357
674	630	592	558	527	500	475	453	433	414	397

Trip Fuel and Time Required

AIR DIST (NM)		LANDING WEIGHT (1000 LB)					TIME (HRS:MIN)
		90	110	130	150	170	
50	FUEL (1000 LB)	1.2	1.3	1.5	1.7	1.8	0:14
	ALT (FT)	11000	11000	9000	9000	7000	
100	FUEL (1000 LB)	1.9	2.1	2.3	2.5	2.7	0:23
	ALT (FT)	19000	17000	17000	17000	15000	
150	FUEL (1000 LB)	2.5	2.8	3.0	3.3	3.5	0:31
	ALT (FT)	25000	25000	23000	21000	21000	
200	FUEL (1000 LB)	3.0	3.3	3.7	4.0	4.3	0:38
	ALT (FT)	29000	27000	27000	25000	25000	
250	FUEL (1000 LB)	3.5	3.9	4.3	4.7	5.1	0:44
	ALT (FT)	39000	35000	31000	29000	27000	
300	FUEL (1000 LB)	3.9	4.4	4.9	5.3	5.8	0:51
	ALT (FT)	41000	39000	35000	33000	31000	
350	FUEL (1000 LB)	4.4	4.9	5.4	6.0	6.5	0:57
	ALT (FT)	41000	39000	37000	35000	31000	
400	FUEL (1000 LB)	4.8	5.4	6.0	6.6	7.2	1:03
	ALT (FT)	41000	41000	37000	35000	31000	
450	FUEL (1000 LB)	5.2	5.9	6.6	7.2	7.9	1:10
	ALT (FT)	41000	41000	37000	35000	31000	
500	FUEL (1000 LB)	5.7	6.4	7.1	7.9	8.7	1:17
	ALT (FT)	41000	41000	37000	35000	33000	

Based on 280/.78 climb, Long Range Cruise, and .78/280/250 descent.

Holding Planning

Flaps Up

WEIGHT (1000 LB)	TOTAL FUEL FLOW (LB/HR)								
	PRESSURE ALTITUDE (FT)								
	1500	5000	10000	15000	20000	25000	30000	35000	41000
190	6700	6590	6540	6500	6440	6490	6700		
180	6390	6270	6210	6170	6070	6110	6290		
170	6070	5960	5880	5840	5730	5740	5890	6240	
160	5760	5640	5560	5500	5400	5380	5510	5730	
150	5450	5330	5240	5170	5080	5010	5130	5280	
140	5130	5020	4930	4840	4770	4660	4770	4870	
130	4820	4710	4610	4520	4440	4330	4400	4480	
120	4520	4400	4300	4210	4120	4020	4040	4110	4440
110	4220	4090	3990	3900	3810	3800	3750	3800	4030
100	3910	3780	3750	3650	3560	3490	3440	3440	3620
90	3700	3570	3440	3340	3250	3180	3140	3100	3240

This table includes 5% additional fuel for holding in a racetrack pattern.

Flight Crew Oxygen Requirements

Required Pressure (PSI) for 76 Cubic FT Cylinder

BOTTLE TEMPERATURE		NUMBER OF CREW USING OXYGEN		
°C	°F	2	3	4
50	122	735	1055	1360
45	113	725	1040	1340
40	104	715	1020	1320
35	95	700	1005	1300
30	86	690	990	1280
25	77	680	975	1255
20	68	670	960	1240
15	59	655	940	1215
10	50	645	925	1195
5	41	635	910	1175
0	32	620	890	1150
-5	23	610	875	1130
-10	14	600	860	1110

Required Pressure (PSI) for 114/115 Cubic FT Cylinder

BOTTLE TEMPERATURE		NUMBER OF CREW USING OXYGEN		
°C	°F	2	3	4
50	122	530	735	945
45	113	520	725	930
40	104	510	715	915
35	95	505	700	900
30	86	495	690	885
25	77	485	680	870
20	68	480	670	860
15	59	470	655	840
10	50	460	645	830
5	41	455	635	815
0	32	445	620	800
-5	23	440	610	785
-10	14	430	600	770

ENGINE INOP

MAX CONTINUOUS THRUST

Net Level Off Weight

PRESSURE ALTITUDE (1000 FT)	LEVEL OFF WEIGHT (1000 LB)		
	ISA + 10°C & BELOW	ISA + 15°C	ISA + 20°C
30	96.7	93.8	90.5
28	104.7	101.4	98.1
26	113.2	109.5	106.1
24	122.7	118.7	114.8
22	133.6	129.0	124.5
20	145.3	140.0	134.7
18	156.2	150.3	144.1
16	166.8	160.9	154.5
14	176.4	171.0	165.5
12	187.0	180.6	173.7

Anti-Ice Adjustments

ANTI-ICE CONFIGURATION	LEVEL OFF WEIGHT ADJUSTMENT (1000 LB)								
	PRESSURE ALITITUDE (1000 FT)								
	12	14	16	18	20	22	24	26	28
ENGINE ONLY	-4.2	-3.9	-3.9	-3.8	-3.4	-3.2	-2.9	-2.7	-2.4
ENGINE & WING	-16.7	-15.6	-14.7	-14.6	-14.1	-12.8	-11.6	-10.7	

Performance Dispatch — Chapter PD
Landing — Section 82

Landing Field Limit Weight - Dry Runway
Based on anti-skid operative and automatic speedbrakes
Flaps 40
Wind Corrected Field Length (FT)

FIELD LENGTH AVAILABLE (FT)	WIND COMPONENT (KTS)							
	-15	-10	-5	0	10	20	30	40
3000			2720	3000	3220	3440	3660	3880
3400		2770	3100	3400	3630	3860	4080	4310
3800	2780	3130	3470	3800	4040	4270	4510	4740
4200	3120	3480	3850	4200	4440	4690	4930	5180
4600	3460	3840	4220	4600	4850	5100	5360	5610
5000	3800	4200	4600	5000	5260	5520	5780	6040
5400	4140	4560	4980	5400	5670	5940	6200	6470
5800	4480	4920	5350	5800	6080	6350	6630	6900
6200	4820	5270	5730	6200	6480	6770	7050	7340
6600	5160	5630	6100	6600	6890	7180	7480	7770
7000	5500	5990	6480	7000	7300	7600	7900	8200
7400	5840	6350	6850	7400	7710	8020	8320	8630
7800	6180	6700	7230	7800	8120	8430	8750	9060
8200	6520	7060	7610	8200	8520	8850	9170	9500
8600	6760	7300	7850	8600	8930	9260	9600	9930
9000	6970	7500	8050	9000	9340	9680	10020	10360
9400	7190	7700	8250	9400	9750	10100	10440	10790
9800	7400	7900	8450	9800	10160	10510	10870	
10200	7610	8100	8650	10200	10560	10930		
10600	7830	8300	8850	10600	10970			

Field Limit Weight (1000 LB)

WIND CORR'D FIELD LENGTH (FT)	AIRPORT PRESSURE ALTITUDE (FT)					
	0	2000	4000	6000	8000	10000
3800	102.3	96.3	90.3			
4200	119.6	113.9	107.0	100.3	94.0	87.9
4600	133.7	127.4	121.4	115.5	108.4	101.4
5000	147.8	140.5	133.6	127.1	120.9	114.7
5400	162.0	153.8	145.8	138.4	131.5	124.8
5800	174.0	166.1	157.5	149.0	141.0	133.6
6200	182.7	176.8	168.4	159.5	150.8	142.4
6600	190.1	184.3	178.5	169.7	160.5	151.6
7000		191.3	185.2	179.1	170.2	160.8
7400			192.0	185.7	179.2	169.8
7800				192.4	185.7	178.5
8200					192.2	184.0
8600						187.3
9000						190.5
9400						193.8

Decrease field limit weight by 12800 lb when using manual speedbrakes.

Landing Field Limit Weight - Dry Runway

Based on anti-skid inoperative and manual speedbrakes

Flaps 40

Wind Corrected Field Length (FT)

FIELD LENGTH AVAILABLE (FT)	WIND COMPONENT (KTS)							
	-15	-10	-5	0	10	20	30	40
6000				6000	6500	7000	7500	8000
6400				6400	6910	7420	7930	8440
6800			5970	6800	7320	7840	8360	8880
7200			6360	7200	7730	8260	8790	9320
7600		5880	6740	7600	8140	8680	9220	9760
8000		6250	7130	8000	8550	9100	9650	10200
8400	5730	6620	7510	8400	8960	9520	10080	10640
8800	6090	6990	7900	8800	9370	9940	10510	11080
9200	6440	7360	8280	9200	9780	10360	10940	11520
9600	6800	7730	8670	9600	10190	10780	11370	11960
10000	7150	8100	9050	10000	10600	11200	11800	12400
10400	7510	8470	9440	10400	11010	11620	12230	12840
10800	7860	8840	9820	10800	11420	12040	12660	13280
11200	8220	9210	10210	11200	11830	12460	13090	13720
11600	8570	9580	10590	11600	12240	12880	13520	14160
12000	8930	9950	10980	12000	12650	13300	13950	14600
12400	9280	10320	11360	12400	13060	13720	14380	15040
12800	9640	10690	11750	12800	13470	14140	14810	15480
13200	9990	11060	12130	13200	13880	14560	15240	15920
13600	10350	11430	12520	13600	14290	14980	15670	16360

Field Limit Weight (1000 LB)

WIND CORR'D FIELD LENGTH (FT)	AIRPORT PRESSURE ALTITUDE (FT)					
	0	2000	4000	6000	8000	10000
6800	89.9					
7200	97.8	91.3				
7600	105.8	98.8	90.8			
8000	113.7	106.3	97.9	91.2		
8400	121.6	113.8	105.0	97.9	91.1	
8800	129.5	121.1	112.1	104.5	97.4	90.4
9200	137.3	128.4	119.0	111.1	103.6	96.3
9600	145.3	135.7	125.8	117.5	109.6	102.0
10000	153.4	143.1	132.6	124.0	115.7	107.7
10400	161.5	150.7	139.4	130.3	121.7	113.4
10800	168.7	158.3	146.4	136.7	127.7	119.0
11200	175.3	165.4	153.5	143.0	133.6	124.6
11600	181.5	171.9	160.1	149.3	139.1	129.8
12000	187.7	178.1	166.7	155.6	144.9	135.0
12400	193.8	184.0	173.2	161.8	150.8	140.2
12800		189.8	179.1	168.0	156.7	145.7
13200			184.7	174.2	162.5	151.2
13600			190.3	179.9	168.4	156.7
14000				185.5	174.2	162.2
14400				191.1	179.9	167.6
14800					185.5	173.1
15200					191.1	178.5
15600						183.9
16000						189.3
16400						194.8

Landing Field Limit Weight - Wet Runway

Based on anti-skid operative and automatic speedbrakes

Flaps 40

Wind Corrected Field Length (FT)

FIELD LENGTH AVAILABLE (FT)	WIND COMPONENT (KTS)							
	-15	-10	-5	0	10	20	30	40
3000				3000	3240	3490	3730	3980
3400			3080	3400	3650	3900	4160	4410
3800		3090	3460	3800	4060	4320	4580	4840
4200	3050	3440	3830	4200	4470	4740	5000	5270
4600	3390	3800	4210	4600	4880	5150	5430	5700
5000	3730	4160	4590	5000	5280	5570	5850	6140
5400	4070	4520	4960	5400	5690	5980	6280	6570
5800	4410	4870	5340	5800	6100	6400	6700	7000
6200	4750	5230	5710	6200	6510	6820	7120	7430
6600	5090	5590	6090	6600	6920	7230	7550	7860
7000	5430	5950	6460	7000	7320	7650	7970	8300
7400	5770	6310	6840	7400	7730	8060	8400	8730
7800	6110	6660	7220	7800	8140	8480	8820	9160
8200	6450	7020	7590	8200	8550	8900	9240	9590
8600	6790	7380	7970	8600	8960	9310	9670	10020
9000	7130	7740	8340	9000	9360	9730	10090	10460
9400	7470	8090	8720	9400	9770	10140	10520	10890
9800	7730	8350	8980	9800	10180	10560	10940	11320
10200	7940	8550	9180	10200	10590	10980	11360	11750
10600	8150	8750	9380	10600	11000	11390	11790	12180

Field Limit Weight (1000 LB)

WIND CORR'D FIELD LENGTH (FT)	AIRPORT PRESSURE ALTITUDE (FT)					
	0	2000	4000	6000	8000	10000
4200	95.5	89.7				
4600	111.7	105.2	98.7	92.5	86.7	
5000	124.9	119.1	113.1	106.0	99.4	92.9
5400	137.0	130.6	124.3	118.3	111.8	104.6
5800	149.4	141.9	134.9	128.3	122.0	115.8
6200	161.7	153.5	145.5	138.1	131.3	124.6
6600	172.2	164.4	155.8	147.4	139.5	132.3
7000	180.6	173.9	165.3	156.5	148.0	139.9
7400	187.0	181.4	174.6	165.5	156.5	147.8
7800	193.5	187.5	181.6	174.3	165.0	155.8
8200		193.5	187.4	181.3	173.3	163.7
8600			193.3	187.0	180.5	171.6
9000				192.8	186.2	178.9
9400					191.8	183.7
9800						186.7
10200						189.5
10600						192.3

Decrease field limit weight by 12800 lb when using manual speedbrakes.

Landing Field Limit Weight - Wet Runway

Based on anti-skid inoperative and manual speedbrakes

Flaps 40

Wind Corrected Field Length (FT)

FIELD LENGTH AVAILABLE (FT)	WIND COMPONENT (KTS)							
	-15	-10	-5	0	10	20	30	40
6000					6550	7100	7660	8210
6400					6960	7520	8090	8650
6800				6800	7370	7950	8520	9090
7200				7200	7780	8370	8950	9530
7600			6650	7600	8190	8780	9380	9970
8000			7040	8000	8600	9200	9810	10410
8400		6450	7420	8400	9010	9630	10240	10850
8800		6820	7810	8800	9420	10040	10670	11290
9200		7190	8190	9200	9830	10470	11100	11730
9600	6540	7560	8580	9600	10240	10890	11530	12170
10000	6890	7930	8960	10000	10650	11310	11960	12610
10400	7250	8300	9350	10400	11060	11730	12390	13050
10800	7600	8670	9730	10800	11470	12150	12820	13490
11200	7960	9040	10120	11200	11880	12560	13250	13930
11600	8310	9410	10500	11600	12290	12980	13680	14370
12000	8670	9780	10890	12000	12700	13400	14110	14810
12400	9020	10150	11270	12400	13110	13830	14540	15250
12800	9380	10520	11660	12800	13520	14240	14970	15690
13200	9730	10890	12040	13200	13930	14660	15400	16130
13600	10090	11260	12430	13600	14340	15090	15830	16570

Landing Field Limit Weight - Wet Runway

Based on anti-skid inoperative and manual speedbrakes

Flaps 40

Field Limit Weight (1000 LB)

WIND CORR'D FIELD LENGTH (FT)	AIRPORT PRESSURE ALTITUDE (FT)					
	0	2000	4000	6000	8000	10000
7600	86.2					
8000	93.0	86.7				
8400	99.9	93.2	85.5			
8800	106.8	99.8	91.7	85.4		
9200	113.7	106.3	97.9	91.2		
9600	120.6	112.8	104.1	97.0	90.3	
10000	127.5	119.2	110.2	102.8	95.8	88.9
10400	134.3	125.6	116.3	108.5	101.2	94.0
10800	141.0	131.9	122.2	114.2	106.5	99.0
11200	148.1	138.3	128.2	119.8	111.7	104.0
11600	155.2	144.7	134.1	125.4	117.0	109.0
12000	162.1	151.4	140.0	130.9	122.2	113.9
12400	168.4	158.0	146.1	136.4	127.4	118.7
12800	174.2	164.2	152.3	141.9	132.6	123.6
13200	179.7	169.9	158.1	147.4	137.4	128.2
13600	185.0	175.6	163.9	152.9	142.3	132.7
14000	190.3	180.7	169.5	158.3	147.5	137.3
14400		185.7	175.0	163.7	152.6	141.8
14800		190.8	180.0	169.1	157.7	146.6
15200			184.9	174.4	162.8	151.4
15600			189.8	179.4	167.9	156.2
16000			194.6	184.3	172.9	161.0
16400				189.2	177.9	165.7
16800				194.0	182.8	170.5
17200					187.7	175.2
17600					192.6	179.9

Landing Climb Limit Weight
Valid for approach with flaps 15 and landing with flaps 40
Based on engine bleed for packs on and anti-ice off

AIRPORT OAT		AIRPORT LANDING CLIMB LIMIT WEIGHT (1000 LB)						
		AIRPORT PRESSURE ALTITUDE (FT)						
°C	°F	-2000	0	2000	4000	6000	8000	10000
54	129	148.9	140.3					
52	126	151.6	144.0					
50	122	154.4	147.5	136.2				
48	118	157.3	150.5	139.8				
46	115	160.3	153.2	143.0	132.0			
44	111	163.2	156.0	145.8	135.2			
42	108	166.1	158.7	148.4	138.3	127.0		
40	104	169.1	161.6	151.0	140.9	129.9		
38	100	172.0	164.4	153.7	143.3	132.7	121.0	
36	97	174.8	167.3	156.4	146.0	135.3	123.1	
34	93	176.9	170.3	159.2	148.6	137.6	125.2	115.1
32	90	177.8	173.5	162.0	150.9	139.7	127.5	117.4
30	86	178.0	175.8	164.4	152.9	141.7	129.7	119.6
28	82	178.2	176.7	166.4	154.6	143.5	131.7	121.5
26	79	178.4	176.9	167.9	156.1	144.8	133.6	123.3
24	75	178.5	177.0	168.5	157.3	145.8	135.1	124.7
22	72	178.7	177.2	168.6	158.2	146.9	136.2	125.8
20	68	178.9	177.3	168.7	158.6	147.9	137.1	126.8
18	64	179.0	177.4	168.8	158.6	148.6	137.9	127.6
16	61	179.2	177.6	168.9	158.7	148.9	138.7	128.4
14	57	179.3	177.7	169.0	158.8	149.0	139.4	129.1
12	54	179.5	177.8	169.1	158.9	149.0	139.6	129.9
10	50	179.6	178.0	169.2	158.9	149.1	139.6	130.5
-40	-40	181.2	179.2	170.3	160.2	150.1	140.5	131.9

With engine bleed for packs off, increase weight by 2700 lb.
With engine anti-ice on, decrease weight by 500 lb.
With engine and wing anti-ice on, decrease weight by 3100 lb.
When operating in icing conditions during any part of the flight with forecast landing temperature below 10°C, decrease weight by 16100 lb.

ENGINE INOP

ADVISORY INFORMATION

Go-Around Climb Gradient
Flaps 15
Based on engine bleed for packs on and anti-ice off

OAT (°C)	REFERENCE GO-AROUND GRADIENT (%) PRESSURE ALTITUDE (FT)					
	0	2000	4000	6000	8000	10000
54	3.08					
50	3.76	2.68				
46	4.28	3.35	2.28			
42	4.80	3.83	2.89	1.82		
38	5.33	4.31	3.35	2.36	1.26	
34	5.87	4.82	3.83	2.80	1.65	0.72
30	6.43	5.31	4.22	3.19	2.07	1.14
26	6.46	5.67	4.52	3.46	2.42	1.48
22	6.49	5.69	4.74	3.66	2.66	1.71
18	6.52	5.71	4.75	3.84	2.83	1.88
14	6.54	5.72	4.77	3.85	2.98	2.02
10	6.56	5.74	4.78	3.86	2.99	2.16
6	6.58	5.75	4.79	3.87	3.00	2.17
2	6.60	5.77	4.81	3.88	3.01	2.19

Gradient Adjustment for Weight (%)

WEIGHT (1000 LB)	REFERENCE GO-AROUND GRADIENT (%)							
	0	1	2	3	4	5	6	7
190	-2.95	-3.30	-3.66	-4.00	-4.35	-4.68	-5.01	-5.34
180	-2.59	-2.92	-3.24	-3.55	-3.86	-4.15	-4.44	-4.72
170	-2.21	-2.49	-2.77	-3.04	-3.30	-3.55	-3.79	-4.03
160	-1.77	-2.00	-2.23	-2.44	-2.65	-2.85	-3.05	-3.24
150	-1.27	-1.44	-1.60	-1.75	-1.90	-2.04	-2.18	-2.32
140	-0.69	-0.78	-0.87	-0.95	-1.03	-1.11	-1.18	-1.26
130	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
120	0.78	0.87	0.97	1.07	1.17	1.27	1.37	1.47
110	1.71	1.93	2.14	2.36	2.58	2.79	3.01	3.22
100	2.85	3.21	3.57	3.93	4.29	4.65	5.02	5.38

Gradient Adjustment for Speed (%)

SPEED (KIAS)	WEIGHT ADJUSTED GO-AROUND GRADIENT (%)										
	0	1	2	3	4	5	6	7	8	9	10
VREF40	-0.17	-0.17	-0.18	-0.18	-0.18	-0.18	-0.18	-0.18	-0.17	-0.17	-0.17
VREF40+5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
VREF40+10	0.11	0.10	0.10	0.10	0.10	0.11	0.12	0.13	0.15	0.17	0.20
VREF40+15	0.20	0.19	0.17	0.17	0.17	0.18	0.19	0.21	0.24	0.27	0.31
VREF40+20	0.27	0.24	0.22	0.21	0.20	0.20	0.21	0.23	0.25	0.28	0.32
VREF40+25	0.31	0.27	0.24	0.22	0.20	0.19	0.19	0.19	0.20	0.21	0.24
VREF40+30	0.33	0.28	0.23	0.20	0.16	0.13	0.11	0.09	0.08	0.07	0.06

With engine bleed for packs off, increase gradient by 0.4%.
With engine anti-ice on, decrease gradient by 0.1%.
With engine and wing anti-ice on, decrease gradient by 0.3%.
With operating in icing conditions during any part of the flight with forecast landing temperature below 10°C, decrease gradient by 1.2%.

Quick Turnaround Limit Weight - Category H Steel Brakes

Flaps 40

OAT		QUICK TURNAROUND LIMIT WEIGHT (1000 LB)						
		AIRPORT PRESSURE ALTITUDE (FT)						
°C	°F	-2000	0	2000	4000	6000	8000	10000
54	129	185.3	179.2					
50	122	186.4	180.3	174.2				
45	113	187.8	181.6	175.5	169.0			
40	104	189.4	183.1	176.8	170.4	163.5		
35	95	189.9	184.5	178.2	171.8	164.9	158.1	
30	86	189.9	186.0	179.6	173.2	166.3	159.4	152.7
25	77	189.9	187.5	181.1	174.6	167.7	160.8	154.0
20	68	189.9	189.1	182.6	176.0	169.1	162.2	155.3
15	59	189.9	189.9	184.1	177.4	170.6	163.6	156.7
10	50	189.9	189.9	185.6	178.9	172.2	165.1	158.1
5	41	189.9	189.9	187.2	180.5	173.7	166.6	159.6
0	32	189.9	189.9	188.9	182.1	175.3	168.2	161.1
-5	23	189.9	189.9	189.9	183.7	176.8	169.8	162.6
-10	14	189.9	189.9	189.9	185.4	178.4	171.4	164.2
-15	5	189.9	189.9	189.9	187.1	180.2	173.1	165.8
-20	-4	189.9	189.9	189.9	189.0	182.0	174.8	167.5
-30	-22	189.9	189.9	189.9	189.9	185.7	178.3	170.9
-40	-40	189.9	189.9	189.9	189.9	189.7	182.3	174.6
-50	-58	189.9	189.9	189.9	189.9	189.9	186.5	178.5
-54	-65	189.9	189.9	189.9	189.9	189.9	188.2	180.2

**Increase weight by 1700 lb per 1% uphill slope. Decrease weight by 2600 lb per 1% downhill slope.
Increase weight by 4100 lb per 10 knots headwind. Decrease weight by 17000 lb per 10 knots tailwind.
After landing at weights exceeding those shown above, adjusted for slope and wind, wait at least 67 minutes and check that wheel thermal plugs have not melted before executing a subsequent takeoff.**

**As an alternate procedure, ensure that each brake pressure plate temperature, without artificial cooling, is less than 218°C as follows:
No sooner than 10 and no later than 15 minutes after parking, measure each brake pressure plate surface temperature at a minimum of two points per brake by an accurate method (using a Doric Microtemp 450 hand held thermometer or equivalent, hold temperature probe in place for 20 seconds or until reading stabilizes). If each measured temperature is less than 218°C, immediate dispatch is allowed; otherwise the required minimum ground wait period of 67 minutes applies.**

If a Brake Temperature Monitoring System (BTMS) is installed:

**No sooner than 10 and no later than 15 minutes after parking, check the BRAKE TEMP light. If the BRAKE TEMP light is not on, no ground waiting period is required. If the BRAKE TEMP light is on, do not dispatch until at least 67 minutes after landing, or until all the BTMS readings on the systems Display are below 3.5 and the BRAKE TEMP light is off. Check that wheel thermal plugs have not melted before making a subsequent takeoff.
Note: If any brake temperature display digit is blank or indicates 0.0 or 0.1, then this method cannot be used.**

Quick Turnaround Limit Weight - Category P Carbon Brakes

Flaps 40

OAT		LIMIT WEIGHT (1000 LB)					
		AIRPORT PRESSURE ALTITUDE (FT)					
°C	°F	0	2000	4000	6000	8000	10000
54	129	166.9					
50	122	167.9	161.8				
45	113	169.2	163.1	156.5			
40	104	170.5	164.4	157.8	151.4		
35	95	171.8	165.7	159.1	152.7	146.3	
30	86	173.2	167.1	160.5	154.0	147.6	141.3
25	77	174.6	168.4	161.8	155.3	148.9	142.5
20	68	176.0	169.8	163.2	156.6	150.2	143.8
15	59	177.4	171.3	164.7	158.0	151.5	145.1
10	50	178.8	172.8	166.2	159.5	152.9	146.4
5	41	180.3	174.3	167.7	160.9	154.3	147.8
0	32	181.9	175.8	169.2	162.4	155.7	149.2
-5	23	183.5	177.3	170.8	163.9	157.2	150.6
-10	14	185.1	178.8	172.4	165.5	158.7	152.0
-15	5	186.7	180.4	174.1	167.1	160.3	153.5
-20	-4	188.5	182.1	175.8	168.8	161.9	155.1
-30	-22	190.0	185.5	179.1	172.3	165.3	158.3
-40	-40	190.0	189.4	182.7	176.0	168.8	161.7
-50	-58	190.0	190.0	186.5	179.7	172.7	165.4
-54	-65	190.0	190.0	188.0	181.3	174.2	166.9

**Increase weight by 1400 lb per 1% uphill slope. Decrease weight by 2700 lb per 1% downhill slope.
Increase weight by 3700 lb per 10 knots headwind. Decrease weight by 18400 lb per 10 knots tailwind.
After landing at weights exceeding those shown above, adjusted for slope and wind, wait at least 48 minutes and check that wheel thermal plugs have not melted before executing a takeoff.**

If a Brake Temperature Monitoring System (BTMS) is installed:

**No sooner than 10 and no later than 15 minutes after parking, check the BRAKE TEMP light. If the BRAKE TEMP light is not on, no ground waiting period is required. If the BRAKE TEMP light is on, do not dispatch until at least 48 minutes after landing, or until all the BTMS readings on the systems Display are below 3.0 and the BRAKE TEMP light is off. Check that wheel thermal plugs have not melted before making a subsequent takeoff.
Note: If any brake temperature display digit is blank or indicates 0.0 or 0.1, then this method cannot be used.**

Intentionally
Blank

Performance Dispatch — Chapter PD
Gear Down — Section 83

GEAR DOWN

Takeoff Climb Limit Weight
Flaps 5
Based on engine bleed for packs on and anti-ice off

AIRPORT OAT		TAKEOFF CLIMB WEIGHT (1000 LB)					
		AIRPORT PRESSURE ALTITUDE (FT)					
°C	°F	0	2000	4000	6000	8000	10000
54	129	137.5	129.6	122.3	114.1	102.5	
52	126	140.4	129.6	122.3	114.8	104.7	
50	122	143.5	130.2	122.3	114.8	106.7	95.4
48	118	146.8	133.3	122.1	114.8	106.9	97.4
46	115	149.9	136.2	123.0	114.8	106.9	99.2
44	111	153.0	139.1	125.8	114.6	106.9	100.5
42	108	155.8	142.1	128.7	115.5	106.9	100.5
40	104	158.7	145.0	131.6	118.3	106.7	100.3
38	100	161.8	147.9	134.4	121.0	107.5	100.3
36	97	164.4	150.5	137.1	123.8	110.4	100.3
34	93	167.3	153.4	139.7	126.5	113.0	101.1
32	90	170.6	156.0	142.4	129.1	115.7	103.8
30	86	173.7	159.3	145.2	131.8	118.3	106.4
28	82	176.5	162.7	148.1	134.4	121.0	109.1
26	79	176.8	166.0	151.2	137.3	123.6	111.7
24	75	176.8	166.8	154.3	139.9	126.5	114.6
22	72	177.0	167.1	156.0	142.8	129.1	117.2
20	68	177.0	167.1	156.3	145.2	131.8	119.9
18	64	177.2	167.1	156.3	145.9	134.4	122.3
16	61	177.2	167.3	156.5	146.1	135.8	123.2
14	57	177.4	167.3	156.5	146.1	136.4	123.8
12	54	177.4	167.5	156.5	146.1	136.4	124.7
10	50	177.6	167.5	156.7	146.3	136.6	125.4
-40	-40	178.7	168.4	157.6	147.7	138.0	126.5

With engine bleeds for packs off, increase weight by 600 lb.
With engine anti-ice on, decrease weight by 500 lb.
With engine and wing anti-ice on, decrease weight by 11700 lb (optional system).

GEAR DOWN

Landing Climb Limit Weight

Valid for approach with Flaps 15 and landing with Flaps 40

Based on engine bleed for packs on and anti-ice off

AIRPORT OAT		LANDING CLIMB LIMIT WEIGHT (1000 LB)					
		AIRPORT PRESSURE ALTITUDE (FT)					
°C	°F	0	2000	4000	6000	8000	10000
54	129	127.6					
52	126	130.9					
50	122	134.2	123.8				
48	118	136.8	127.1				
46	115	139.2	130.2	119.9			
44	111	141.6	132.5	122.8			
42	108	144.2	134.8	125.8	115.3		
40	104	146.8	137.1	128.0	117.9		
38	100	149.4	139.5	130.2	120.6	109.8	
36	97	152.0	141.8	132.5	122.8	111.7	
34	93	154.6	144.6	134.9	124.9	113.5	104.4
32	90	157.4	147.0	137.1	126.8	115.7	106.5
30	86	160.0	149.2	138.6	128.6	117.7	108.5
28	82	160.2	151.0	140.2	130.3	119.5	110.2
26	79	160.4	152.7	141.5	131.3	121.1	111.9
24	75	160.5	152.8	142.6	132.2	122.6	113.0
22	72	160.6	152.9	143.6	133.1	123.4	114.0
20	68	160.7	153.0	143.7	134.0	124.2	114.9
18	64	160.9	153.1	143.8	134.8	125.0	115.6
16	61	161.0	153.2	143.9	134.9	125.7	116.3
14	57	161.1	153.3	143.9	135.0	126.4	117.0
12	54	161.2	153.4	144.0	135.0	126.5	117.7
10	50	161.3	153.4	144.0	135.1	126.5	118.4
-40	-40	162.4	154.5	145.1	135.9	127.3	119.5

With engine bleed for packs off, increase weight by 2700 lb.
With engine anti-ice on, decrease weight by 500 lb.
With engine and wing anti-ice on, decrease weight by 2800 lb.
When operating in icing conditions during any part of the flight with forecast landing temperature below 10’C, decrease weight by 16900 lb.

GEAR DOWN

Takeoff Obstacle Limit Weight
Flaps 5
Sea Level, 30°C & Below, Zero Wind
Based on engine bleed for packs on and anti-ice off
Reference Obstacle Limit Weight (1000 LB)

OBSTACLE HEIGHT (FT)	REFERENCE OBSTACLE LIMIT WEIGHT (1000 LB) DISTANCE FROM BRAKE RELEASE (1000 FT)								
	8	10	12	14	16	18	20	22	24
10	162.7								
50	151.2	166.0	175.8						
100	141.2	155.3	165.5	173.0					
150	133.7	147.2	157.5	165.3	171.2	175.5			
200	127.5	140.5	150.8	158.8	165.0	170.0	173.8	176.8	
250	122.1	134.9	145.1	153.2	159.7	164.9	169.1	172.5	175.2
300	117.3	130.0	140.0	148.2	154.9	160.3	164.7	168.4	171.4
350	112.9	125.6	135.6	143.7	150.5	156.1	160.7	164.5	167.8
400	109.0	121.5	131.5	139.7	146.5	152.2	156.9	161.0	164.4
450	105.4	117.8	127.8	136.0	142.7	148.5	153.4	157.6	161.2
500	102.1	114.4	124.3	132.5	139.3	145.2	150.2	154.4	158.1
550	99.0	111.2	121.1	129.3	136.2	142.0	147.1	151.4	155.2
600	96.1	108.2	118.1	126.3	133.2	139.1	144.1	148.6	152.5
650	93.3	105.4	115.2	123.4	130.3	136.3	141.4	145.9	149.8
700	90.8	102.8	112.5	120.7	127.7	133.6	138.8	143.3	147.3
750		100.3	110.0	118.2	125.1	131.1	136.3	140.8	144.9
800		97.9	107.6	115.7	122.7	128.7	133.9	138.5	142.6
850		95.6	105.3	113.4	120.4	126.4	131.7	136.3	140.4
900		93.5	103.1	111.2	118.2	124.2	129.5	134.2	138.3
950		91.4	101.0	109.1	116.1	122.1	127.4	132.1	136.3
1000			99.0	107.1	114.0	120.1	125.4	130.1	134.3

Obstacle height must be calculated from lowest point of the runway to conservatively account for runway slope.

OAT Adjustments

OAT (°C)	REFERENCE OBSTACLE LIMIT WEIGHT (1000 LB)									
	90	100	110	120	130	140	150	160	170	180
30 & BELOW	0	0	0	0	0	0	0	0	0	0
32	-1.3	-1.5	-1.7	-1.9	-2.1	-2.3	-2.5	-2.7	-2.8	-3.0
34	-2.7	-3.0	-3.4	-3.8	-4.2	-4.6	-4.9	-5.3	-5.7	-6.1
36	-4.0	-4.6	-5.1	-5.7	-6.3	-6.8	-7.4	-8.0	-8.5	-9.1
38	-5.3	-6.1	-6.8	-7.6	-8.4	-9.1	-9.9	-10.6	-11.4	-12.1
40	-6.7	-7.6	-8.5	-9.5	-10.4	-11.4	-12.3	-13.3	-14.2	-15.2
42	-8.0	-9.1	-10.2	-11.4	-12.5	-13.6	-14.7	-15.8	-17.0	-18.1
44	-9.4	-10.6	-11.9	-13.2	-14.5	-15.8	-17.1	-18.4	-19.7	-21.0
46	-10.7	-12.2	-13.6	-15.1	-16.5	-18.0	-19.5	-20.9	-22.4	-23.8
48	-12.1	-13.7	-15.3	-16.9	-18.6	-20.2	-21.8	-23.5	-25.1	-26.7
50	-13.4	-15.2	-17.0	-18.8	-20.6	-22.4	-24.2	-26.0	-27.8	-29.6

GEAR DOWN

Takeoff Obstacle Limit Weight

Flaps 5

Pressure Altitude Adjustments

ALT (FT)	OAT ADJUSTED OBSTACLE LIMIT WEIGHT (1000 LB)									
	90	100	110	120	130	140	150	160	170	180
S.L. & BELOW	0	0	0	0	0	0	0	0	0	0
1000	-3.6	-4.0	-4.4	-4.8	-5.2	-5.6	-6.0	-6.4	-6.8	-7.2
2000	-7.3	-8.1	-8.9	-9.7	-10.5	-11.3	-12.1	-12.9	-13.7	-14.5
3000	-9.9	-11.0	-12.2	-13.3	-14.5	-15.6	-16.8	-17.9	-19.1	-20.2
4000	-12.5	-14.0	-15.5	-17.0	-18.5	-20.0	-21.5	-23.0	-24.5	-26.0
5000	-15.6	-17.4	-19.2	-21.0	-22.8	-24.6	-26.4	-28.2	-30.1	-31.9
6000	-18.6	-20.8	-22.9	-25.0	-27.1	-29.2	-31.4	-33.5	-35.6	-37.8
7000	-21.6	-24.1	-26.6	-29.1	-31.6	-34.0	-36.5	-39.0	-41.5	-44.0
8000	-24.7	-27.5	-30.3	-33.2	-36.0	-38.8	-41.7	-44.5	-47.3	-50.2
9000	-27.7	-30.9	-34.2	-37.4	-40.6	-43.8	-47.0	-50.2	-53.5	-56.7
10000	-30.8	-34.4	-38.0	-41.6	-45.2	-48.8	-52.4	-56.0	-59.6	-63.2

Wind Adjustments

WIND (KTS)	OAT & ALT ADJUSTED OBSTACLE LIMIT WEIGHT (1000 LB)									
	90	100	110	120	130	140	150	160	170	180
15 TW	-10.4	-11.4	-12.5	-13.6	-14.6	-15.7	-16.7	-17.8	-18.9	-19.9
10 TW	-6.9	-7.6	-8.3	-9.0	-9.7	-10.5	-11.2	-11.9	-12.6	-13.3
5 TW	-3.5	-3.8	-4.2	-4.5	-4.9	-5.2	-5.6	-5.9	-6.3	-6.6
0	0	0	0	0	0	0	0	0	0	0
10 HW	2.4	2.2	2.1	2.0	1.9	1.8	1.6	1.5	1.4	1.2
20 HW	4.8	4.5	4.2	4.0	3.8	3.5	3.2	3.0	2.8	2.5
30 HW	7.1	6.8	6.4	6.0	5.6	5.2	4.9	4.5	4.1	3.8
40 HW	9.5	9.0	8.5	8.0	7.5	7.0	6.5	6.0	5.5	5.0

With engine bleed for packs off, increase weight by 500 lb.
With engine anti-ice on, decrease weight by 4300 lb.
With engine and wing anti-ice on, decrease weight by 16300 lb (optional system).

GEAR DOWN

Long Range Cruise Altitude Capability

Max Cruise Thrust, 100 ft/min residual rate of climb

WEIGHT (1000 LB)	PRESSURE ALTITUDE (FT)		
	ISA + 10°C & BELOW	ISA + 15°C	ISA + 20°C
190	14400	11200	8200
180	16900	14100	11000
170	19600	16800	14000
160	22000	19400	16700
150	24300	22200	19300
140	26500	25000	22400
130	28800	27300	25500
120	30800	29700	28100
110	32700	31700	30500
100	34700	33700	32600
90	36900	35900	34800

GEAR DOWN

Long Range Cruise Trip Fuel and Time

Ground to Air Miles Conversion

AIR DISTANCE (NM)					GROUND DISTANCE (NM)	AIR DISTANCE (NM)				
HEADWIND COMPONENT (KTS)						TAILWIND COMPONENT(KTS)				
100	80	60	40	20		20	40	60	80	100
323	288	259	236	217	200	187	175	165	156	148
483	432	389	354	325	300	280	263	247	234	222
642	575	518	471	433	400	374	351	330	312	296
800	718	646	589	542	500	468	438	412	390	370
957	859	774	706	650	600	561	526	495	468	444
1113	1000	902	823	758	700	655	615	578	546	519
1268	1140	1029	940	865	800	749	703	661	625	593
1422	1280	1156	1056	973	900	843	791	745	704	668
1576	1419	1283	1173	1081	1000	937	879	828	783	743
1729	1558	1410	1289	1189	1100	1031	968	911	862	818
1881	1697	1536	1405	1296	1200	1125	1056	995	941	894
2033	1835	1662	1521	1404	1300	1218	1145	1079	1020	969
2184	1972	1788	1637	1511	1400	1313	1233	1162	1100	1045
2334	2109	1913	1753	1619	1500	1407	1322	1246	1179	1121
2483	2245	2038	1868	1726	1600	1501	1411	1330	1259	1197
2632	2381	2163	1984	1833	1700	1595	1500	1414	1339	1273
2780	2517	2287	2099	1940	1800	1689	1589	1499	1419	1349
2927	2652	2411	2214	2047	1900	1784	1678	1583	1499	1426
3074	2786	2535	2328	2154	2000	1878	1767	1668	1579	1502

Reference Fuel and Time Required

AIR DIST (NM)	PRESSURE ALTITUDE (1000 FT)							
	10		14		20		24	
	FUEL (1000 LB)	TIME (HR:MIN)	FUEL (1000 LB)	TIME (HR:MIN)	FUEL (1000 LB)	TIME (HR:MIN)	FUEL (1000 LB)	TIME (HR:MIN)
200	6.3	0:50	6.0	0:49	5.7	0:47	5.6	0:46
300	9.3	1:13	8.8	1:10	8.2	1:07	7.9	1:05
400	12.2	1:36	11.6	1:32	10.7	1:26	10.3	1:23
500	15.3	1:58	14.4	1:53	13.3	1:45	12.7	1:41
600	18.3	2:20	17.3	2:13	15.9	2:05	15.1	2:00
700	21.4	2:41	20.2	2:34	18.5	2:24	17.6	2:18
800	24.6	3:03	23.1	2:55	21.1	2:42	20.1	2:36
900	27.7	3:24	26.1	3:15	23.8	3:01	22.6	2:54
1000	30.9	3:46	29.1	3:35	26.5	3:20	25.2	3:11
1100	34.2	4:07	32.1	3:55	29.3	3:38	27.8	3:29
1200	37.4	4:27	35.2	4:15	32.0	3:56	30.4	3:47
1300	40.8	4:48	38.3	4:34	34.8	4:15		
1400	44.1	5:09	41.4	4:54	37.6	4:33		
1500	47.5	5:29	44.6	5:13	40.5	4:51		
1600	50.9	5:49	47.8	5:32	43.4	5:08		
1700	54.4	6:09	51.0	5:51	46.3	5:26		
1800	57.9	6:28	54.3	6:10	49.3	5:44		
1900	61.5	6:48	57.6	6:28				
2000	65.0	7:07	61.0	6:47				

GEAR DOWN

Long Range Cruise Trip Fuel and Time

Fuel Required Adjustments (1000 LB)

REFERENCE FUEL REQUIRED (1000 LB)	LANDING WEIGHT (1000 LB)				
	90	110	130	150	170
5	-0.9	-0.5	0.0	0.5	1.0
10	-1.6	-0.8	0.0	0.9	1.8
15	-2.4	-1.2	0.0	1.3	2.6
20	-3.2	-1.6	0.0	1.7	3.5
25	-4.0	-2.0	0.0	2.2	4.3
30	-4.7	-2.4	0.0	2.6	5.1
35	-5.5	-2.7	0.0	3.0	5.9
40	-6.3	-3.1	0.0	3.4	6.7
45	-7.0	-3.5	0.0	3.8	7.5
50	-7.8	-3.9	0.0	4.2	8.3
55	-8.6	-4.3	0.0	4.6	9.1
60	-9.4	-4.7	0.0	5.0	9.9
65	-10.1	-5.1	0.0	5.4	10.7
70	-10.9	-5.5	0.0	5.8	11.5

Based on VREF40 + 70 climb, Long Range Cruise and VREF40 + 70 descent.

GEAR DOWN

Holding Planning

Flaps Up

WEIGHT (1000 LB)	TOTAL FUEL FLOW (LB/HR)							
	PRESSURE ALTITUDE (FT)							
	1500	5000	10000	15000	20000	25000	30000	35000
190	10100	10040	10020	10100				
180	9580	9520	9470	9520	9600			
170	9070	9000	8940	8960	9000			
160	8580	8500	8430	8420	8430			
150	8100	8000	7930	7890	7870	8000		
140	7630	7520	7440	7370	7330	7400		
130	7170	7040	6950	6870	6810	6830	7170	
120	6700	6580	6470	6390	6300	6300	6480	
110	6230	6130	6000	5920	5810	5790	5890	
100	5770	5670	5560	5450	5330	5280	5360	5600
90	5330	5230	5130	5020	4900	4810	4870	4950

This table includes 5% additional fuel for holding in a racetrack pattern.

GEAR DOWN

ENGINE INOP

MAX CONTINUOUS THRUST

Net Level Off Weight

PRESSURE ALTITUDE (1000 FT)	LEVEL OFF WEIGHT (1000 LB)		
	ISA + 10°C & BELOW	ISA + 15°C	ISA + 20°C
30	96.7	93.8	90.5
28	104.7	101.4	98.1
26	113.2	109.5	106.1
24	122.7	118.7	114.8
22	133.6	129.0	124.5
20	145.3	140.0	134.7
18	156.2	150.3	144.1
16	166.8	160.9	154.5
14	176.4	171.0	165.5
12	187.0	180.6	173.7

Anti-Ice Adjustments

ANTI-ICE CONFIGURATION	LEVEL OFF WEIGHT ADJUSTMENT (1000 LB)								
	PRESSURE ALITITUDE (1000 FT)								
	12	14	16	18	20	22	24	26	28
ENGINE ONLY	-4.2	-3.9	-3.9	-3.8	-3.4	-3.2	-2.9	-2.7	-2.4
ENGINE & WING	-16.7	-15.6	-14.7	-14.6	-14.1	-12.8	-11.6	-10.7	

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Performance Dispatch — Chapter PD

Text — Section 84

Introduction

This chapter contains self dispatch performance data intended primarily for use by flight crews in the event that information cannot be obtained from the airline dispatch office. The takeoff data provided is for a single takeoff flap at max takeoff thrust. The range of conditions covered is limited to those normally encountered in airline operation. In the event of conflict between the data presented in this chapter and that contained in the approved Airplane Flight Manual, the Flight Manual shall always take precedence.

Takeoff

The maximum allowable takeoff weight will be the least of the Field, Climb, Obstacle, Brake Energy and Tire Speed Limit Weights as determined from the tables shown.

Brake Energy or Tire Speed Limit Weight tables are only provided if they are limiting for the range of conditions covered in the FCOM Section PD.

Field Limit Weight - Slope and Wind Corrections

These tables for dry and wet runways provide corrections to the field length available for the effects of runway slope and wind component along the runway. Enter the appropriate table with the available field length and runway slope to determine the slope corrected field length. Next enter the appropriate table with slope corrected field length and wind component to determine the slope and wind corrected field length.

Field and Climb Limit Weight

Tables are presented for selected airport pressure altitudes and runway conditions and show both Field and Climb Limit Weights. Enter the appropriate table for pressure altitude and runway condition with “Slope and Wind Corrected Field Length” determined above and airport OAT to obtain Field Limit Weight. Also read Climb Limit Weight for the same OAT. Intermediate altitudes may be interpolated or use next higher altitude. When finding a maximum weight for a wet runway, the dry runway limit weight must also be determined and the lower of the two weights used.

Obstacle Limit Weight

The Reference Obstacle Limit Weight table provides obstacle limit weights for reference airport conditions based on obstacle height above the runway surface and distance from brake release. Enter the adjustment tables to adjust the reference Obstacle Limit Weight for the effects of OAT, pressure altitude and wind as indicated. In the case of multiple obstacles, enter the tables successively with each obstacle and determine the most limiting weight.

Tire Speed Limit

Tire Speed Limit Weight tables are only provided if they are limiting for the range of conditions covered in the FCOM Section PD.

Maximum tire speed limited weights are presented for 225 MPH tires. To determine the tire speed limit weight, enter the table with OAT and airport pressure altitude. Adjust the tire speed limit weight according to the notes below the table to account for wind.

Brake Energy Limit VMBE

Brake Energy Limit Weight tables are only provided if they are limiting for the range of conditions covered in the FCOM Section PD.

The Maximum Brake Energy Speed table provides the Reference VMBE for a variety of airport pressure altitudes and temperatures. Enter the Weight Adjusted VMBE table to adjust the Reference VMBE for the actual brake release gross weight. Correct VMBE for slope and wind. If V1 exceeds VMBE, decrease brake release weight as indicated for each knot that V1 exceeds VMBE and determine V1, VR, and V2 for the lower brake release weight.

Enroute

Long Range Cruise Maximum Operating Altitude

These tables provide the maximum operating altitude in the same manner as the FMC. Maximum altitudes are shown for a given cruise weight and maneuver capability. Note that this table considers both thrust and buffet limits, providing the more limiting of the two. Any data that is thrust limited is denoted by an asterisk and represents only a thrust limited condition in level flight with 100 ft/min residual rate of climb. Flying above these altitudes with sustained banks in excess of approximately 15° may cause the airplane to lose speed and/or altitude. The altitudes shown in the table are limited to the maximum certified altitude of 41000 ft.

Long Range Cruise Trip Fuel and Time

Long Range Cruise Trip Fuel and Time tables are provided to determine trip time and fuel required to destination.

To determine trip fuel and time for a constant altitude cruise, first enter the Ground to Air Miles Conversion table to convert ground distance and enroute wind to an equivalent still air distance for use with the Reference Fuel and Time tables. Next, enter the Reference Fuel and Time table with air distance from the Ground to Air Miles Conversion table and the desired altitude and read Reference Fuel and Time Required. Lastly, enter the Fuel Required Adjustment table with the Reference Fuel and the planned landing weight to obtain the adjustment to the fuel required at the planned landing weight.

Long Range Cruise Step Climb Trip Fuel and Time

The Long Range Cruise Step Climb Trip Fuel and Time tables are provided to determine trip time and fuel required to destination when flying a step climb profile. Step climb profiles are based on 4000 ft step climbs to keep the flight within 2000 ft of the optimum altitude for the current cruise weight. To determine trip fuel and time, enter the Ground to Air Miles Conversion table and determine air distance as discussed above. Then enter the Trip Fuel and Time Required table with air distance and planned landing weight to read trip fuel. Continue across the table to read trip time.

Short Trip Fuel and Time

These tables are provided to determine trip fuel and time for short distances or alternates. Obtain air distance from the table using the ground distance and wind component to the alternate. Enter the Trip Fuel and Time Required table with air distance and read trip fuel required for the expected landing weight, together with time to alternate at right. For distances greater than shown or other altitudes, use the Long Range Cruise Trip Fuel and Time tables.

Holding Planning

This table provides total fuel flow information necessary for planning flaps up holding and reserve fuel requirements. Data is based on the FMC holding speed schedule which is the higher of the maximum endurance and flaps up maneuver speeds. As noted, the fuel flow is based on flight in a racetrack holding pattern. For holding in straight and level flight, reduce table values by 5%.

Flight Crew Oxygen Requirements

This airplane is equipped with a chemical passenger oxygen system. Regulations require that sufficient oxygen be provided to the flight crew to account for the greater of supplemental breathing oxygen in the event of a cabin depressurization or protective breathing in the event of smoke or harmful fumes in the flight deck. The oxygen quantity associated with the above requirements is achieved with the minimum dispatch oxygen cylinder pressure.

To determine the minimum dispatch oxygen cylinder pressure enter the appropriate flight crew oxygen table with the number of crew plus observers using oxygen and read the minimum cylinder pressure required for the appropriate cylinder temperature.

Net Level Off Weight

The Net Level Off Weight table is provided to determine terrain clearance capability in straight and level flight following an engine failure. Regulations require terrain clearance planning based on net performance which is the gross (or actual) gradient performance degraded by 1.1%. In addition, the net level off pressure altitude must clear the terrain by 1000 ft.

To determine the maximum weight for terrain clearance, enter the table with required net level off pressure altitude and expected ISA deviation to obtain weight. Adjust weight for anti-ice operation as noted below the table.

Landing

Tables are provided for determining the maximum landing weight as limited by field length or climb requirements for a single landing flap.

Maximum landing weight is the lowest of the field length limit weight, climb limit weight, or maximum certified landing weight.

Landing Field Limit Weight

For the expected runway condition and anti-skid system configuration, obtain wind corrected field length by entering the Wind Corrected Field Length table with field length available and wind component along the runway. Now enter the Field Limit Weight table with wind corrected field length and pressure altitude to read field limit weight.

Landing Climb Limit Weight

Enter the table with airport OAT and pressure altitude to read landing climb limit weight. Apply the noted adjustments as required.

Go-Around Climb Gradient

Enter the Reference Go-Around Gradient table with airport OAT and pressure altitude to determine the reference go-around gradient. Then adjust the reference gradient for airplane weight and speed using the tables provided to determine the weight and speed adjusted go-around gradient. Apply the necessary corrections for engine bleed configuration and icing conditions as noted.

Quick Turnaround Limit Weight

Enter the appropriate table (Steel or Carbon Brakes) with airport pressure altitude and OAT to read maximum quick turnaround weight. Apply the noted adjustments as required.

If the landing weight exceeds the maximum quick turnaround weight, wait the specified time and then check that the wheel thermal plugs have not melted before executing a subsequent takeoff. For Steel Brakes, the alternate procedures on the charts can be used to ensure the brake temperature is within limits. These procedures cannot be used for carbon brakes.

Gear Down

This section provides flight planning data for revenue operation with gear down. Unless otherwise noted, the gear down tables in this section are identical in format and usage to the corresponding gear up tables previously described.

To eliminate erroneous displays the flight crew should enter only gross weight data on the PERF INIT page of the Control Display Unit (CDU). Omission of the cost index and cruise altitude entries on the PERF INIT page will render the VNAV function unavailable during flight. As a result, the following information will not be provided: VNAV guidance and speed schedules, trip fuel and ETA predictions, optimum and maximum altitude data, step climb and top of descent predictions, and the VNAV descent guidance path.

The gross weight entry allows the FMCS takeoff and approach speed schedules to be generated. In addition, the flap maneuver speed and VREF speed bugs will be available for display on the primary flight display speed tape. Except for VNAV, normal autopilot and autothrottle modes will remain available for use during the flight, as will the LNAV mode.

Takeoff/Landing Climb Limit Weight

Enter the appropriate table with airport OAT and pressure altitude to determine Takeoff/Landing Climb Limit Weight with gear down. Correct the weight obtained for engine bleed configuration as required.

Performance Inflight — Chapter PI

Table of Contents — Section TOC

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Performance Inflight — Chapter PI
Table of Contents — Section 10

737-600 CFM56-7B22 KG FAA CATD

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Performance Inflight — Chapter PI
Pkg Model Identification — Section 10

General

The table below shows the airplanes that have been identified with the following performance package. Note, some airplanes may be identified with more than one performance package. This configuration table information reflects the Boeing delivered configuration updated for service bulletin incorporations in conformance with the policy stated in the introduction section of the FCOM. The performance data is prepared for the owner/operator named on the title page. The intent of this information is to assist flight crews and airlines in knowing which performance package is applicable to a given airplane. The performance package model identification information is based on Boeing's knowledge of the airline's fleet at a point in time approximately three months prior to the page date. Notice of Errata (NOE) will not be provided to airlines to identify airplanes that are moved between performance packages within this manual or airplanes added to the airline's fleet whose performance packages are already represented in this manual. These types of changes will be updated in the next block revision. Owners/operators are responsible for ensuring the operational documentation they are using is complete and matches the current configuration of their airplanes, and the accuracy and validity of all information furnished by the owner/operator or any other party. Owners/operators receiving active revision service are responsible to ensure that any modifications to the listed airplanes are properly reflected in this manual.

Serial and tabulation number are supplied by Boeing.

Registry Number	Serial Number	Tabulation Number
YX600	YX600	YX600

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Performance Inflight — Chapter PI
General — Section 10

Takeoff Speeds - Dry Runway
V1, VR, V2 for Max Takeoff Thrust

WEIGHT (1000 KG)	FLAPS 1			FLAPS 5			FLAPS 10			FLAPS 15			FLAPS 25		
	V1	VR	V2	V1	VR	V2	V1	VR	V2	V1	VR	V2	V1	VR	V2
72	142	143	149	138	139	146									
68	137	138	145	134	134	142	129	129	135	126	126	133	125	125	132
64	133	134	141	129	130	138	124	125	132	121	122	129	120	121	128
60	127	128	136	124	125	134	119	120	128	117	117	125	116	116	124
56	122	122	132	118	119	129	114	114	123	112	112	121	111	111	120
52	116	117	127	112	113	124	108	109	119	106	107	117	105	106	115
48	110	111	122	106	107	119	103	103	114	101	101	112	100	101	111
44	104	105	117	100	101	114	97	97	110	95	96	108	94	95	107
40	98	99	112	94	95	109	91	92	105	90	90	103	89	90	102

Check V1(MCG).

V1, VR, V2 Adjustments*

TEMP		V1							VR							V2						
		PRESS ALT (1000 FT)							PRESS ALT (1000 FT)							PRESS ALT (1000 FT)						
°C	°F	-2	0	2	4	6	8	10	-2	0	2	4	6	8	10	-2	0	2	4	6	8	10
70	158	6	7						6	7						-1	-1					
60	140	5	6	7	8				4	5	6	7				-1	-1	-1	-1			
50	122	3	4	5	6	7	9	10	3	4	5	6	7	9	10	0	0	0	-1	-1	-1	-1
40	104	1	2	3	4	6	7	9	1	2	3	4	6	7	9	0	0	0	0	0	0	0
30	86	0	0	1	3	4	6	7	0	0	1	3	4	6	7	0	0	0	0	0	0	0
20	68	0	0	1	1	3	4	6	0	0	1	1	3	4	6	0	0	0	0	0	0	0
-60	-76	0	0	1	1	2	3	4	0	0	1	1	2	3	5	0	0	0	0	0	0	1

Slope and Wind V1 Adjustments*

WEIGHT (1000 KG)	SLOPE (%)					WIND (KTS)							
	-2	-1	0	1	2	-15	-10	-5	0	10	20	30	40
72	-3	-1	0	1	1	-2	-1	-1	0	0	1	1	1
68	-3	-1	0	1	1	-2	-1	-1	0	0	1	1	1
64	-3	-1	0	1	1	-2	-1	-1	0	0	1	1	1
60	-2	-1	0	1	1	-2	-1	-1	0	0	1	1	1
56	-2	-1	0	1	1	-2	-1	-1	0	0	1	1	1
52	-2	-1	0	1	1	-2	-1	0	0	0	1	1	1
48	-1	-1	0	1	1	-2	-1	0	0	0	1	1	1
44	-1	0	0	1	1	-2	-1	0	0	0	1	1	1
40	0	0	0	1	1	-2	-1	0	0	0	1	1	1

***V1 not to exceed VR.**

V1(MCG)
Max Takeoff Thrust

TEMP		PRESSURE ALTITUDE (FT)						
°C	°F	-2000	0	2000	4000	6000	8000	10000
70	158	100	98					
60	140	100	98	96	95			
50	122	102	100	97	95	93	91	89
40	104	107	105	101	98	94	91	89
30	86	110	110	106	102	98	94	91
20	68	110	110	108	106	103	98	94
-60	-76	112	111	109	107	105	102	99

Takeoff Speeds - Wet Runway

V1, VR, V2 for Max Takeoff Thrust

WEIGHT	FLAPS 1			FLAPS 5			FLAPS 10			FLAPS 15			FLAPS 25		
(1000 KG)	V1	VR	V2	V1	VR	V2	V1	VR	V2	V1	VR	V2	V1	VR	V2
72	136	143	149	131	139	146									
68	131	138	145	126	134	142	123	129	135	122	126	133	122	125	132
64	126	134	141	121	130	138	118	125	132	117	122	129	116	121	128
60	120	128	136	116	125	134	113	120	128	111	117	125	110	116	124
56	114	122	132	110	119	129	107	114	123	105	112	121	104	111	120
52	108	117	127	104	113	124	101	109	119	100	107	117	99	106	115
48	101	111	122	98	107	119	95	103	114	94	101	112	93	101	111
44	95	105	117	92	101	114	89	97	110	88	96	108	87	95	107
40	89	99	112	85	95	109	83	92	105	82	90	103	81	90	102

Check V1(MCG).

V1, VR, V2 Adjustments*

TEMP		V1							VR							V2						
		PRESS ALT (1000 FT)							PRESS ALT (1000 FT)							PRESS ALT (1000 FT)						
°C	°F	-2	0	2	4	6	8	10	-2	0	2	4	6	8	10	-2	0	2	4	6	8	10
70	158	9	10						6	7						-1	-1					
60	140	7	7	9	10				4	5	6	7				-1	-1	-1	-1			
50	122	4	5	6	8	9	12	13	3	4	5	6	7	9	10	0	0	0	-1	-1	-1	-1
40	104	1	2	4	5	7	9	11	1	2	3	4	6	7	9	0	0	0	0	0	0	0
30	86	0	0	2	3	5	7	9	0	0	1	3	4	6	7	0	0	0	0	0	0	0
20	68	0	0	1	2	3	5	7	0	0	1	1	3	4	6	0	0	0	0	0	0	0
-60	-76	0	0	1	2	3	4	5	0	0	1	1	2	3	5	0	0	0	0	0	0	1

Slope and Wind V1 Adjustments*

WEIGHT	SLOPE (%)					WIND (KTS)							
(1000 KG)	-2	-1	0	1	2	-15	-10	-5	0	10	20	30	40
72	-4	-2	0	2	5	-4	-2	-1	0	1	1	2	3
68	-4	-2	0	2	4	-4	-2	-1	0	1	1	2	3
64	-4	-2	0	2	4	-4	-2	-1	0	1	1	2	3
60	-4	-2	0	2	4	-4	-2	-1	0	1	1	2	3
56	-3	-2	0	2	3	-4	-3	-1	0	1	2	2	3
52	-3	-1	0	2	3	-4	-3	-1	0	1	2	2	3
48	-3	-1	0	1	3	-4	-3	-1	0	1	2	3	3
44	-2	-1	0	1	3	-4	-3	-1	0	1	2	3	4
40	-2	-1	0	1	2	-5	-3	-1	0	1	2	3	4

***V1 not to exceed VR.**

V1(MCG)

Max Takeoff Thrust

TEMP		PRESSURE ALTITUDE (FT)						
°C	°F	-2000	0	2000	4000	6000	8000	10000
70	158	100	98					
60	140	100	98	96	95			
50	122	102	100	97	95	93	91	89
40	104	107	105	101	98	94	91	89
30	86	110	110	106	102	98	94	91
20	68	110	110	108	106	103	98	94
-60	-76	112	111	109	107	105	102	99

Stab Trim Setting

Max Takeoff Thrust

Flaps 1 and 5

WEIGHT (1000 KG)	C.G. (%MAC)								
	13	15	16	18	21	24	27	30	33
70	8 1/2	8 1/2	8 1/4	7 1/4	6 1/2	6	5 1/4	4 1/2	4
60	8 1/2	8	7 1/2	6 3/4	6	5 1/4	4 3/4	4	3 1/2
50	7 3/4	7 1/4	6 3/4	6	5 1/4	4 3/4	4	3 1/2	2 3/4
40	6	5 1/2	5 1/2	5	4 1/4	3 3/4	3 1/4	2 3/4	2 1/4
36	5	4 3/4	4 3/4	4 1/2	4	3 1/2	3	2 3/4	2 1/4

Flaps 10, 15 and 25

WEIGHT (1000 KG)	C.G. (%MAC)									
	13	15	16	18	21	24	27	29	32	33
70	8 1/2	8 1/2	8 1/4	7	6 1/4	5 1/2	4 3/4	4	3 1/4	3
60	8 1/2	7 3/4	7 1/4	6 1/4	5 1/2	4 3/4	4	3 1/2	2 3/4	2 1/2
50	7 3/4	6 3/4	6 1/4	5 1/4	4 3/4	4	3 1/4	2 3/4	2 1/4	2 1/4
40	5 1/2	5	4 3/4	4 1/4	3 1/2	3	3 1/2	2 1/4	2 1/4	2 1/4
36	4 1/4	4	4	3 3/4	3 1/4	2 3/4	2 1/4	2 1/4	2 1/4	2 1/4

VREF

WEIGHT (1000 KG)	FLAPS		
	40	30	15
70	144	146	152
66	139	141	147
62	135	137	143
58	130	132	138
54	125	127	133
50	120	122	128
46	115	117	122
42	110	112	117
38	104	106	111

Flap Maneuver Speeds

FLAP POSITION	MANEUVER SPEED
UP	VREF40 + 70
1	VREF40 + 50
5	VREF40 + 30
10	VREF40 + 30
15	VREF40 + 20
25	VREF40 + 10
30	VREF30
40	VREF40

ADVISORY INFORMATION

Slush/Standing Water Takeoff

Maximum Reverse Thrust

Weight Adjustments (1000 KG)

DRY FIELD/OBSTACLE LIMIT WEIGHT (1000 KG)	SLUSH/STANDING WATER DEPTH								
	3 mm (0.12 INCHES)			6 mm (0.25 INCHES)			13 mm (0.50 INCHES)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
80	-9.0	-12.0	-14.9	-10.8	-13.7	-16.7	-14.6	-17.5	-20.5
75	-8.0	-10.9	-13.9	-9.4	-12.4	-15.3	-12.6	-15.5	-18.5
70	-7.0	-10.0	-12.9	-8.2	-11.1	-14.1	-10.7	-13.7	-16.6
65	-6.1	-9.1	-12.0	-7.1	-10.0	-13.0	-9.1	-12.1	-15.0
60	-5.3	-8.3	-11.2	-6.1	-9.0	-12.0	-7.7	-10.7	-13.6
55	-4.6	-7.6	-10.5	-5.2	-8.1	-11.1	-6.5	-9.4	-12.4
50	-4.0	-7.0	-9.9	-4.4	-7.4	-10.3	-5.5	-8.4	-11.4
45	-3.5	-6.4	-9.4	-3.8	-6.8	-9.7	-4.6	-7.6	-10.5
40	-3.0	-6.0	-8.9	-3.3	-6.2	-9.2	-4.0	-6.9	-9.9
35	-2.7	-5.6	-8.6	-2.9	-5.8	-8.8	-3.6	-6.5	-9.5

V1(MCG) Limit Weight (1000 KG)

ADJUSTED FIELD LENGTH (M)	SLUSH/STANDING WATER DEPTH								
	3 mm (0.12 INCHES)			6 mm (0.25 INCHES)			13 mm (0.50 INCHES)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
1400	25.3			28.5			33.1		
1600	38.1			41.1			45.4	26.7	
1800	51.1	31.4		53.7	34.5		57.7	39.0	
2000	64.1	44.3		66.6	47.1	27.9	69.9	51.3	32.5
2200	77.2	57.2	37.5	79.6	59.8	40.5	82.2	63.5	44.8
2400		70.3	50.4		72.7	53.1		75.8	57.1
2600		83.5	63.5		85.8	65.9		88.0	69.4
2800			76.6			78.9			81.6
3000			89.8						

1. **Enter Weight Adjustment table with slush/standing water depth and dry field/obstacle limit weight to obtain slush/standing water weight adjustment.**
2. **Adjust field length available by -40 m/+35 m for every 5°C above/below 4°C.**
3. **Find V1(MCG) limit weight for adjusted field length and pressure altitude.**
4. **Max allowable slush/standing water limited weight is lesser of weights from 1 and 3.**

V1 Adjustment (KIAS)

WEIGHT (1000 KG)	SLUSH/STANDING WATER DEPTH								
	3 mm (0.12 INCHES)			6 mm (0.25 INCHES)			13 mm (0.50 INCHES)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
80	-14	-9	-4	-6	-1	0	1	1	1
75	-16	-11	-6	-9	-4	0	1	1	1
70	-17	-12	-7	-11	-6	-1	0	1	1
65	-18	-13	-8	-14	-9	-4	-5	0	1
60	-19	-14	-9	-16	-11	-6	-8	-3	1
55	-20	-15	-10	-17	-12	-7	-11	-6	-1
50	-21	-16	-11	-19	-14	-9	-14	-9	-4
45	-22	-17	-12	-20	-15	-10	-16	-11	-6
40	-22	-17	-12	-21	-16	-11	-18	-13	-8
35	-23	-18	-13	-21	-16	-11	-19	-14	-9

1. **Obtain V1, VR and V2 for the actual weight using the Dry Runway Takeoff Speeds table.**
2. **If V1(MCG) limited, set V1 = V1(MCG). If not V1(MCG) limited, enter V1 Adjustment table with the actual weight to obtain V1 speed adjustment. If adjusted V1 is less than V1(MCG), set V1 = V1(MCG). V1 not to exceed VR.**

ADVISORY INFORMATION

Slush/Standing Water Takeoff

No Reverse Thrust

Weight Adjustments (1000 KG)

DRY FIELD/OBSTACLE LIMIT WEIGHT (1000 KG)	SLUSH/STANDING WATER DEPTH								
	3 mm (0.12 INCHES)			6 mm (0.25 INCHES)			13 mm (0.50 INCHES)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
80	-10.7	-13.9	-17.1	-13.0	-16.1	-19.3	-17.4	-20.6	-23.8
75	-9.6	-12.7	-15.9	-11.3	-14.5	-17.7	-14.8	-17.9	-21.1
70	-8.5	-11.7	-14.8	-9.8	-13.0	-16.2	-12.5	-15.7	-18.8
65	-7.5	-10.7	-13.9	-8.5	-11.7	-14.9	-10.6	-13.7	-16.9
60	-6.6	-9.8	-13.0	-7.4	-10.6	-13.8	-9.0	-12.2	-15.4
55	-5.8	-9.0	-12.2	-6.5	-9.7	-12.8	-7.9	-11.0	-14.2
50	-5.1	-8.2	-11.4	-5.7	-8.9	-12.1	-7.1	-10.3	-13.4
45	-4.4	-7.6	-10.8	-5.2	-8.3	-11.5	-6.7	-9.8	-13.0
40	-3.9	-7.0	-10.2	-4.8	-8.0	-11.1	-6.6	-9.8	-13.0
35	-3.4	-6.5	-9.7	-4.6	-7.7	-10.9	-7.0	-10.1	-13.3

V1(MCG) Limit Weight (1000 KG)

ADJUSTED FIELD LENGTH (M)	SLUSH/STANDING WATER DEPTH								
	3 mm (0.12 INCHES)			6 mm (0.25 INCHES)			13 mm (0.50 INCHES)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
1800				27.3			38.9		
2000	34.1			42.4			53.0	27.6	
2200	50.3			57.1	31.1		65.9	42.5	
2400	65.3	38.2		71.1	46.1		77.9	56.2	31.3
2600	79.4	54.1	25.7	84.7	60.6	34.8	89.2	68.9	46.0
2800		68.9	42.3		74.5	49.7		80.8	59.5
3000		82.8	57.8		88.0	64.1			71.9
3200			72.4			77.9			83.6
3400			86.1						

1. **Enter Weight Adjustment table with slush/standing water depth and dry field/obstacle limit weight to obtain slush/standing water weight adjustment.**
2. **Adjust field length available by -50 m/+45 m for every 5°C above/below 4°C.**
3. **Find V1(MCG) limit weight for adjusted field length and pressure altitude.**
4. **Max allowable slush/standing water limited weight is lesser of weights from 1 and 3.**

V1 Adjustment (KIAS)

WEIGHT (1000 KG)	SLUSH/STANDING WATER DEPTH								
	3 mm (0.12 INCHES)			6 mm (0.25 INCHES)			13 mm (0.50 INCHES)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
80	-21	-16	-11	-10	-5	0	0	0	0
75	-21	-16	-11	-13	-8	-3	0	0	0
70	-22	-17	-12	-16	-11	-6	-1	0	0
65	-23	-18	-13	-19	-14	-9	-6	-1	0
60	-24	-19	-14	-21	-16	-11	-11	-6	-1
55	-25	-20	-15	-23	-18	-13	-15	-10	-5
50	-27	-22	-17	-24	-19	-14	-19	-14	-9
45	-28	-23	-18	-26	-21	-16	-21	-16	-11
40	-29	-24	-19	-27	-22	-17	-23	-18	-13
35	-30	-25	-20	-28	-23	-18	-25	-20	-15

1. **Obtain V1, VR and V2 for the actual weight using the Dry Runway Takeoff Speeds table.**
2. **If V1(MCG) limited, set V1 = V1(MCG). If not V1(MCG) limited, enter V1 Adjustment table with the actual weight to obtain V1 speed adjustment. If adjusted V1 is less than V1(MCG), set V1 = V1(MCG). V1 not to exceed VR.**

ADVISORY INFORMATION

Slippery Runway Takeoff
Maximum Reverse Thrust
Weight Adjustment (1000 KG)

DRY FIELD/OBSTACLE LIMIT WEIGHT (1000 KG)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT(FT)			PRESS ALT(FT)			PRESS ALT(FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
80	-0.5	-0.5	-0.5	-5.0	-5.0	-5.0	-9.0	-9.0	-9.0
75	-0.8	-0.8	-0.8	-4.9	-4.9	-4.9	-8.4	-8.4	-8.4
70	-0.9	-0.9	-0.9	-4.7	-4.7	-4.7	-7.9	-7.9	-7.9
65	-1.0	-1.0	-1.0	-4.5	-4.5	-4.5	-7.3	-7.3	-7.3
60	-1.0	-1.0	-1.0	-4.1	-4.1	-4.1	-6.7	-6.7	-6.7
55	-0.8	-0.8	-0.8	-3.8	-3.8	-3.8	-6.1	-6.1	-6.1
50	-0.6	-0.6	-0.6	-3.3	-3.3	-3.3	-5.5	-5.5	-5.5
45	-0.2	-0.2	-0.2	-2.8	-2.8	-2.8	-4.9	-4.9	-4.9
40	0.0	0.0	0.0	-2.2	-2.2	-2.2	-4.3	-4.3	-4.3
35	0.0	0.0	0.0	-1.5	-1.5	-1.5	-3.6	-3.6	-3.6

V1(MCG) Limit Weight (1000 KG)

ADJUSTED FIELD LENGTH (M)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
1000	28.0								
1200	44.7	28.2							
1400	63.0	44.9	28.3	31.4					
1600	83.9	63.2	45.0	45.0	26.3				
1800		84.1	63.4	59.7	39.9		29.3		
2000			84.3	75.7	54.1	34.8	39.8		
2200					69.6	48.7	50.4	31.1	
2400					86.6	63.7	61.3	41.6	
2600						80.1	72.5	52.3	32.9
2800							84.0	63.2	43.4
3000								74.4	54.1
3200								85.9	65.1
3400									76.4
3600									87.9

1. **Enter Weight Adjustment table with reported braking action and dry field/obstacle limit weight to obtain slippery runway weight adjustment.**
2. **Adjust "Good" field length available by -30 m/+25 m for every 5°C above/below 4°C.**
   Adjust "Medium" field length available by -30 m/+25 m for every 5°C above/below 4°C.
   Adjust "Poor" field length available by -45 m/+40 m for every 5°C above/below 4°C.
3. **Find V1(MCG) limit weight for adjusted field length and pressure altitude.**
4. **Max allowable slippery runway limited weight is lesser of weights from 1 and 3.**

ADVISORY INFORMATION

Slippery Runway Takeoff
Maximum Reverse Thrust
V1 Adjustment (KIAS)

WEIGHT (1000 KG)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT(FT)			PRESS ALT(FT)			PRESS ALT(FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
80	-6	-4	-3	-14	-13	-11	-26	-25	-23
75	-6	-5	-4	-15	-14	-13	-27	-25	-24
70	-7	-6	-5	-16	-15	-14	-28	-26	-25
65	-8	-6	-5	-18	-16	-15	-29	-28	-27
60	-8	-7	-6	-19	-17	-16	-31	-29	-28
55	-9	-8	-6	-20	-18	-17	-32	-31	-30
50	-10	-8	-7	-21	-19	-18	-34	-32	-31
45	-10	-9	-8	-22	-20	-19	-35	-34	-33
40	-10	-9	-8	-23	-22	-20	-37	-35	-34
35	-11	-10	-8	-24	-23	-21	-38	-37	-36

1. **Obtain V1, VR and V2 for the actual weight using the Dry Runway Takeoff Speeds table.**
2. **If V1(MCG) limited, set V1 = V1(MCG). If not V1(MCG) limited, enter V1 Adjustment table with the actual weight to obtain V1 speed adjustment. If adjusted V1 is less than V1(MCG), set V1 = V1(MCG). V1 not to exceed VR.**

ADVISORY INFORMATION

Slippery Runway Takeoff

No Reverse Thrust

Weight Adjustments (1000 KG)

DRY FIELD/OBSTACLE LIMIT WEIGHT (1000 KG)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT(FT)			PRESS ALT(FT)			PRESS ALT(FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
80	-1.2	-1.2	-1.2	-6.9	-6.9	-6.9	-11.7	-11.7	-11.7
75	-1.5	-1.5	-1.5	-6.6	-6.6	-6.6	-10.8	-10.8	-10.8
70	-1.7	-1.7	-1.7	-6.3	-6.3	-6.3	-9.9	-9.9	-9.9
65	-1.8	-1.8	-1.8	-5.9	-5.9	-5.9	-9.2	-9.2	-9.2
60	-1.8	-1.8	-1.8	-5.6	-5.6	-5.6	-8.5	-8.5	-8.5
55	-1.7	-1.7	-1.7	-5.2	-5.2	-5.2	-7.9	-7.9	-7.9
50	-1.6	-1.6	-1.6	-4.8	-4.8	-4.8	-7.4	-7.4	-7.4
45	-1.4	-1.4	-1.4	-4.4	-4.4	-4.4	-7.0	-7.0	-7.0
40	-1.1	-1.1	-1.1	-3.9	-3.9	-3.9	-6.7	-6.7	-6.7
35	-0.7	-0.7	-0.7	-3.5	-3.5	-3.5	-6.5	-6.5	-6.5

V1(MCG) Limit Weight (1000 KG)

ADJUSTED FIELD LENGTH (M)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
1200	36.2								
1400	55.2	36.4							
1600	76.9	55.4	36.5						
1800		77.1	55.6	36.7					
2000			77.3	54.1	30.5				
2200				72.9	47.5				
2400					65.7	41.1			
2600					85.5	58.8			
2800						78.0	36.8		
3000							53.2		
3200							67.6	37.2	
3400							80.7	53.5	
3600								67.9	37.5
3800								80.9	53.8
4000									68.1
4200									81.1

1. **Enter Weight Adjustment table with reported braking action and dry field/obstacle limit weight to obtain slippery runway weight adjustment.**
2. **Adjust "Good" field length available by -35 m/+30 m for every 5°C above/below 4°C.**
   Adjust "Medium" field length available by -35 m/+30 m for every 5°C above/below 4°C.
   Adjust "Poor" field length available by -55 m/+50 m for every 5°C above/below 4°C.
3. **Find V1(MCG) limit weight for adjusted field length and pressure altitude.**
4. **Max allowable slippery runway limited weight is lesser of weights from 1 and 3.**

ADVISORY INFORMATION

Slippery Runway Takeoff
No Reverse Thrust
V1 Adjustment (KIAS)

WEIGHT (1000 KG)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
80	-7	-5	-2	-18	-16	-13	-36	-34	-31
75	-8	-5	-3	-20	-17	-15	-37	-35	-32
70	-9	-6	-4	-21	-18	-16	-38	-36	-33
65	-10	-7	-5	-22	-20	-17	-40	-38	-35
60	-11	-8	-6	-24	-22	-19	-42	-40	-37
55	-12	-9	-7	-26	-24	-21	-45	-42	-40
50	-13	-11	-8	-28	-26	-23	-47	-45	-42
45	-14	-12	-9	-30	-28	-25	-50	-47	-45
40	-15	-13	-10	-32	-30	-27	-52	-49	-47
35	-17	-14	-12	-34	-32	-29	-54	-51	-49

1. **Obtain V1, VR and V2 for the actual weight using the Dry Runway Takeoff Speeds table.**
2. **If V1(MCG) limited, set V1 = V1(MCG). If not V1(MCG) limited, enter V1 Adjustment table with the actual weight to obtain V1 speed adjustment. If adjusted V1 is less than V1(MCG), set V1 = V1(MCG). V1 not to exceed VR.**

Takeoff %N1

Based on engine bleeds for packs on, engine and wing anti-ice on or off

OAT (°C)	AIRPORT PRESSURE ALTITUDE (FT)												
	-2000	-1000	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
60	87.7	88.3	88.7	88.8	88.9	89.1	89.2	89.2	89.1	88.6	88.3	88.7	89.2
55	88.5	89.1	89.5	89.7	89.8	89.9	90.0	90.0	90.0	89.5	89.0	88.8	88.6
50	89.3	89.8	90.4	90.5	90.6	90.7	90.9	90.8	90.8	90.4	89.9	89.7	89.6
45	90.2	90.7	91.2	91.3	91.4	91.5	91.7	91.6	91.6	91.2	90.8	90.7	90.5
40	91.1	91.6	92.1	92.2	92.3	92.4	92.5	92.4	92.4	92.1	91.7	91.6	91.5
35	91.9	92.5	93.0	93.1	93.2	93.2	93.3	93.3	93.2	92.9	92.5	92.5	92.4
30	91.5	92.6	93.8	93.9	94.0	94.0	94.1	94.0	93.9	93.7	93.4	93.3	93.2
25	90.8	91.9	93.1	93.7	94.4	94.8	94.9	94.8	94.8	94.4	94.0	94.0	94.0
20	90.0	91.1	92.3	93.0	93.6	94.3	95.0	95.6	95.6	95.3	94.9	94.8	94.7
15	89.3	90.4	91.6	92.2	92.8	93.6	94.3	94.8	95.3	95.9	96.1	95.9	95.5
10	88.5	89.6	90.8	91.4	92.1	92.8	93.5	94.0	94.5	95.1	95.7	96.4	97.1
5	87.8	88.9	90.0	90.7	91.3	92.0	92.7	93.2	93.7	94.3	94.9	95.6	96.3
0	87.0	88.1	89.2	89.9	90.5	91.2	91.9	92.4	92.9	93.5	94.1	94.8	95.5
-5	86.2	87.3	88.4	89.1	89.7	90.4	91.1	91.6	92.1	92.7	93.3	94.0	94.7
-10	85.4	86.5	87.6	88.3	88.9	89.6	90.3	90.8	91.3	91.9	92.5	93.2	93.9
-15	84.6	85.7	86.8	87.5	88.1	88.8	89.4	90.0	90.5	91.1	91.7	92.4	93.1
-20	83.8	84.9	86.0	86.6	87.3	87.9	88.6	89.1	89.7	90.3	90.8	91.6	92.3
-25	83.0	84.1	85.2	85.8	86.4	87.1	87.8	88.3	88.8	89.4	90.0	90.7	91.5
-30	82.2	83.3	84.4	85.0	85.6	86.3	86.9	87.4	88.0	88.6	89.2	89.9	90.6
-35	81.4	82.4	83.5	84.1	84.7	85.4	86.1	86.6	87.1	87.7	88.3	89.0	89.8
-40	80.6	81.6	82.7	83.3	83.9	84.5	85.2	85.7	86.2	86.8	87.4	88.2	88.9
-45	79.7	80.7	81.8	82.4	83.0	83.7	84.3	84.8	85.3	86.0	86.6	87.3	88.0
-50	78.9	79.9	80.9	81.5	82.1	82.8	83.4	83.9	84.5	85.1	85.7	86.4	87.2

%N1 Adjustments for Engine Bleeds

BLEED CONFIGURATION	AIRPORT PRESSURE ALTITUDE (FT)												
	-2000	-1000	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
PACKS OFF	0.7	0.7	0.7	0.7	0.7	0.7	0.8	0.8	0.8	0.8	0.9	0.9	0.9

Assumed Temperature Reduced Thrust

Maximum Assumed Temperature (Table 1 of 3)

Based on 25% Takeoff Thrust Reduction

OAT (°C)	AIRPORT PRESSURE ALTITUDE (FT)											
	-1000	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
55	73	71	69	67								
50	73	71	69	67	65	63						
45	73	71	69	67	65	63	61	59	57			
40	72	71	69	67	65	63	61	59	57	55		
35	66	66	66	66	65	63	61	59	57	55	53	
30	63	61	61	61	61	61	61	59	57	55	53	51
25	63	61	59	57	56	56	56	56	56	55	53	51
20	63	61	59	57	55	53	51	51	51	50	50	50
15	63	61	59	57	55	53	51	50	47	45	45	45
10 & BELOW	63	61	59	57	55	53	51	50	47	45	43	41

Takeoff %N1 (Table 2 of 3)

Based on engine bleeds for packs on, engine and wing anti-ice on or off

ASSUMED TEMP (°C)	AIRPORT PRESSURE ALTITUDE (FT)											
	-1000	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
75	85.7	86.0	86.7	87.4	88.2	88.9	89.5	90.1	90.2	90.2	90.6	91.1
70	86.6	87.0	87.1	87.1	87.5	88.3	88.9	89.4	89.5	89.6	90.0	90.4
65	87.4	87.8	88.0	88.0	88.2	88.3	88.3	88.8	88.9	88.9	89.4	89.8
60	88.3	88.7	88.8	88.9	89.1	89.2	89.2	89.1	88.6	88.3	88.7	89.2
55	89.1	89.5	89.7	89.8	89.9	90.0	90.0	90.0	89.5	89.0	88.8	88.6
50	89.8	90.4	90.5	90.6	90.7	90.9	90.8	90.8	90.4	89.9	89.7	89.6
45	90.7	91.2	91.3	91.4	91.5	91.7	91.6	91.6	91.2	90.8	90.7	90.5
40	91.6	92.1	92.2	92.3	92.4	92.5	92.4	92.4	92.1	91.7	91.6	91.5
35	92.5	93.0	93.1	93.2	93.2	93.3	93.3	93.2	92.9	92.5	92.5	92.4
30	92.6	93.8	93.9	94.0	94.0	94.1	94.0	93.9	93.7	93.4	93.3	93.2
25	91.9	93.1	93.7	94.4	94.8	94.9	94.8	94.8	94.4	94.0	94.0	94.0
20	91.1	92.3	93.0	93.6	94.3	95.0	95.6	95.6	95.3	94.9	94.8	94.7
15	90.4	91.6	92.2	92.8	93.6	94.3	94.8	95.3	95.9	96.1	95.9	95.5
10	89.6	90.8	91.4	92.1	92.8	93.5	94.0	94.5	95.1	95.7	96.4	97.1
MINIMUM ASSUMED TEMP (°C)	32	30	28	26	24	22	20	18	16	15	12	10

With engine bleed for packs off, increase %N1 by 0.9.

Assumed Temperature Reduced Thrust

%N1 Adjustment for Temperature Difference (Table 3 of 3)

ASSUMED TEMP MINUS OAT (°C)	OUTSIDE AIR TEMPERATURE (°C)													
	-40	-20	0	5	10	15	20	25	30	35	40	45	50	55
110	11.6													
100	10.3	7.9												
90	10.8	8.4												
80	12.2	7.1	5.0											
70	11.0	7.6	5.4	5.2	3.5									
60	9.6	9.0	4.1	4.0	3.9	3.8	2.1							
50	8.0	7.7	4.5	2.8	2.6	2.7	2.6	2.4	0.8					
40		6.2	5.9	4.7	3.0	2.6	2.7	2.8	2.6	2.5	2.9			
30		4.7	4.6	4.5	4.4	4.2	4.1	4.0	4.0	3.9	3.8	3.7	3.6	
20			3.1	3.0	3.0	3.0	2.9	2.8	2.7	2.7	2.6	2.6	2.5	2.4
10			1.5	1.5	1.5	1.5	1.5	1.5	1.4	1.4	1.4	1.3	1.3	1.3
0			0	0	0	0	0	0	0	0	0	0	0	0

1. **Determine Maximum Assumed Temperature allowed from Table 1.**
2. **Find Maximum %N1 from Table 2 using the desired assumed temperature (no greater than temperature from Table 1).**
3. **Use the difference between assumed temperature and OAT to determine the %N1 adjustment from Table 3.**
4. **Subtract %N1 adjustment from Maximum %N1 in Table 2.**

Takeoff Speeds - Dry Runway (20K Derate)

V1, VR, V2

WEIGHT	FLAPS 1			FLAPS 5			FLAPS 10			FLAPS 15			FLAPS 25		
(1000 KG)	V1	VR	V2	V1	VR	V2	V1	VR	V2	V1	VR	V2	V1	VR	V2
72	144	144	148												
68	140	140	145	136	136	142									
64	135	135	141	131	131	138	126	126	132	123	124	129			
60	129	130	136	126	126	134	121	121	127	118	119	125			
56	124	124	131	120	121	129	116	116	123	113	113	121	113	113	120
52	118	118	126	115	115	124	110	111	119	108	108	116	107	107	115
48	112	112	121	109	109	119	105	105	114	103	103	112	102	102	111
44	106	106	116	102	103	114	99	99	109	97	97	107	96	97	106
40	100	100	111	96	97	108	93	93	104	91	92	103	91	91	102

Check V1(MCG).

V1, VR, V2 Adjustments*

TEMP		V1							VR							V2						
		PRESS ALT (1000 FT)							PRESS ALT (1000 FT)							PRESS ALT (1000 FT)						
°C	°F	-2	0	2	4	6	8	10	-2	0	2	4	6	8	10	-2	0	2	4	6	8	10
70	158	6	7						6	7						0	0					
60	140	5	6	5	6				5	6	6	6				0	0	0	0			
50	122	3	4	4	4	5	7	9	3	4	4	4	6	7	9	0	0	0	0	0	0	0
40	104	1	2	2	2	4	6	8	1	2	2	3	4	6	8	0	0	0	0	0	0	0
30	86	0	0	0	0	2	4	7	0	0	0	1	3	5	7	0	0	0	0	0	0	0
20	68	0	0	0	0	1	3	5	0	0	0	1	2	3	5	0	0	0	0	0	1	0
-60	-76	0	0	0	0	1	2	4	0	0	0	1	2	3	4	0	0	0	0	0	1	1

Slope and Wind V1 Adjustments*

WEIGHT	SLOPE (%)					WIND (KTS)							
(1000 KG)	-2	-1	0	1	2	-15	-10	-5	0	10	20	30	40
72	-2	-1	0	0	0	-1	0	0	0	0	0	0	0
68	-2	-1	0	0	0	-1	0	0	0	0	0	0	0
64	-2	-1	0	0	0	-1	0	0	0	0	0	0	0
60	-2	-1	0	0	0	-1	-1	0	0	0	0	0	0
56	-2	-1	0	0	0	-1	-1	0	0	0	0	0	0
52	-2	-1	0	0	0	-1	-1	0	0	0	0	0	0
48	-1	-1	0	0	0	-1	-1	0	0	0	0	0	0
44	-1	0	0	0	0	-1	-1	0	0	0	0	0	0
40	-1	0	0	1	1	-2	-1	0	0	0	1	1	1

***V1 not to exceed VR.**

V1(MCG)

TEMP		PRESSURE ALTITUDE (FT)						
°C	°F	-2000	0	2000	4000	6000	8000	10000
70	158	95	93					
60	140	95	93	94	95			
50	122	97	95	94	95	93	90	86
40	104	102	99	99	98	94	90	86
30	86	105	105	104	103	98	93	88
20	68	105	105	104	103	100	97	92
-60	-76	107	106	105	104	102	99	97

Takeoff Speeds - Wet Runway (20K Derate)

V1, VR, V2

WEIGHT	FLAPS 1			FLAPS 5			FLAPS 10			FLAPS 15			FLAPS 25		
(1000 KG)	V1	VR	V2	V1	VR	V2	V1	VR	V2	V1	VR	V2	V1	VR	V2
72	139	144	148												
68	134	140	145	130	136	142									
64	129	135	141	125	131	138	122	126	132	121	124	129			
60	123	130	136	119	126	134	116	121	127	115	119	125			
56	117	124	131	113	121	129	110	116	123	109	113	121	108	113	120
52	111	118	126	107	115	124	104	111	119	103	108	116	102	107	115
48	104	112	121	101	109	119	98	105	114	97	103	112	96	102	111
44	98	106	116	95	103	114	92	99	109	91	97	107	90	97	106
40	92	100	111	88	97	108	86	93	104	85	92	103	84	91	102

Check V1(MCG).

V1, VR, V2 Adjustment*

TEMP		V1							VR							V2						
		PRESS ALT (1000 FT)							PRESS ALT (1000 FT)							PRESS ALT (1000 FT)						
°C	°F	-2	0	2	4	6	8	10	-2	0	2	4	6	8	10	-2	0	2	4	6	8	10
70	158	9	11						6	7						0	0					
60	140	7	8	7	8				5	6	6	6				0	0	0	0			
50	122	4	5	5	5	7	9	13	3	4	4	4	6	7	9	0	0	0	0	0	0	0
40	104	2	2	2	2	4	7	10	1	2	2	3	4	6	8	0	0	0	0	0	0	0
30	86	0	0	0	0	2	5	8	0	0	0	1	3	5	7	0	0	0	0	0	0	0
20	68	0	0	0	0	1	3	6	0	0	0	1	2	3	5	0	0	0	0	0	1	0
-60	-76	0	0	0	0	1	3	4	0	0	0	1	2	3	4	0	0	0	0	0	1	1

Slope and Wind V1 Adjustment*

WEIGHT	SLOPE (%)					WIND (KTS)							
(1000 KG)	-2	-1	0	1	2	-15	-10	-5	0	10	20	30	40
72	-5	-2	0	2	5	-3	-2	-1	0	0	1	2	2
68	-4	-2	0	2	4	-3	-2	-1	0	1	1	2	2
64	-4	-2	0	2	4	-3	-2	-1	0	1	1	2	2
60	-4	-2	0	2	4	-4	-2	-1	0	1	1	2	3
56	-3	-2	0	2	4	-4	-2	-1	0	1	1	2	3
52	-3	-2	0	2	3	-4	-2	-1	0	1	2	2	3
48	-3	-1	0	1	3	-4	-3	-1	0	1	2	2	3
44	-2	-1	0	1	2	-4	-3	-1	0	1	2	2	3
40	-2	-1	0	1	2	-5	-3	-1	0	1	2	3	3

***V1 not to exceed VR.**

V1(MCG)

TEMP		PRESSURE ALTITUDE (FT)						
°C	°F	-2000	0	2000	4000	6000	8000	10000
70	158	95	93					
60	140	95	93	94	95			
50	122	97	95	94	95	93	90	86
40	104	102	99	99	98	94	90	86
30	86	105	105	104	103	98	93	88
20	68	105	105	104	103	100	97	92
-60	-76	107	106	105	104	102	99	97

Stab Trim Setting (20K Derate)

Flaps 1 and 5

WEIGHT (1000 KG)	C.G. (%MAC)							
	12	14	16	18	24	28	31	33
70	8 1/2	8 1/2	8 1/4	7 3/4	6 1/4	5 1/2	4 3/4	4 1/4
60	8 1/2	8 1/4	7 3/4	7	5 3/4	4 3/4	4 1/4	3 3/4
50	8 1/4	7 3/4	7	6 1/4	5	4 1/4	3 3/4	3 1/4
40	6 3/4	6 1/4	5 3/4	5 1/4	4 1/4	3 1/2	3	2 1/2
36	5 3/4	5 1/2	5 1/4	4 3/4	3 3/4	3 1/4	2 3/4	2 1/2

Flaps 10, 15 and 25

WEIGHT (1000 KG)	C.G. (%MAC)							
	12	14	16	18	24	28	31	33
70	8 1/2	8 1/2	8 1/4	7 1/4	5 3/4	4 3/4	4	3 1/2
60	8 1/2	8 1/4	7 1/2	6 1/2	5	4	3 1/4	2 3/4
50	8 1/4	7 1/2	6 3/4	5 3/4	4 1/2	3 1/4	2 3/4	2 1/4
40	6 1/4	5 3/4	5	4 1/2	3 1/2	2 1/2	2 1/4	2 1/4
36	5	4 3/4	4 1/4	4	3	2 1/4	2 1/4	2 1/4

ADVISORY INFORMATION

Slush/Standing Water Takeoff (20K Derate)

Maximum Reverse Thrust

Weight Adjustments (1000 KG)

20K DERATE DRY FIELD/OBSTACLE LIMIT WEIGHT (1000 KG)	SLUSH/STANDING WATER DEPTH								
	3 mm (0.12 INCHES)			6 mm (0.25 INCHES)			13 mm (0.50 INCHES)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
80	-10.7	-12.5	-14.3	-13.0	-14.9	-16.7	-17.9	-19.7	-21.5
75	-9.0	-10.9	-12.7	-11.0	-12.8	-14.6	-14.9	-16.8	-18.6
70	-7.6	-9.4	-11.3	-9.1	-10.9	-12.7	-12.3	-14.1	-15.9
65	-6.4	-8.2	-10.0	-7.5	-9.4	-11.2	-10.1	-11.9	-13.7
60	-5.4	-7.2	-9.0	-6.2	-8.0	-9.9	-8.2	-10.0	-11.8
55	-4.5	-6.3	-8.2	-5.2	-7.0	-8.8	-6.6	-8.4	-10.3
50	-3.9	-5.7	-7.5	-4.4	-6.2	-8.0	-5.5	-7.3	-9.1
45	-3.5	-5.3	-7.1	-3.8	-5.6	-7.5	-4.6	-6.5	-8.3
40	-3.2	-5.0	-6.9	-3.5	-5.4	-7.2	-4.2	-6.0	-7.8
35	-3.2	-5.0	-6.8	-3.5	-5.3	-7.1	-4.1	-5.9	-7.7

V1(MCG) Limit Weight (1000 KG)

ADJUSTED FIELD LENGTH (M)	SLUSH/STANDING WATER DEPTH								
	3 mm (0.12 INCHES)			6 mm (0.25 INCHES)			13 mm (0.50 INCHES)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
1200							26.7		
1400	32.4			34.8			38.7		
1600	45.5	25.6		47.7	28.2		51.1	32.4	
1800	58.9	38.6		61.0	40.9		64.0	44.5	26.1
2000	72.8	51.8	31.8	74.6	54.0	34.2	77.4	57.1	38.1
2200	87.1	65.5	44.9	88.7	67.4	47.1		70.3	50.5
2400		79.5	58.3		81.2	60.3		84.1	63.3
2600			72.1			73.9			76.8
2800			86.4			88.0			

1. **Enter Weight Adjustment table with slush/standing water depth and 20K Derate dry field/obstacle limit weight to obtain slush/standing water weight adjustment.**
2. **Adjust field length available by -35 m/+30 m for every 5°C above/below 4°C.**
3. **Find V1(MCG) limit weight for adjusted field length and pressure altitude.**
4. **Max allowable slush/standing water limited weight is lesser of weights from 1 and 3.**

ADVISORY INFORMATION

Slush/Standing Water Takeoff (20K Derate)
Maximum Reverse Thrust
V1 Adjustment (KIAS)

WEIGHT (1000 KG)	SLUSH/STANDING WATER DEPTH								
	3 mm (0.12 INCHES)			6 mm (0.25 INCHES)			13 mm (0.50 INCHES)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
80	-12	-10	-7	-2	0	0	0	0	0
75	-13	-11	-8	-5	-3	0	0	0	0
70	-14	-12	-9	-8	-5	-3	0	0	0
65	-15	-13	-10	-10	-8	-5	0	0	0
60	-16	-14	-11	-13	-10	-8	-4	-2	0
55	-17	-15	-12	-15	-12	-10	-8	-5	-3
50	-18	-16	-13	-16	-14	-11	-11	-8	-6
45	-19	-17	-14	-18	-15	-13	-13	-11	-8
40	-20	-18	-15	-19	-16	-14	-15	-13	-10
35	-21	-19	-16	-20	-17	-15	-17	-14	-12

1. **Obtain V1, VR and V2 for the actual weight using the 20K Derate Dry Runway Takeoff Speeds table.**
2. **If V1(MCG) limited, set V1 = V1(MCG). If not V1(MCG) limited, enter V1 Adjustment table with the actual weight to obtain V1 speed adjustment. If adjusted V1 is less than V1(MCG), set V1 = V1(MCG). V1 not to exceed VR.**

ADVISORY INFORMATION

Slush/Standing Water Takeoff (20K Derate)

No Reverse Thrust

Weight Adjustments (1000 KG)

20K DERATE DRY FIELD/OBSTACLE LIMIT WEIGHT (1000 KG)	SLUSH/STANDING WATER DEPTH								
	3 mm (0.12 INCHES)			6 mm (0.25 INCHES)			13 mm (0.50 INCHES)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
80	-12.7	-15.6	-18.6	-15.2	-18.1	-21.1	-20.1	-23.1	-26.0
75	-10.9	-13.8	-16.8	-12.9	-15.8	-18.8	-16.9	-19.8	-22.8
70	-9.3	-12.2	-15.2	-10.9	-13.8	-16.8	-14.1	-17.0	-20.0
65	-7.9	-10.8	-13.8	-9.1	-12.1	-15.0	-11.6	-14.6	-17.5
60	-6.7	-9.6	-12.6	-7.6	-10.6	-13.5	-9.6	-12.5	-15.5
55	-5.7	-8.7	-11.6	-6.4	-9.4	-12.3	-7.9	-10.9	-13.8
50	-5.0	-7.9	-10.9	-5.5	-8.5	-11.4	-6.6	-9.6	-12.5
45	-4.4	-7.4	-10.3	-4.8	-7.8	-10.7	-5.7	-8.7	-11.6
40	-4.1	-7.0	-10.0	-4.4	-7.4	-10.3	-5.2	-8.1	-11.1
35	-3.9	-6.9	-9.8	-4.3	-7.3	-10.2	-5.0	-8.0	-10.9

V1(MCG) Limit Weight (1000 KG)

ADJUSTED FIELD LENGTH (M)	SLUSH/STANDING WATER DEPTH								
	3 mm (0.12 INCHES)			6 mm (0.25 INCHES)			13 mm (0.50 INCHES)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
1600							35.5		
1800	33.4			39.0			48.3	26.2	
2000	49.1			53.8	28.1		62.8	38.5	
2200	64.4	37.3		69.0	42.6		80.0	51.7	29.3
2400	79.4	52.9	25.4	84.9	57.5	31.7		66.8	41.6
2600		68.1	41.2		72.9	46.3		84.8	55.2
2800		83.0	56.7		88.9	61.3			70.9
3000			71.9			76.8			89.9
3200			86.6						

1. **Enter Weight Adjustment table with slush/standing water depth and 20K Derate dry field/obstacle limit weight to obtain slush/standing water weight adjustment.**
2. **Adjust field length available by -45 m/+40 m for every 5°C above/below 4°C.**
3. **Find V1(MCG) limit weight for adjusted field length and pressure altitude.**
4. **Max allowable slush/standing water limited weight is lesser of weights from 1 and 3.**

ADVISORY INFORMATION

Slush/Standing Water Takeoff (20K Derate)
No Reverse Thrust
V1 Adjustment (KIAS)

WEIGHT (1000 KG)	SLUSH/STANDING WATER DEPTH								
	3 mm (0.12 INCHES)			6 mm (0.25 INCHES)			13 mm (0.50 INCHES)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
80	-18	-15	-13	-4	-2	0	0	0	0
75	-19	-16	-14	-8	-5	-3	0	0	0
70	-20	-17	-15	-11	-9	-6	0	0	0
65	-21	-18	-16	-14	-12	-9	0	0	0
60	-22	-19	-17	-17	-14	-12	-6	-3	-1
55	-23	-20	-18	-19	-17	-14	-11	-8	-6
50	-24	-21	-19	-21	-19	-16	-15	-12	-10
45	-25	-22	-20	-23	-20	-18	-18	-15	-13
40	-26	-23	-21	-24	-22	-19	-20	-18	-15
35	-27	-25	-22	-25	-23	-20	-23	-20	-18

1. **Obtain V1, VR and V2 for the actual weight using the 20K Derate Dry Runway Takeoff Speeds table.**
2. **If V1(MCG) limited, set V1 = V1(MCG). If not V1(MCG) limited, enter V1 Adjustment table with the actual weight to obtain V1 speed adjustment. If adjusted V1 is less than V1(MCG), set V1 = V1(MCG). V1 not to exceed VR.**

ADVISORY INFORMATION

Slippery Runway Takeoff (20K Derate)

Maximum Reverse Thrust

Weight Adjustment (1000 KG)

20K DERATE DRY FIELD/OBSTACLE LIMIT WEIGHT (1000 KG)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
80	-0.8	-0.8	-0.8	-5.4	-5.4	-5.4	-9.8	-9.8	-9.8
75	-0.8	-0.8	-0.8	-5.0	-5.0	-5.0	-8.9	-8.9	-8.9
70	-0.8	-0.8	-0.8	-4.6	-4.6	-4.6	-8.0	-8.0	-8.0
65	-0.9	-0.9	-0.9	-4.3	-4.3	-4.3	-7.3	-7.3	-7.3
60	-0.9	-0.9	-0.9	-4.0	-4.0	-4.0	-6.6	-6.6	-6.6
55	-0.8	-0.8	-0.8	-3.7	-3.7	-3.7	-6.1	-6.1	-6.1
50	-0.8	-0.8	-0.8	-3.5	-3.5	-3.5	-5.6	-5.6	-5.6
45	-0.8	-0.8	-0.8	-3.2	-3.2	-3.2	-5.2	-5.2	-5.2
40	-0.7	-0.7	-0.7	-3.0	-3.0	-3.0	-4.9	-4.9	-4.9
35	-0.6	-0.6	-0.6	-2.9	-2.9	-2.9	-4.7	-4.7	-4.7

V1(MCG) Limit Weight (1000 KG)

ADJUSTED FIELD LENGTH (M)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
1000	31.1								
1200	49.5	31.3							
1400	68.9	49.6	31.4	36.2					
1600	89.8	69.1	49.8	50.9	30.9				
1800		90.0	69.3	66.6	45.3	25.6	35.1		
2000				83.6	60.6	39.9	45.6	25.8	
2200					77.1	54.8	56.5	36.1	
2400						70.8	68.0	46.6	26.8
2600						88.2	80.0	57.6	37.1
2800								69.1	47.6
3000								81.2	58.7
3200									70.2
3400									82.3

1. **Enter Weight Adjustment table with reported braking action and 20K Derate dry field/obstacle limit weight to obtain slippery runway weight adjustment.**
2. **Adjust "Good" field length available by -25 m/+20 m for every 5°C above/below 4°C.**
   Adjust "Medium" field length available by -25 m/+20 m for every 5°C above/below 4°C.
   Adjust "Poor" field length available by -40 m/+35 m for every 5°C above/below 4°C.
3. **Find V1(MCG) limit weight for adjusted field length and pressure altitude.**
4. **Max allowable slippery runway limited weight is lesser of weights from 1 and 3.**

ADVISORY INFORMATION

Slippery Runway Takeoff (20K Derate)
Maximum Reverse Thrust
V1 Adjustment (KIAS)

WEIGHT (1000 KG)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
80	-12	-9	-7	-19	-17	-14	-32	-29	-27
75	-9	-6	-4	-16	-14	-11	-28	-25	-23
70	-7	-5	-2	-15	-13	-10	-26	-24	-21
65	-7	-4	-2	-15	-13	-10	-26	-24	-21
60	-7	-5	-2	-16	-14	-11	-27	-25	-22
55	-8	-6	-3	-18	-15	-13	-29	-27	-24
50	-9	-7	-4	-20	-17	-15	-32	-29	-27
45	-10	-8	-5	-21	-19	-16	-34	-31	-29
40	-11	-9	-6	-22	-20	-17	-35	-33	-30
35	-11	-8	-6	-23	-20	-18	-36	-33	-31

1. **Obtain V1, VR and V2 for the actual weight using the 20K Derate Dry Runway Takeoff Speeds table.**
2. **If V1(MCG) limited, set V1 = V1(MCG). If not V1(MCG) limited, enter V1 Adjustment table with the actual weight to obtain V1 speed adjustment. If adjusted V1 is less than V1(MCG), set V1 = V1(MCG). V1 not to exceed VR.**

ADVISORY INFORMATION

Slippery Runway Takeoff (20K Derate)

No Reverse Thrust

Weight Adjustments (1000 KG)

20K DERATE DRY FIELD/OBSTACLE LIMIT WEIGHT (1000 KG)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
80	-1.4	-1.4	-1.4	-7.2	-7.2	-7.2	-13.4	-13.4	-13.4
75	-1.5	-1.5	-1.5	-6.7	-6.7	-6.7	-11.7	-11.7	-11.7
70	-1.5	-1.5	-1.5	-6.2	-6.2	-6.2	-10.3	-10.3	-10.3
65	-1.5	-1.5	-1.5	-5.7	-5.7	-5.7	-9.1	-9.1	-9.1
60	-1.5	-1.5	-1.5	-5.3	-5.3	-5.3	-8.3	-8.3	-8.3
55	-1.5	-1.5	-1.5	-4.9	-4.9	-4.9	-7.7	-7.7	-7.7
50	-1.4	-1.4	-1.4	-4.6	-4.6	-4.6	-7.4	-7.4	-7.4
45	-1.4	-1.4	-1.4	-4.3	-4.3	-4.3	-7.4	-7.4	-7.4
40	-1.3	-1.3	-1.3	-4.0	-4.0	-4.0	-7.7	-7.7	-7.7
35	-1.2	-1.2	-1.2	-3.8	-3.8	-3.8	-8.2	-8.2	-8.2

V1(MCG) Limit Weight (1000 KG)

ADJUSTED FIELD LENGTH (M)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
1200	41.6								
1400	62.4	41.8							
1600	84.3	62.6	41.9	28.1					
1800		84.5	62.8	46.2					
2000			84.7	64.9	39.4				
2200				84.6	57.9	32.7			
2400					77.2	50.9			
2600						69.9	37.4		
2800						89.8	52.3		
3000							66.8	35.4	
3200							80.9	50.4	
3400								64.9	33.3
3600								79.1	48.4
3800									63.0
4000									77.2

1. **Enter Weight Adjustment table with reported braking action and 20K Derate dry field/obstacle limit weight to obtain slippery runway weight adjustment.**
2. **Adjust "Good" field length available by -30 m/+25 m for every 5°C above/below 4°C.**
   Adjust "Medium" field length available by -30 m/+25 m for every 5°C above/below 4°C.
   Adjust "Poor" field length available by -50 m/+45 m for every 5°C above/below 4°C.
3. **Find V1(MCG) limit weight for adjusted field length and pressure altitude.**
4. **Max allowable slippery runway limited weight is lesser of weights from 1 and 3.**

ADVISORY INFORMATION

Slippery Runway Takeoff (20K Derate)
No Reverse Thrust
V1 Adjustment (KIAS)

WEIGHT (1000 KG)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
80	-12	-10	-7	-23	-20	-18	-42	-39	-37
75	-10	-7	-5	-20	-18	-15	-38	-35	-33
70	-8	-6	-3	-19	-17	-14	-36	-34	-31
65	-8	-6	-3	-20	-17	-15	-36	-34	-31
60	-9	-6	-4	-21	-19	-16	-38	-36	-33
55	-10	-8	-5	-23	-20	-18	-41	-38	-36
50	-11	-9	-6	-25	-23	-20	-43	-41	-38
45	-13	-10	-8	-27	-25	-22	-46	-43	-41
40	-14	-11	-9	-29	-26	-24	-47	-45	-42
35	-14	-11	-9	-30	-27	-25	-48	-45	-43

1. **Obtain V1, VR and V2 for the actual weight using the 20K Derate Dry Runway Takeoff Speeds table.**
2. **If V1(MCG) limited, set V1 = V1(MCG). If not V1(MCG) limited, enter V1 Adjustment table with the actual weight to obtain V1 speed adjustment. If adjusted V1 is less than V1(MCG), set V1 = V1(MCG). V1 not to exceed VR.**

Takeoff %N1 (20K Derate)

Based on engine bleeds for packs on, engine and wing anti-ice on or off

OAT (°C)	AIRPORT PRESSURE ALTITUDE (FT)												
	-2000	-1000	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
60	84.0	84.4	84.7	86.1	87.3	88.1	89.1	89.3	89.5	88.8	88.2	87.9	87.5
55	84.8	85.3	85.8	87.0	88.1	89.0	90.0	90.1	90.3	89.6	88.8	87.9	86.9
50	85.8	86.3	86.8	87.9	88.9	89.8	90.8	90.9	91.0	90.3	89.6	88.7	87.7
45	86.8	87.2	87.7	88.7	89.7	90.7	91.7	91.7	91.7	91.1	90.4	89.5	88.6
40	87.7	88.2	88.6	89.7	90.6	91.6	92.5	92.4	92.4	91.8	91.2	90.3	89.4
35	88.6	89.0	89.5	90.6	91.5	92.4	93.4	93.3	93.2	92.5	91.9	91.0	90.1
30	88.2	89.3	90.5	91.4	92.5	93.3	94.3	94.1	94.0	93.4	92.7	91.8	90.9
25	87.5	88.6	89.7	90.7	91.8	92.7	93.8	94.2	94.7	94.2	93.5	92.6	91.7
20	86.8	87.9	89.0	90.0	91.1	91.9	93.0	93.4	93.9	94.5	94.3	93.4	92.5
15	86.0	87.2	88.3	89.3	90.3	91.2	92.2	92.6	93.1	93.7	94.2	94.2	93.4
10	85.3	86.4	87.5	88.5	89.6	90.4	91.5	91.9	92.3	92.9	93.4	93.7	94.3
5	84.6	85.7	86.8	87.7	88.8	89.6	90.7	91.1	91.6	92.1	92.6	92.9	93.5
0	83.8	84.9	86.0	87.0	88.0	88.9	89.9	90.3	90.8	91.4	91.8	92.1	92.7
-5	83.1	84.2	85.2	86.2	87.2	88.1	89.1	89.5	90.0	90.5	91.0	91.3	91.9
-10	82.3	83.4	84.5	85.4	86.4	87.3	88.3	88.7	89.2	89.7	90.2	90.5	91.0
-15	81.6	82.6	83.7	84.6	85.6	86.5	87.5	87.9	88.3	88.9	89.3	89.7	90.2
-20	80.8	81.8	82.9	83.8	84.8	85.7	86.7	87.0	87.5	88.1	88.5	88.8	89.4
-25	80.0	81.1	82.1	83.0	84.0	84.8	85.8	86.2	86.7	87.3	87.7	88.0	88.5
-30	79.2	80.3	81.3	82.2	83.2	84.0	85.0	85.4	85.8	86.4	86.8	87.2	87.7
-35	78.4	79.5	80.5	81.4	82.4	83.2	84.1	84.5	85.0	85.6	86.0	86.3	86.8
-40	77.6	78.6	79.6	80.6	81.5	82.3	83.3	83.7	84.1	84.7	85.1	85.4	86.0
-45	76.8	77.8	78.8	79.7	80.7	81.5	82.4	82.8	83.3	83.8	84.2	84.5	85.1
-50	76.0	77.0	78.0	78.9	79.8	80.6	81.6	81.9	82.4	82.9	83.3	83.7	84.2

%N1 Adjustments for Engine Bleeds

BLEED CONFIGURATION	AIRPORT PRESSURE ALTITUDE (FT)												
	-2000	-1000	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
PACKS OFF	0.7	0.7	0.7	0.7	0.7	0.7	0.8	0.8	0.8	0.8	0.9	0.9	0.9

Assumed Temperature Reduced Thrust (20K Derate)

Maximum Assumed Temperature (Table 1 of 3)

Based on 25% Takeoff Thrust Reduction

OAT (°C)	AIRPORT PRESSURE ALTITUDE (FT)											
	-1000	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
55	73	71	69	67								
50	73	71	69	67	65	63						
45	73	71	69	67	65	63	61	59	57			
40	69	68	69	67	65	63	61	59	57	55		
35	64	63	65	66	65	63	61	59	57	55	53	
30	61	59	60	61	61	61	61	59	57	55	53	51
25	61	59	60	60	60	60	59	58	57	55	53	51
20	61	59	60	60	60	60	59	58	53	51	52	51
15	61	59	60	60	60	60	59	58	53	49	46	46
10 & BELOW	61	59	60	60	60	60	59	58	53	49	45	40

Takeoff %N1 (Table 2 of 3)

Based on engine bleeds for packs on, engine and wing anti-ice on or off

ASSUMED TEMP (°C)	AIRPORT PRESSURE ALTITUDE (FT)											
	-1000	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
75	81.4	81.5	84.0	85.8	87.2	88.8	89.7	90.6	90.4	90.1	89.8	89.4
70	82.5	82.6	84.3	85.5	86.6	88.2	89.1	89.9	89.7	89.5	89.2	88.8
65	83.4	83.7	85.2	86.4	87.2	88.2	88.5	89.3	89.1	88.9	88.6	88.1
60	84.4	84.7	86.1	87.3	88.1	89.1	89.3	89.5	88.8	88.2	87.9	87.5
55	85.3	85.8	87.0	88.1	89.0	90.0	90.1	90.3	89.6	88.8	87.9	86.9
50	86.3	86.8	87.9	88.9	89.8	90.8	90.9	91.0	90.3	89.6	88.7	87.7
45	87.2	87.7	88.7	89.7	90.7	91.7	91.7	91.7	91.1	90.4	89.5	88.6
40	88.2	88.6	89.7	90.6	91.6	92.5	92.4	92.4	91.8	91.2	90.3	89.4
35	89.0	89.5	90.6	91.5	92.4	93.4	93.3	93.2	92.5	91.9	91.0	90.1
30	89.3	90.5	91.4	92.5	93.3	94.3	94.1	94.0	93.4	92.7	91.8	90.9
25	88.6	89.7	90.7	91.8	92.7	93.8	94.2	94.7	94.2	93.5	92.6	91.7
20	87.9	89.0	90.0	91.1	91.9	93.0	93.4	93.9	94.5	94.3	93.4	92.5
15	87.2	88.3	89.3	90.3	91.2	92.2	92.6	93.1	93.7	94.2	94.2	93.4
10	86.4	87.5	88.5	89.6	90.4	91.5	91.9	92.3	92.9	93.4	93.7	94.3
MINIMUM ASSUMED TEMP (°C)	32	30	30	30	29	29	27	25	21	18	14	10

With engine bleed for packs off, increase %N1 by 0.9.

Assumed Temperature Reduced Thrust (20K Derate)
%N1 Adjustment for Temperature Difference (Table 3 of 3)

ASSUMED TEMP MINUS OAT (°C)	OUTSIDE AIR TEMPERATURE (°C)													
	-40	-20	0	5	10	15	20	25	30	35	40	45	50	55
110	11.2													
100	10.3	6.0												
90	10.5	8.2												
80	11.8	7.1	3.2											
70	10.7	7.4	5.3	3.6	1.8									
60	9.2	8.7	4.1	4.0	3.9	2.2	0.5							
50	7.8	7.5	4.3	2.7	2.6	3.7	2.7	0.9	0.5					
40		6.0	5.7	4.4	2.8	2.9	3.3	3.1	1.4	1.1	0.8			
30		4.6	4.4	4.3	4.2	4.1	4.0	3.9	3.5	3.3	3.0	2.8	3.4	
20			3.0	2.9	2.9	2.9	2.8	2.7	2.6	2.6	2.5	2.5	2.4	2.3
10			1.5	1.5	1.5	1.5	1.4	1.4	1.4	1.3	1.3	1.3	1.2	1.2
0			0	0	0	0	0	0	0	0	0	0	0	0

1. **Determine Maximum Assumed Temperature allowed from Table 1.**
2. **Find Maximum %N1 from Table 2 using the desired assumed temperature (no greater than temperature from Table 1).**
3. **Use the difference between assumed temperature and OAT to determine the %N1 adjustment from Table 3.**
4. **Subtract %N1 adjustment from Maximum %N1 in Table 2.**

Takeoff Speeds - Dry Runway (18K Derate)

V1, VR, V2

WEIGHT (1000 KG)	FLAPS 1			FLAPS 5			FLAPS 10			FLAPS 15			FLAPS 25		
	V1	VR	V2	V1	VR	V2	V1	VR	V2	V1	VR	V2	V1	VR	V2
68	140	140	144												
64	135	136	140	132	132	138									
60	130	131	136	127	127	133									
56	125	125	131	122	122	129	117	117	123	114	115	121	114	114	120
52	119	120	126	116	116	124	112	112	118	109	109	116	108	109	115
48	113	113	121	110	110	119	106	106	114	104	104	112	103	103	111
44	107	107	116	104	104	114	100	100	109	98	98	107	97	98	106
40	101	101	111	97	98	108	94	94	104	92	93	102	92	92	101

Check V1(MCG).

V1, VR, V2 Adjustments*

TEMP		V1							VR							V2						
		PRESS ALT (1000 FT)							PRESS ALT (1000 FT)							PRESS ALT (1000 FT)						
°C	°F	-2	0	2	4	6	8	10	-2	0	2	4	6	8	10	-2	0	2	4	6	8	10
70	158	6	7						6	7						0	0					
60	140	4	5	5	6				4	5	6	6				0	0	0	0			
50	122	3	4	4	4	6	7	9	3	4	4	4	6	7	9	0	0	0	0	0	0	0
40	104	1	2	2	3	4	6	8	1	2	2	3	4	6	8	0	0	0	0	0	0	0
30	86	0	0	0	1	2	5	7	0	0	1	1	3	5	7	0	0	0	0	0	0	0
20	68	0	0	0	1	2	3	5	0	0	1	1	2	3	5	0	0	0	0	0	0	0
-60	-76	0	0	0	1	2	3	3	0	0	1	1	2	3	4	0	0	0	0	0	0	1

Slope and Wind V1 Adjustments*

WEIGHT (1000 KG)	SLOPE (%)					WIND (KTS)							
	-2	-1	0	1	2	-15	-10	-5	0	10	20	30	40
72	-2	0	0	0	0	-1	0	0	0	0	0	0	0
68	-2	0	0	0	0	-1	0	0	0	0	0	0	0
64	-2	0	0	0	0	-1	0	0	0	0	0	0	0
60	-2	0	0	0	0	-1	0	0	0	0	0	0	0
56	-1	0	0	0	0	-1	0	0	0	0	0	0	0
52	-1	0	0	0	0	-1	0	0	0	0	0	0	0
48	-1	0	0	0	0	-1	0	0	0	0	0	0	0
44	-1	0	0	0	0	-1	-1	0	0	0	0	0	0
40	-1	0	0	0	0	-1	-1	0	0	0	0	0	0

***V1 not to exceed VR.**

V1(MCG)

TEMP		PRESSURE ALTITUDE (FT)						
°C	°F	-2000	0	2000	4000	6000	8000	10000
70	158	92	90					
60	140	92	90	91	92			
50	122	94	92	91	92	90	86	82
40	104	99	97	96	94	91	86	82
30	86	102	101	100	99	95	90	84
20	68	102	102	101	99	97	94	89
-60	-76	103	103	102	100	98	96	94

Takeoff Speeds - Wet Runway (18K Derate)

V1, VR, V2

WEIGHT (1000 KG)	FLAPS 1			FLAPS 5			FLAPS 10			FLAPS 15			FLAPS 25		
	V1	VR	V2	V1	VR	V2	V1	VR	V2	V1	VR	V2	V1	VR	V2
68	136	140	144												
64	131	136	140	126	132	138									
60	125	131	136	121	127	133									
56	119	125	131	115	122	129	113	117	123	111	115	121	111	114	120
52	113	120	126	109	116	124	106	112	118	105	109	116	105	109	115
48	107	113	121	103	110	119	100	106	114	99	104	112	98	103	111
44	100	107	116	97	104	114	94	100	109	93	98	107	92	98	106
40	94	101	111	90	98	108	88	94	104	87	93	102	86	92	101

Check V1(MCG).

V1, VR, V2 Adjustments*

TEMP		V1							VR							V2						
		PRESS ALT (1000 FT)							PRESS ALT (1000 FT)							PRESS ALT (1000 FT)						
°C	°F	-2	0	2	4	6	8	10	-2	0	2	4	6	8	10	-2	0	2	4	6	8	10
70	158	9	10						6	7						0	0					
60	140	7	8	8	8				4	5	6	6				0	0	0	0			
50	122	4	5	5	5	7	10	14	3	4	4	4	6	7	9	0	0	0	0	0	0	0
40	104	2	3	3	3	5	7	11	1	2	2	3	4	6	8	0	0	0	0	0	0	0
30	86	0	0	0	1	3	5	8	0	0	1	1	3	5	7	0	0	0	0	0	0	0
20	68	0	0	0	1	2	3	6	0	0	1	1	2	3	5	0	0	0	0	0	0	0
-60	-76	0	0	0	1	2	3	4	0	0	1	1	2	3	4	0	0	0	0	0	0	1

Slope and Wind V1 Adjustments*

WEIGHT (1000 KG)	SLOPE (%)					WIND (KTS)							
	-2	-1	0	1	2	-15	-10	-5	0	10	20	30	40
72	-5	-2	0	2	5	-3	-2	-1	0	0	1	2	2
68	-4	-2	0	2	4	-3	-2	-1	0	1	1	2	2
64	-4	-2	0	2	4	-3	-2	-1	0	1	1	2	2
60	-4	-2	0	2	4	-4	-2	-1	0	1	1	2	3
56	-3	-2	0	2	4	-4	-2	-1	0	1	1	2	3
52	-3	-2	0	2	3	-4	-2	-1	0	1	2	2	3
48	-3	-1	0	1	3	-4	-3	-1	0	1	2	2	3
44	-2	-1	0	1	2	-4	-3	-1	0	1	2	2	3
40	-2	-1	0	1	2	-5	-3	-1	0	1	2	3	3

***V1 not to exceed VR.**

V1(MCG)

TEMP		PRESSURE ALTITUDE (FT)						
°C	°F	-2000	0	2000	4000	6000	8000	10000
70	158	92	90					
60	140	92	90	91	92			
50	122	94	92	91	92	90	86	82
40	104	99	97	96	94	91	86	82
30	86	102	101	100	99	95	90	84
20	68	102	102	101	99	97	94	89
-60	-76	103	103	102	100	98	96	94

Stab Trim Setting (18K Derate)

Flaps 1 and 5

WEIGHT (1000 KG)	C.G. (%MAC)							
	12	14	16	18	24	28	31	33
70	8 1/2	8 1/2	8 1/4	7 3/4	6 1/2	5 1/2	5	4 1/2
60	8 1/2	8 1/2	7 3/4	7 1/4	5 3/4	5	4 1/2	4
50	8 1/4	8	7 1/4	6 3/4	5 1/4	4 1/2	4	3 1/2
40	7	6 3/4	6	5 1/2	4 1/2	3 3/4	3 1/4	2 3/4
36	6	6	5 1/2	5	4	3 1/2	3	2 1/2

Flaps 10, 15 and 25

WEIGHT (1000 KG)	C.G. (%MAC)								
	12	14	16	18	24	28	30	31	33
70	8 1/2	8 1/2	8 1/4	7 1/2	6	5	4 1/2	4 1/4	3 3/4
60	8 1/2	8 1/4	7 1/2	6 3/4	5 1/4	4 1/4	3 3/4	3 1/2	3
50	8 1/4	7 1/2	6 3/4	6	4 1/2	3 3/4	3 1/4	3	2 1/2
40	6 1/4	5 3/4	5 1/2	5	3 3/4	3	2 1/2	2 1/4	2 1/4
36	5 1/4	5	4 3/4	4 1/4	3 1/4	2 1/2	2 1/4	2 1/4	2 1/4

ADVISORY INFORMATION

Slush/Standing Water Takeoff (18K Derate)

Maximum Reverse Thrust

Weight Adjustments (1000 KG)

18K DERATE DRY FIELD/OBSTACLE LIMIT WEIGHT (1000 KG)	SLUSH/STANDING WATER DEPTH								
	3 mm (0.12 INCHES)			6 mm (0.25 INCHES)			13 mm (0.50 INCHES)		
	PRESS ALT(FT)			PRESS ALT(FT)			PRESS ALT(FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
80	-11.4	-13.2	-15.1	-14.2	-16.0	-17.8	-19.8	-21.6	-23.4
75	-9.6	-11.4	-13.2	-11.8	-13.6	-15.4	-16.3	-18.2	-20.0
70	-8.0	-9.8	-11.6	-9.7	-11.5	-13.3	-13.3	-15.2	-17.0
65	-6.6	-8.4	-10.2	-7.9	-9.7	-11.5	-10.8	-12.6	-14.4
60	-5.4	-7.2	-9.0	-6.4	-8.2	-10.0	-8.6	-10.4	-12.2
55	-4.5	-6.3	-8.1	-5.2	-7.0	-8.8	-6.8	-8.7	-10.5
50	-3.8	-5.6	-7.4	-4.3	-6.1	-8.0	-5.5	-7.3	-9.1
45	-3.3	-5.2	-7.0	-3.7	-5.6	-7.4	-4.6	-6.4	-8.2
40	-3.1	-4.9	-6.7	-3.5	-5.3	-7.1	-4.1	-5.9	-7.8
35	-3.1	-4.9	-6.7	-3.5	-5.3	-7.1	-4.0	-5.9	-7.7

V1(MCG) Limit Weight (1000 KG)

ADJUSTED FIELD LENGTH (M)	SLUSH/STANDING WATER DEPTH								
	3 mm (0.12 INCHES)			6 mm (0.25 INCHES)			13 mm (0.50 INCHES)		
	PRESS ALT(FT)			PRESS ALT(FT)			PRESS ALT(FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
1200				25.2			29.1		
1400	36.3			38.3			41.6		
1600	49.8	29.3		51.7	31.5		54.4	35.1	
1800	63.8	42.7		65.4	44.6		67.6	47.7	28.5
2000	78.3	56.4	35.6	79.6	58.2	37.7	81.3	60.7	41.0
2200		70.6	49.1		72.1	51.0		74.1	53.8
2400		85.4	63.1		86.5	64.8		87.9	67.0
2600			77.5			78.9			80.6

1. **Enter Weight Adjustment table with slush/standing water depth and 18K Derate dry field/obstacle limit weight to obtain slush/standing water weight adjustment.**
2. **Adjust field length available by -35 m/+30 m for every 5°C above/below 4°C.**
3. **Find V1(MCG) limit weight for adjusted field length and pressure altitude.**
4. **Max allowable slush/standing water limited weight is lesser of weights from 1 and 3.**

ADVISORY INFORMATION

Slush/Standing Water Takeoff (18K Derate)
Maximum Reverse Thrust
V1 Adjustment (KIAS)

WEIGHT (1000 KG)	SLUSH/STANDING WATER DEPTH								
	3 mm (0.12 INCHES)			6 mm (0.25 INCHES)			13 mm (0.50 INCHES)		
	PRESS ALT(FT)			PRESS ALT(FT)			PRESS ALT(FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
80	-9	-6	-4	0	0	0	0	0	0
75	-10	-8	-5	-2	0	0	0	0	0
70	-12	-9	-7	-5	-3	0	0	0	0
65	-13	-11	-8	-8	-5	-3	0	0	0
60	-14	-12	-9	-10	-8	-5	-1	0	0
55	-16	-13	-11	-13	-10	-8	-5	-3	0
50	-17	-14	-12	-14	-12	-9	-9	-6	-4
45	-18	-15	-13	-16	-13	-11	-12	-9	-7
40	-19	-16	-14	-17	-15	-12	-14	-11	-9
35	-20	-17	-15	-18	-16	-13	-15	-13	-10

1. **Obtain V1, VR and V2 for the actual weight using the 18K Derate Dry Runway Takeoff Speeds table.**
2. **If V1(MCG) limited, set V1 = V1(MCG).If not V1(MCG) limited, enter V1 Adjustment table with the actual weight to obtain V1 speed adjustment. If adjusted V1 is less than V1(MCG), set V1 = V1(MCG). V1 not to exceed VR.**

ADVISORY INFORMATION

Slush/Standing Water Takeoff (18K Derate)

No Reverse Thrust

Weight Adjustments (1000 KG)

18K DERATE DRY FIELD/OBSTACLE LIMIT WEIGHT (1000 KG)	SLUSH/STANDING WATER DEPTH								
	3 mm (0.12 INCHES)			6 mm (0.25 INCHES)			13 mm (0.50 INCHES)		
	PRESS ALT(FT)			PRESS ALT(FT)			PRESS ALT(FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
80	-13.6	-16.1	-18.6	-16.4	-18.9	-21.4	-22.0	-24.5	-27.0
75	-11.5	-14.0	-16.5	-13.8	-16.3	-18.8	-18.4	-20.9	-23.3
70	-9.7	-12.2	-14.7	-11.5	-14.0	-16.5	-15.2	-17.6	-20.1
65	-8.1	-10.6	-13.1	-9.5	-12.0	-14.5	-12.4	-14.9	-17.4
60	-6.8	-9.3	-11.8	-7.9	-10.4	-12.9	-10.0	-12.5	-15.0
55	-5.7	-8.2	-10.7	-6.5	-9.0	-11.5	-8.1	-10.6	-13.1
50	-4.9	-7.4	-9.9	-5.5	-8.0	-10.5	-6.7	-9.2	-11.7
45	-4.3	-6.8	-9.3	-4.8	-7.3	-9.7	-5.6	-8.1	-10.6
40	-4.0	-6.5	-9.0	-4.3	-6.8	-9.3	-5.1	-7.5	-10.0
35	-3.9	-6.4	-8.9	-4.2	-6.7	-9.2	-4.9	-7.4	-9.9

V1(MCG) Limit Weight (1000 KG)

ADJUSTED FIELD LENGTH (M)	SLUSH/STANDING WATER DEPTH								
	3 mm (0.12 INCHES)			6 mm (0.25 INCHES)			13 mm (0.50 INCHES)		
	PRESS ALT(FT)			PRESS ALT(FT)			PRESS ALT(FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
1400							27.2		
1600	25.4			30.9			39.7		
1800	41.1			45.5			53.4	33.1	
2000	56.8	32.8		60.8	37.8		69.6	46.0	26.6
2200	72.5	48.5		77.3	52.7	30.2		60.7	39.1
2400	88.4	64.3	40.3		68.5	44.8		78.7	52.7
2600		80.1	56.0		85.5	60.1			68.8
2800			71.8			76.4			89.2
3000			87.6						

1. **Enter Weight Adjustment table with slush/standing water depth and 18K Derate dry field/obstacle limit weight to obtain slush/standing water weight adjustment.**
2. **Adjust field length available by -45 m/+40 m for every 5°C above/below 4°C.**
3. **Find V1(MCG) limit weight for adjusted field length and pressure altitude.**
4. **Max allowable slush/standing water limited weight is lesser of weights from 1 and 3.**

ADVISORY INFORMATION

Slush/Standing Water Takeoff (18K Derate)
No Reverse Thrust
V1 Adjustment (KIAS)

WEIGHT (1000 KG)	SLUSH/STANDING WATER DEPTH								
	3 mm (0.12 INCHES)			6 mm (0.25 INCHES)			13 mm (0.50 INCHES)		
	PRESS ALT(FT)			PRESS ALT(FT)			PRESS ALT(FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
80	-14	-11	-9	0	0	0	0	0	0
75	-15	-13	-10	-4	-2	0	0	0	0
70	-17	-14	-12	-8	-5	-3	0	0	0
65	-18	-16	-13	-11	-9	-6	0	0	0
60	-19	-17	-14	-14	-12	-9	-2	0	0
55	-21	-18	-16	-17	-14	-12	-7	-5	-2
50	-22	-19	-17	-19	-17	-14	-12	-9	-7
45	-23	-21	-18	-21	-18	-16	-16	-13	-11
40	-24	-22	-19	-22	-20	-17	-18	-16	-13
35	-25	-23	-20	-24	-21	-19	-21	-18	-16

1. **Obtain V1, VR and V2 for the actual weight using the 18K Derate Dry Runway Takeoff Speeds table.**
2. **If V1(MCG) limited, set V1 = V1(MCG).If not V1(MCG) limited, enter V1 Adjustment table with the actual weight to obtain V1 speed adjustment. If adjusted V1 is less than V1(MCG), set V1 = V1(MCG). V1 not to exceed VR.**

ADVISORY INFORMATION

Slippery Runway Takeoff (18K Derate)
Maximum Reverse Thrust
Weight Adjustment (1000 KG)

18K DERATE DRY FIELD/OBSTACLE LIMIT WEIGHT (1000 KG)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT(FT)			PRESS ALT(FT)			PRESS ALT(FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
80	-0.8	-0.8	-0.8	-5.8	-5.8	-5.8	-10.5	-10.5	-10.5
75	-0.8	-0.8	-0.8	-5.2	-5.2	-5.2	-9.2	-9.2	-9.2
70	-0.7	-0.7	-0.7	-4.6	-4.6	-4.6	-8.2	-8.2	-8.2
65	-0.7	-0.7	-0.7	-4.2	-4.2	-4.2	-7.2	-7.2	-7.2
60	-0.6	-0.6	-0.6	-3.8	-3.8	-3.8	-6.5	-6.5	-6.5
55	-0.6	-0.6	-0.6	-3.5	-3.5	-3.5	-5.9	-5.9	-5.9
50	-0.6	-0.6	-0.6	-3.3	-3.3	-3.3	-5.4	-5.4	-5.4
45	-0.7	-0.7	-0.7	-3.1	-3.1	-3.1	-5.2	-5.2	-5.2
40	-0.7	-0.7	-0.7	-3.0	-3.0	-3.0	-5.0	-5.0	-5.0
35	-0.7	-0.7	-0.7	-3.0	-3.0	-3.0	-5.1	-5.1	-5.1

V1(MCG) Limit Weight (1000 KG)

ADJUSTED FIELD LENGTH (M)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
1000	33.6								
1200	52.6	35.2							
1400	72.4	54.2	36.8	39.4					
1600		74.1	55.9	54.6	36.2		27.7		
1800			75.8	70.8	51.1	33.0	38.2		
2000				88.4	67.2	47.8	48.9	30.3	
2200					84.4	63.5	60.2	40.8	
2400						80.5	72.2	51.7	32.9
2600							84.9	63.1	43.4
2800								75.3	54.5
3000								88.1	66.1
3200									78.4

1. **Enter Weight Adjustment table with reported braking action and 18K Derate dry field/obstacle limit weight to obtain slippery runway weight adjustment.**
2. **Adjust "Good" field length available by -25 m/+20 m for every 5°C above/below 4°C.**
   Adjust "Medium" field length available by -25 m/+20 m for every 5°C above/below 4°C.
   Adjust "Poor" field length available by -40 m/+35 m for every 5°C above/below 4°C.
3. **Find V1(MCG) limit weight for adjusted field length and pressure altitude.**
4. **Max allowable slippery runway limited weight is lesser of weights from 1 and 3.**

ADVISORY INFORMATION

Slippery Runway Takeoff (18K Derate)
Maximum Reverse Thrust
V1 Adjustment (KIAS)

WEIGHT (1000 KG)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
80	-10	-8	-7	-15	-14	-13	-26	-25	-23
75	-7	-6	-5	-14	-12	-11	-24	-22	-21
70	-6	-5	-4	-13	-12	-11	-23	-22	-21
65	-6	-5	-3	-14	-13	-11	-24	-22	-21
60	-6	-5	-4	-15	-14	-12	-25	-24	-22
55	-7	-6	-5	-16	-15	-14	-27	-26	-24
50	-8	-7	-6	-18	-17	-15	-29	-28	-27
45	-9	-8	-7	-20	-18	-17	-31	-30	-29
40	-10	-9	-8	-21	-20	-18	-33	-32	-31
35	-10	-9	-8	-22	-21	-20	-35	-34	-32

1. **Obtain V1, VR and V2 for the actual weight using the 18K Derate Dry Runway Takeoff Speeds table.**
2. **If V1(MCG) limited, set V1 = V1(MCG).If not V1(MCG) limited, enter V1 Adjustment table with the actual weight to obtain V1 speed adjustment. If adjusted V1 is less than V1(MCG), set V1 = V1(MCG). V1 not to exceed VR.**

ADVISORY INFORMATION

Slippery Runway Takeoff (18K Derate)

No Reverse Thrust

Weight Adjustments (1000 KG)

18K DERATE DRY FIELD/OBSTACLE LIMIT WEIGHT (1000 KG)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
80	-2.0	-2.0	-2.0	-7.7	-7.7	-7.7	-15.3	-15.3	-15.3
75	-1.8	-1.8	-1.8	-6.9	-6.9	-6.9	-12.9	-12.9	-12.9
70	-1.6	-1.6	-1.6	-6.2	-6.2	-6.2	-10.9	-10.9	-10.9
65	-1.4	-1.4	-1.4	-5.6	-5.6	-5.6	-9.4	-9.4	-9.4
60	-1.3	-1.3	-1.3	-5.1	-5.1	-5.1	-8.2	-8.2	-8.2
55	-1.2	-1.2	-1.2	-4.7	-4.7	-4.7	-7.5	-7.5	-7.5
50	-1.2	-1.2	-1.2	-4.4	-4.4	-4.4	-7.1	-7.1	-7.1
45	-1.2	-1.2	-1.2	-4.2	-4.2	-4.2	-7.2	-7.2	-7.2
40	-1.3	-1.3	-1.3	-4.1	-4.1	-4.1	-7.7	-7.7	-7.7
35	-1.4	-1.4	-1.4	-4.0	-4.0	-4.0	-8.5	-8.5	-8.5

V1(MCG) Limit Weight (1000 KG)

ADJUSTED FIELD LENGTH (M)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
1200	45.5	26.5							
1400	66.7	47.3	28.2						
1600	88.4	68.5	49.1	33.8					
1800			70.4	52.2	28.5				
2000				71.5	46.7				
2200					65.7	41.2			
2400					85.6	60.0	30.8		
2600						79.6	45.4		
2800							60.1	31.1	
3000							74.9	45.7	
3200							89.7	60.4	31.4
3400								75.1	46.0
3600								90.0	60.7
3800									75.4

1. **Enter Weight Adjustment table with reported braking action and 18K Derate dry field/obstacle limit weight to obtain slippery runway weight adjustment.**
2. **Adjust "Good" field length available by -25 m/+20 m for every 5°C above/below 4°C.**
   Adjust "Medium" field length available by -25 m/+20 m for every 5°C above/below 4°C.
   Adjust "Poor" field length available by -45 m/+40 m for every 5°C above/below 4°C.
3. **Find V1(MCG) limit weight for adjusted field length and pressure altitude.**
4. **Max allowable slippery runway limited weight is lesser of weights from 1 and 3.**

ADVISORY INFORMATION

Slippery Runway Takeoff (18K Derate)
No Reverse Thrust
V1 Adjustment (KIAS)

WEIGHT (1000 KG)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
80	-10	-7	-5	-18	-15	-13	-36	-33	-31
75	-8	-6	-3	-17	-14	-12	-33	-31	-28
70	-7	-5	-2	-17	-14	-12	-32	-30	-27
65	-7	-5	-2	-18	-15	-13	-33	-31	-28
60	-8	-5	-3	-19	-17	-14	-35	-33	-30
55	-9	-6	-4	-21	-18	-16	-38	-35	-33
50	-10	-8	-5	-23	-21	-18	-40	-38	-35
45	-11	-9	-6	-25	-23	-20	-43	-41	-38
40	-12	-10	-7	-27	-25	-22	-45	-43	-40
35	-13	-11	-8	-29	-26	-24	-46	-44	-41

1. **Obtain V1, VR and V2 for the actual weight using the 18K Derate Dry Runway Takeoff Speeds table.**
2. **If V1(MCG) limited, set V1 = V1(MCG).If not V1(MCG) limited, enter V1 Adjustment table with the actual weight to obtain V1 speed adjustment. If adjusted V1 is less than V1(MCG), set V1 = V1(MCG).V1 not to exceed VR.**

Takeoff %N1 (18K Derate)

Based on engine bleeds for packs on, engine and wing anti-ice on or off

OAT (°C)	AIRPORT PRESSURE ALTITUDE (FT)												
	-2000	-1000	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
60	82.0	82.4	82.8	83.6	84.5	85.5	86.5	86.4	86.4	85.6	85.2	84.7	84.3
55	82.8	83.3	83.7	84.5	85.5	86.4	87.3	87.3	87.2	86.5	85.8	84.8	83.8
50	83.7	84.1	84.5	85.5	86.5	87.3	88.2	88.1	88.1	87.4	86.7	85.7	84.7
45	84.6	85.1	85.5	86.4	87.4	88.2	89.0	88.9	88.9	88.2	87.5	86.6	85.6
40	85.7	86.1	86.6	87.4	88.2	89.0	89.8	89.7	89.6	89.0	88.4	87.4	86.5
35	86.6	87.1	87.5	88.3	89.1	89.9	90.7	90.5	90.4	89.8	89.2	88.3	87.4
30	86.2	87.3	88.4	89.2	90.1	90.8	91.6	91.4	91.3	90.6	90.0	89.1	88.2
25	85.5	86.6	87.7	88.5	89.4	90.2	91.0	91.6	92.0	91.5	90.9	90.0	89.0
20	84.8	85.9	87.0	87.8	88.7	89.5	90.3	90.8	91.3	91.8	91.7	90.8	90.0
15	84.1	85.2	86.3	87.1	88.0	88.8	89.5	90.1	90.5	91.1	91.6	91.7	90.8
10	83.4	84.5	85.5	86.3	87.2	88.0	88.8	89.3	89.8	90.3	90.8	91.3	91.9
5	82.7	83.7	84.8	85.6	86.5	87.3	88.0	88.5	89.0	89.5	90.1	90.5	91.1
0	82.0	83.0	84.1	84.9	85.7	86.5	87.3	87.8	88.2	88.8	89.3	89.7	90.3
-5	81.2	82.3	83.3	84.1	85.0	85.7	86.5	87.0	87.4	88.0	88.5	88.9	89.5
-10	80.5	81.5	82.5	83.3	84.2	84.9	85.7	86.2	86.6	87.2	87.7	88.1	88.7
-15	79.7	80.8	81.8	82.6	83.4	84.2	84.9	85.4	85.8	86.4	86.9	87.3	87.9
-20	79.0	80.0	81.0	81.8	82.6	83.4	84.1	84.6	85.0	85.6	86.1	86.5	87.1
-25	78.2	79.2	80.2	81.0	81.8	82.6	83.3	83.8	84.2	84.7	85.2	85.7	86.2
-30	77.5	78.4	79.4	80.2	81.0	81.8	82.5	82.9	83.4	83.9	84.4	84.8	85.4
-35	76.7	77.7	78.6	79.4	80.2	80.9	81.7	82.1	82.6	83.1	83.6	84.0	84.6
-40	75.9	76.9	77.8	78.6	79.4	80.1	80.8	81.3	81.7	82.2	82.7	83.1	83.7
-45	75.1	76.1	77.0	77.8	78.6	79.3	80.0	80.4	80.9	81.4	81.9	82.3	82.8
-50	74.3	75.2	76.2	76.9	77.7	78.4	79.1	79.6	80.0	80.5	81.0	81.4	81.9

%N1 Adjustments for Engine Bleeds

BLEED CONFIGURATION	AIRPORT PRESSURE ALTITUDE (FT)												
	-2000	-1000	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
PACKS OFF	0.7	0.7	0.7	0.7	0.7	0.7	0.8	0.8	0.8	0.8	0.9	0.9	0.9

Assumed Temperature Reduced Thrust (18K Derate)

Maximum Assumed Temperature (Table 1 of 3)

Based on 25% Takeoff Thrust Reduction

OAT (°C)	PRESSURE ALTITUDE (FT)											
	-1000	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
54	73	71	69	67								
50	73	71	69	67	65	63						
45	73	71	69	67	65	63	61	59	57			
40	69	69	68	67	65	63	61	59	57	55		
35	64	64	63	64	65	63	61	59	57	55	53	
30	61	59	59	59	60	61	61	59	57	55	53	51
25	61	59	58	59	59	60	58	57	56	55	53	51
20	61	59	58	59	59	60	58	57	52	51	50	50
15	61	59	58	59	59	60	58	57	52	48	45	44
10 & BELOW	61	59	58	59	59	60	58	57	52	48	44	39

Takeoff %N1 (Table 2 of 3)

Based on engine bleeds for packs on, engine and wing anti-ice on or off

ASSUMED TEMP (°C)	AIRPORT PRESSURE ALTITUDE (FT)											
	-1000	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
75	79.8	80.1	81.1	82.7	84.5	86.2	86.7	87.3	87.1	87.0	86.6	86.2
70	80.7	81.1	81.5	82.5	83.9	85.6	86.1	86.7	86.5	86.4	86.0	85.6
65	81.6	82.0	82.6	83.5	84.5	85.6	85.5	86.1	85.9	85.8	85.4	84.9
60	82.4	82.8	83.6	84.5	85.5	86.5	86.4	86.4	85.6	85.2	84.7	84.3
55	83.3	83.7	84.5	85.5	86.4	87.3	87.3	87.2	86.5	85.8	84.8	83.8
50	84.1	84.5	85.5	86.5	87.3	88.2	88.1	88.1	87.4	86.7	85.7	84.7
45	85.1	85.5	86.4	87.4	88.2	89.0	88.9	88.9	88.2	87.5	86.6	85.6
40	86.1	86.6	87.4	88.2	89.0	89.8	89.7	89.6	89.0	88.4	87.4	86.5
35	87.1	87.5	88.3	89.1	89.9	90.7	90.5	90.4	89.8	89.2	88.3	87.4
30	87.3	88.4	89.2	90.1	90.8	91.6	91.4	91.3	90.6	90.0	89.1	88.2
25	86.6	87.7	88.5	89.4	90.2	91.0	91.6	92.0	91.5	90.9	90.0	89.0
20	85.9	87.0	87.8	88.7	89.5	90.3	90.8	91.3	91.8	91.7	90.8	90.0
15	85.2	86.3	87.1	88.0	88.8	89.5	90.1	90.5	91.1	91.6	91.7	90.8
10	84.5	85.5	86.3	87.2	88.0	88.8	89.3	89.8	90.3	90.8	91.3	91.9
MINIMUM ASSUMED TEMP (°C)	32	30	30	30	29	29	27	25	21	18	14	10

With engine bleed for packs off, increase %N1 by 0.9.

Assumed Temperature Reduced Thrust (18K Derate)
%N1 Adjustment for Temperature Difference (Table 3 of 3)

ASSUMED TEMP MINUS OAT (°C)	OUTSIDE AIR TEMPERATURE (°C)													
	-40	-20	0	5	10	15	20	25	30	35	40	45	50	55
110	10.4													
100	9.2	6.5												
90	9.6	7.3												
80	11.3	6.1	3.7											
70	10.5	6.5	4.4	4.0	2.4									
60	9.0	8.2	3.1	3.0	2.9	2.7	1.1							
50	7.6	7.3	3.5	1.9	1.7	2.9	2.7	1.4	1.2					
40		5.9	5.3	3.7	2.1	2.2	2.8	3.1	1.5	1.6	1.5			
30		4.5	4.3	4.2	3.9	4.0	3.9	3.8	3.5	3.3	3.2	3.4	3.4	
20			2.9	2.9	2.8	2.8	2.7	2.7	2.6	2.5	2.5	2.4	2.3	2.3
10			1.5	1.4	1.4	1.4	1.4	1.4	1.3	1.3	1.3	1.2	1.2	1.2
0			0	0	0	0	0	0	0	0	0	0	0	0

1. **Determine Maximum Assumed Temperature allowed from Table 1.**
2. **Find Maximum %N1 from Table 2 using the desired assumed temperature (no greater than temperature from Table 1).**
3. **Use the difference between assumed temperature and OAT to determine the %N1 adjustment from Table 3.**
4. **Subtract %N1 adjustment from Maximum %N1 in Table 2.**

Max Climb %N1

Based on engine bleed for packs on or off and anti-ice off

TAT (°C)	PRESSURE ALTITUDE (FT)/SPEED (KIAS/MACH)									
	0	5000	10000	15000	20000	25000	30000	35000	37000	41000
	280	280	280	280	280	280	280	.78	.78	.78
60	88.4	88.6	88.5	88.2	88.9	91.3	92.9	94.3	94.4	92.7
55	89.2	89.4	89.3	89.1	89.3	90.6	92.3	93.6	93.7	92.0
50	90.0	90.1	90.1	89.9	90.2	90.7	91.6	92.9	93.0	91.3
45	90.7	90.8	90.9	90.7	91.1	91.6	91.6	92.2	92.3	90.6
40	91.5	91.6	91.6	91.4	92.0	92.4	92.4	91.5	91.6	89.9
35	92.0	92.3	92.3	92.2	92.8	93.2	93.2	92.3	91.6	90.0
30	91.3	93.0	93.0	92.9	93.6	94.0	93.9	93.1	92.5	91.0
25	90.5	93.0	93.8	93.6	94.3	94.8	94.6	93.9	93.3	92.0
20	89.8	92.3	94.5	94.3	95.1	95.5	95.3	94.6	94.1	92.9
15	89.1	91.5	93.9	95.1	95.8	96.2	96.0	95.4	94.9	93.9
10	88.3	90.8	93.1	95.3	96.7	96.9	96.6	96.1	95.7	94.8
5	87.5	90.0	92.4	94.5	97.7	97.8	97.3	96.9	96.5	95.7
0	86.8	89.2	91.6	93.7	97.1	98.9	98.3	97.8	97.4	96.6
-5	86.0	88.4	90.8	92.9	96.3	98.8	99.3	98.5	98.2	97.7
-10	85.2	87.6	89.9	92.1	95.5	98.0	99.6	99.4	99.1	98.6
-15	84.4	86.8	89.1	91.2	94.7	97.3	98.8	100.4	100.1	99.6
-20	83.6	86.0	88.3	90.4	93.9	96.5	98.0	100.1	100.6	100.2
-25	82.8	85.2	87.5	89.6	93.1	95.7	97.2	99.2	99.8	99.4
-30	82.0	84.3	86.6	88.7	92.3	94.9	96.4	98.4	98.9	98.6
-35	81.2	83.5	85.8	87.9	91.4	94.0	95.5	97.6	98.1	97.7
-40	80.4	82.6	84.9	87.0	90.6	93.2	94.7	96.7	97.2	96.9

%N1 Adjustments for Engine Bleeds

BLEED CONFIGURATION	PRESSURE ALTITUDE (1000 FT)					
	0	10	20	30	35	41
ENGINE ANTI-ICE	-0.6	-0.8	-0.9	-0.9	-0.8	-0.8
ENGINE & WING ANTI-ICE*	-1.8	-2.1	-2.5	-2.7	-3.0	-3.0

***Dual bleed sources**

Go-around %N1

Based on engine bleed for packs on, engine and wing anti-ice on or off

AIRPORT OAT		TAT (°C)	AIRPORT PRESSURE ALTITUDE (FT)											
°C	°F		-2000	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
57	134	60	88.5	89.3	89.4									
52	125	55	89.2	90.1	90.3	90.4	90.5							
47	116	50	90.0	90.9	91.0	91.2	91.3	91.4	91.4	91.3				
42	108	45	90.9	91.7	91.9	92.0	92.1	92.2	92.2	92.1	91.8	91.4		
37	99	40	91.8	92.6	92.7	92.8	92.9	93.0	93.0	92.9	92.6	92.2	92.1	92.0
32	90	35	91.9	93.5	93.6	93.7	93.7	93.8	93.7	93.7	93.4	93.0	93.0	92.9
27	81	30	91.2	93.4	94.1	94.5	94.6	94.6	94.6	94.5	94.1	93.8	93.8	93.7
22	72	25	90.5	92.6	93.3	94.0	94.7	95.5	95.4	95.3	95.0	94.6	94.5	94.5
17	63	20	89.7	91.9	92.6	93.3	94.0	94.7	95.2	95.8	96.0	95.7	95.3	95.3
12	54	15	89.0	91.1	91.8	92.5	93.2	93.9	94.5	95.0	95.6	96.2	96.8	96.5
7	45	10	88.3	90.4	91.0	91.7	92.4	93.2	93.7	94.2	94.8	95.4	96.1	96.7
2	36	5	87.5	89.6	90.3	90.9	91.6	92.4	92.9	93.4	94.0	94.6	95.3	95.9
-3	27	0	86.7	88.8	89.5	90.1	90.9	91.6	92.1	92.6	93.2	93.8	94.5	95.1
-8	18	-5	86.0	88.0	88.7	89.4	90.1	90.8	91.3	91.8	92.4	93.0	93.7	94.3
-13	9	-10	85.2	87.2	87.9	88.5	89.2	89.9	90.5	91.0	91.6	92.2	92.9	93.5
-17	1	-15	84.4	86.4	87.1	87.7	88.4	89.1	89.7	90.2	90.8	91.4	92.0	92.7
-22	-8	-20	83.6	85.6	86.3	86.9	87.6	88.3	88.8	89.3	90.0	90.5	91.2	91.9
-27	-17	-25	82.8	84.8	85.4	86.1	86.8	87.5	88.0	88.5	89.1	89.7	90.4	91.1
-32	-26	-30	82.0	84.0	84.6	85.2	85.9	86.6	87.1	87.6	88.3	88.9	89.5	90.2
-37	-35	-35	81.2	83.1	83.8	84.4	85.1	85.8	86.3	86.8	87.4	88.0	88.7	89.4
-42	-44	-40	80.3	82.3	82.9	83.5	84.2	84.9	85.4	85.9	86.5	87.1	87.8	88.5
-47	-53	-45	79.5	81.4	82.1	82.7	83.4	84.0	84.5	85.0	85.7	86.3	87.0	87.6
-52	-62	-50	78.6	80.6	81.2	81.8	82.5	83.1	83.6	84.1	84.8	85.4	86.1	86.8

%N1 Adjustments for Engine Bleeds

BLEED CONFIGURATION	PRESSURE ALTITUDE (FT)											
	-2000	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
PACKS OFF	0.6	0.6	0.6	0.6	0.6	0.6	0.7	0.7	0.7	0.8	0.8	0.8
A/C HIGH	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2

Flight With Unreliable Airspeed/Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

CLIMB (280/.76)

Flaps Up, Set Max Climb Thrust

PRESSURE ALTITUDE (FT)		WEIGHT (1000 KG)			
		40	50	60	70
40000	**PITCH ATT**	**4.5**	**4.0**	**4.0**	
	V/S (FT/MIN)	1800	1100	500	
30000	**PITCH ATT**	**4.5**	**4.0**	**4.0**	**4.0**
	V/S (FT/MIN)	2700	2000	1500	1200
20000	**PITCH ATT**	**7.5**	**6.5**	**6.0**	**6.0**
	V/S (FT/MIN)	4200	3200	2600	2100
10000	**PITCH ATT**	**10.5**	**9.0**	**8.5**	**8.0**
	V/S (FT/MIN)	5400	4300	3400	2800
SEA LEVEL	**PITCH ATT**	**14.5**	**12.5**	**11.0**	**10.0**
	V/S (FT/MIN)	6600	5200	4300	3600

CRUISE (.76/280)

Flaps Up, %N1 for Level Flight

PRESSURE ALTITUDE (FT)		WEIGHT (1000 KG)			
		40	50	60	70
40000	**PITCH ATT**	**2.0**	**2.5**	**3.5**	
	%N1	**82**	**85**	**90**	
35000	**PITCH ATT**	**1.5**	**2.0**	**2.5**	**3.0**
	%N1	**80**	**82**	**84**	**87**
30000	**PITCH ATT**	**1.0**	**1.5**	**2.0**	**2.5**
	%N1	**80**	**81**	**82**	**84**
25000	**PITCH ATT**	**1.0**	**1.5**	**2.0**	**2.5**
	%N1	**76**	**77**	**78**	**80**
20000	**PITCH ATT**	**1.0**	**1.5**	**2.5**	**3.0**
	%N1	**72**	**74**	**75**	**76**
15000	**PITCH ATT**	**1.0**	**1.5**	**2.5**	**3.0**
	%N1	**69**	**70**	**71**	**73**

Flight With Unreliable Airspeed/Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

DESCENT (.76/280)

Flaps Up, Set Idle Thrust

PRESSURE ALTITUDE (FT)		WEIGHT (1000 KG) 40	50	60	70
40000	**PITCH ATT**	**-1.5**	**-0.5**	**0.0**	**0.5**
	V/S (FT/MIN)	-2800	-2500	-2500	-2800
30000	**PITCH ATT**	**-3.0**	**-2.0**	**-1.0**	**0.0**
	V/S (FT/MIN)	-3000	-2500	-2200	-2100
20000	**PITCH ATT**	**-3.0**	**-1.5**	**-0.5**	**0.0**
	V/S (FT/MIN)	-2700	-2200	-2000	-1800
10000	**PITCH ATT**	**-3.0**	**-2.0**	**-1.0**	**0.0**
	V/S (FT/MIN)	-2400	-2000	-1800	-1600
SEA LEVEL	**PITCH ATT**	**-3.5**	**-2.0**	**-1.0**	**0.0**
	V/S (FT/MIN)	-2200	-1800	-1600	-1500

HOLDING (VREF40 + 70)

Flaps Up, %N1 for Level Flight

PRESSURE ALTITUDE (FT)		WEIGHT (1000 KG) 40	50	60	70	80
15000	**PITCH ATT**	**5.0**	**5.0**	**5.0**	**5.0**	**5.0**
	%N1	**56**	**62**	**66**	**70**	**73**
	KIAS	177	195	214	231	248
10000	**PITCH ATT**	**5.0**	**5.0**	**5.0**	**5.0**	**5.0**
	%N1	**52**	**57**	**62**	**66**	**69**
	KIAS	177	194	213	230	246
5000	**PITCH ATT**	**5.0**	**5.5**	**5.0**	**5.0**	**5.0**
	%N1	**48**	**54**	**58**	**62**	**66**
	KIAS	177	194	212	229	245

Flight With Unreliable Airspeed/Turbulent Air Penetration
Altitude and/or vertical speed indications may also be unreliable.

TERMINAL AREA (5000FT)
%N1 for Level Flight
Airport Altitude = -2000 FT

FLAP POSITION (VREF + INCREMENT)		WEIGHT (1000 KG) 40	50	60	70	80
FLAPS UP (GEAR UP) VREF40+70	**PITCH ATT**	**5.0**	**5.5**	**6.0**	**6.5**	**6.5**
	%N1	**47.5**	**52.2**	**56.4**	**60.1**	**63.8**
	KIAS	177	189	201	211	222
FLAPS 1 (GEAR UP) VREF40+50	**PITCH ATT**	**5.0**	**5.5**	**6.0**	**6.5**	**6.5**
	%N1	**49.3**	**54.2**	**58.5**	**62.6**	**66.2**
	KIAS	157	169	181	191	202
FLAPS 5 (GEAR UP) VREF40+30	**PITCH ATT**	**5.5**	**6.0**	**6.5**	**7.0**	**7.0**
	%N1	**49.8**	**55.2**	**59.8**	**64.2**	**67.9**
	KIAS	137	149	161	171	182
FLAPS 10 (GEAR UP) VREF40+30	**PITCH ATT**	**5.0**	**5.5**	**6.0**	**6.5**	**6.5**
	%N1	**53.1**	**58.4**	**63.2**	**67.4**	**71.1**
	KIAS	137	149	161	171	182
FLAPS 15 (GEAR UP) VREF40+20	**PITCH ATT**	**5.5**	**6.0**	**6.5**	**6.5**	**6.5**
	%N1	**53.3**	**58.8**	**63.8**	**68.0**	**71.8**
	KIAS	127	139	151	161	172
FLAPS 25 (GEAR UP) VREF40+10	**PITCH ATT**	**7.0**	**7.0**	**7.5**	**7.5**	**7.5**
	%N1	**54.2**	**60.0**	**65.1**	**69.3**	**73.2**
	KIAS	117	129	141	151	162
FLAPS 15 (GEAR DOWN) VREF40+20	**PITCH ATT**	**6.0**	**6.0**	**6.5**	**7.0**	**7.0**
	%N1	**57.2**	**63.0**	**67.9**	**72.2**	**76.1**
	KIAS	127	139	151	161	172

Flight With Unreliable Airspeed/Turbulent Air Penetration
Altitude and/or vertical speed indications may also be unreliable.

TERMINAL AREA (5000FT)
%N1 for Level Flight
Airport Altitude = -1000 FT

FLAP POSITION (VREF + INCREMENT)		WEIGHT (1000 KG)				
		40	50	60	70	80
FLAPS UP (GEAR UP) VREF40+70	**PITCH ATT**	**5.0**	**5.5**	**6.0**	**6.5**	**6.5**
	%N1	**48.2**	**52.9**	**57.1**	**60.9**	**64.6**
	KIAS	177	189	201	211	222
FLAPS 1 (GEAR UP) VREF40+50	**PITCH ATT**	**5.0**	**5.5**	**6.0**	**6.5**	**6.5**
	%N1	**49.9**	**54.9**	**59.2**	**63.4**	**66.9**
	KIAS	157	169	181	191	202
FLAPS 5 (GEAR UP) VREF40+30	**PITCH ATT**	**5.5**	**6.0**	**6.5**	**7.0**	**7.0**
	%N1	**50.5**	**55.9**	**60.7**	**65.0**	**68.7**
	KIAS	137	149	161	171	182
FLAPS 10 (GEAR UP) VREF40+30	**PITCH ATT**	**5.0**	**5.5**	**6.0**	**6.0**	**6.5**
	%N1	**53.8**	**59.2**	**64.0**	**68.2**	**72.0**
	KIAS	137	149	161	171	182
FLAPS 15 (GEAR UP) VREF40+20	**PITCH ATT**	**5.5**	**6.0**	**6.5**	**6.5**	**6.5**
	%N1	**54.0**	**59.6**	**64.6**	**68.8**	**72.7**
	KIAS	127	139	151	161	172
FLAPS 25 (GEAR UP) VREF40+10	**PITCH ATT**	**7.0**	**7.0**	**7.5**	**7.5**	**7.5**
	%N1	**54.9**	**60.8**	**65.9**	**70.1**	**74.1**
	KIAS	117	129	141	151	162
FLAPS 15 (GEAR DOWN) VREF40+20	**PITCH ATT**	**6.0**	**6.0**	**6.5**	**6.5**	**7.0**
	%N1	**58.0**	**63.8**	**68.7**	**73.1**	**76.9**
	KIAS	127	139	151	161	172

Flight With Unreliable Airspeed/Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

TERMINAL AREA (5000FT)
%N1 for Level Flight
Airport Altitude = SEA LEVEL

FLAP POSITION (VREF + INCREMENT)		WEIGHT (1000 KG) 40	50	60	70	80
FLAPS UP (GEAR UP) VREF40+70	**PITCH ATT**	**5.0**	**5.5**	**6.0**	**6.5**	**6.5**
	%N1	**48.9**	**53.6**	**57.8**	**61.7**	**65.4**
	KIAS	177	189	201	212	222
FLAPS 1 (GEAR UP) VREF40+50	**PITCH ATT**	**5.0**	**5.5**	**6.0**	**6.0**	**6.5**
	%N1	**50.6**	**55.7**	**60.0**	**64.2**	**67.7**
	KIAS	157	169	181	192	202
FLAPS 5 (GEAR UP) VREF40+30	**PITCH ATT**	**5.5**	**6.0**	**6.5**	**7.0**	**7.0**
	%N1	**51.3**	**56.6**	**61.5**	**65.8**	**69.5**
	KIAS	137	149	161	172	182
FLAPS 10 (GEAR UP) VREF40+30	**PITCH ATT**	**5.0**	**5.5**	**6.0**	**6.0**	**6.5**
	%N1	**54.5**	**60.0**	**64.8**	**69.0**	**72.9**
	KIAS	137	149	161	172	182
FLAPS 15 (GEAR UP) VREF40+20	**PITCH ATT**	**5.5**	**6.0**	**6.5**	**6.5**	**6.5**
	%N1	**54.7**	**60.4**	**65.4**	**69.6**	**73.6**
	KIAS	127	139	151	162	172
FLAPS 25 (GEAR UP) VREF40+10	**PITCH ATT**	**7.0**	**7.0**	**7.0**	**7.5**	**7.5**
	%N1	**55.7**	**61.6**	**66.6**	**71.0**	**74.9**
	KIAS	117	129	141	152	162
FLAPS 15 (GEAR DOWN) VREF40+20	**PITCH ATT**	**6.0**	**6.0**	**6.5**	**6.5**	**7.0**
	%N1	**58.8**	**64.7**	**69.5**	**73.9**	**77.8**
	KIAS	127	139	151	162	172

Flight With Unreliable Airspeed/Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

TERMINAL AREA (5000FT)
%N1 for Level Flight
Airport Altitude = 1000 FT

FLAP POSITION (VREF + INCREMENT)		WEIGHT (1000 KG)				
		40	50	60	70	80
FLAPS UP (GEAR UP) VREF40+70	**PITCH ATT**	**5.0**	**5.5**	**6.0**	**6.5**	**6.5**
	%N1	**49.6**	**54.3**	**58.6**	**62.6**	**66.1**
	KIAS	177	190	202	212	223
FLAPS 1 (GEAR UP) VREF40+50	**PITCH ATT**	**5.0**	**5.5**	**6.0**	**6.0**	**6.5**
	%N1	**51.3**	**56.4**	**60.9**	**65.0**	**68.5**
	KIAS	157	170	182	192	203
FLAPS 5 (GEAR UP) VREF40+30	**PITCH ATT**	**5.5**	**6.0**	**6.5**	**7.0**	**7.0**
	%N1	**52.0**	**57.4**	**62.3**	**66.6**	**70.3**
	KIAS	137	150	162	172	183
FLAPS 10 (GEAR UP) VREF40+30	**PITCH ATT**	**5.0**	**5.5**	**6.0**	**6.0**	**6.5**
	%N1	**55.2**	**60.8**	**65.7**	**69.8**	**73.7**
	KIAS	137	150	162	172	183
FLAPS 15 (GEAR UP) VREF40+20	**PITCH ATT**	**5.5**	**6.0**	**6.5**	**6.5**	**6.5**
	%N1	**55.4**	**61.3**	**66.2**	**70.5**	**74.4**
	KIAS	127	140	152	162	173
FLAPS 25 (GEAR UP) VREF40+10	**PITCH ATT**	**7.0**	**7.0**	**7.0**	**7.5**	**7.5**
	%N1	**56.5**	**62.4**	**67.4**	**71.9**	**75.7**
	KIAS	117	130	142	152	163
FLAPS 15 (GEAR DOWN) VREF40+20	**PITCH ATT**	**6.0**	**6.0**	**6.5**	**6.5**	**6.5**
	%N1	**59.6**	**65.5**	**70.4**	**74.8**	**78.6**
	KIAS	127	140	152	162	173

Flight With Unreliable Airspeed/Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

TERMINAL AREA (5000FT)
%N1 for Level Flight
Airport Altitude = 2000 FT

FLAP POSITION (VREF + INCREMENT)		WEIGHT (1000 KG)				
		40	50	60	70	80
FLAPS UP (GEAR UP) VREF40+70	**PITCH ATT**	**5.0**	**5.5**	**6.0**	**6.5**	**6.5**
	%N1	**50.3**	**55.0**	**59.3**	**63.4**	**66.8**
	KIAS	177	190	202	212	223
FLAPS 1 (GEAR UP) VREF40+50	**PITCH ATT**	**5.0**	**5.5**	**6.0**	**6.0**	**6.5**
	%N1	**52.0**	**57.1**	**61.7**	**65.7**	**69.3**
	KIAS	157	170	182	192	203
FLAPS 5 (GEAR UP) VREF40+30	**PITCH ATT**	**5.5**	**6.0**	**6.5**	**7.0**	**7.0**
	%N1	**52.7**	**58.2**	**63.1**	**67.4**	**71.1**
	KIAS	137	150	162	172	183
FLAPS 10 (GEAR UP) VREF40+30	**PITCH ATT**	**5.0**	**5.5**	**6.0**	**6.0**	**6.5**
	%N1	**56.0**	**61.6**	**66.5**	**70.7**	**74.5**
	KIAS	137	150	162	172	183
FLAPS 15 (GEAR UP) VREF40+20	**PITCH ATT**	**5.5**	**6.0**	**6.0**	**6.5**	**6.5**
	%N1	**56.2**	**62.1**	**67.0**	**71.4**	**75.3**
	KIAS	127	140	152	162	173
FLAPS 25 (GEAR UP) VREF40+10	**PITCH ATT**	**7.0**	**7.0**	**7.0**	**7.5**	**7.5**
	%N1	**57.2**	**63.3**	**68.2**	**72.7**	**76.5**
	KIAS	117	130	142	152	163
FLAPS 15 (GEAR DOWN) VREF40+20	**PITCH ATT**	**6.0**	**6.0**	**6.5**	**6.5**	**6.5**
	%N1	**60.4**	**66.2**	**71.3**	**75.6**	**79.5**
	KIAS	127	140	152	162	173

Flight With Unreliable Airspeed/Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

TERMINAL AREA (5000FT)

%N1 for Level Flight

Airport Altitude = 3000 FT

FLAP POSITION (VREF + INCREMENT)		WEIGHT (1000 KG)				
		40	50	60	70	80
FLAPS UP (GEAR UP) VREF40+70	**PITCH ATT**	**5.0**	**5.5**	**6.0**	**6.5**	**6.5**
	%N1	**51.0**	**55.8**	**60.1**	**64.2**	**67.6**
	KIAS	177	190	202	212	223
FLAPS 1 (GEAR UP) VREF40+50	**PITCH ATT**	**5.0**	**5.5**	**6.0**	**6.0**	**6.5**
	%N1	**52.8**	**57.9**	**62.5**	**66.4**	**70.1**
	KIAS	157	170	182	192	203
FLAPS 5 (GEAR UP) VREF40+30	**PITCH ATT**	**5.5**	**6.0**	**6.5**	**6.5**	**7.0**
	%N1	**53.4**	**59.0**	**63.9**	**68.1**	**71.9**
	KIAS	137	150	162	172	183
FLAPS 10 (GEAR UP) VREF40+30	**PITCH ATT**	**5.0**	**5.5**	**6.0**	**6.0**	**6.5**
	%N1	**56.7**	**62.5**	**67.3**	**71.6**	**75.4**
	KIAS	137	150	162	172	183
FLAPS 15 (GEAR UP) VREF40+20	**PITCH ATT**	**5.5**	**6.0**	**6.0**	**6.5**	**6.5**
	%N1	**56.9**	**62.9**	**67.8**	**72.3**	**76.1**
	KIAS	127	140	152	162	173
FLAPS 25 (GEAR UP) VREF40+10	**PITCH ATT**	**7.0**	**7.0**	**7.0**	**7.5**	**7.5**
	%N1	**58.0**	**64.1**	**69.0**	**73.5**	**77.3**
	KIAS	117	130	142	152	163
FLAPS 15 (GEAR DOWN) VREF40+20	**PITCH ATT**	**6.0**	**6.0**	**6.5**	**6.5**	**6.5**
	%N1	**61.2**	**67.0**	**72.2**	**76.5**	**80.4**
	KIAS	127	140	152	162	173

Flight With Unreliable Airspeed/Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

TERMINAL AREA (5000FT)
%N1 for Level Flight
Airport Altitude = 4000 FT

FLAP POSITION (VREF + INCREMENT)		WEIGHT (1000 KG)				
		40	50	60	70	80
FLAPS UP (GEAR UP) VREF40+70	**PITCH ATT**	**5.0**	**5.5**	**6.0**	**6.5**	**6.5**
	%N1	**51.6**	**56.5**	**61.0**	**65.0**	**68.4**
	KIAS	177	190	202	213	224
FLAPS 1 (GEAR UP) VREF40+50	**PITCH ATT**	**5.0**	**5.5**	**6.0**	**6.0**	**6.5**
	%N1	**53.6**	**58.7**	**63.4**	**67.2**	**71.0**
	KIAS	157	170	182	193	204
FLAPS 5 (GEAR UP) VREF40+30	**PITCH ATT**	**5.5**	**6.0**	**6.5**	**6.5**	**7.0**
	%N1	**54.2**	**59.8**	**64.7**	**68.9**	**72.8**
	KIAS	137	150	162	173	184
FLAPS 10 (GEAR UP) VREF40+30	**PITCH ATT**	**5.0**	**5.5**	**6.0**	**6.0**	**6.0**
	%N1	**57.5**	**63.2**	**68.1**	**72.5**	**76.1**
	KIAS	137	150	162	173	184
FLAPS 15 (GEAR UP) VREF40+20	**PITCH ATT**	**5.5**	**6.0**	**6.0**	**6.5**	**6.5**
	%N1	**57.7**	**63.7**	**68.6**	**73.1**	**76.8**
	KIAS	127	140	152	163	174
FLAPS 25 (GEAR UP) VREF40+10	**PITCH ATT**	**7.0**	**7.0**	**7.0**	**7.5**	**7.0**
	%N1	**58.8**	**64.9**	**69.9**	**74.4**	**78.2**
	KIAS	117	130	142	153	164
FLAPS 15 (GEAR DOWN) VREF40+20	**PITCH ATT**	**6.0**	**6.0**	**6.5**	**6.5**	**6.5**
	%N1	**62.0**	**67.8**	**73.0**	**77.3**	**81.3**
	KIAS	127	140	152	163	174

Flight With Unreliable Airspeed/Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

TERMINAL AREA (5000FT)
%N1 for Level Flight
Airport Altitude = 5000 FT

FLAP POSITION (VREF + INCREMENT)		WEIGHT (1000 KG) 40	50	60	70	80
FLAPS UP (GEAR UP) VREF40+70	**PITCH ATT**	**5.0**	**5.5**	**6.0**	**6.5**	**6.5**
	%N1	**52.3**	**57.2**	**61.8**	**65.7**	**69.1**
	KIAS	177	190	203	213	224
FLAPS 1 (GEAR UP) VREF40+50	**PITCH ATT**	**5.0**	**5.5**	**6.0**	**6.0**	**6.5**
	%N1	**54.3**	**59.5**	**64.1**	**68.0**	**71.8**
	KIAS	157	170	183	193	204
FLAPS 5 (GEAR UP) VREF40+30	**PITCH ATT**	**5.5**	**6.0**	**6.5**	**6.5**	**7.0**
	%N1	**54.9**	**60.6**	**65.5**	**69.8**	**73.6**
	KIAS	137	150	163	173	184
FLAPS 10 (GEAR UP) VREF40+30	**PITCH ATT**	**5.0**	**5.5**	**6.0**	**6.0**	**6.0**
	%N1	**58.3**	**64.1**	**68.9**	**73.3**	**76.9**
	KIAS	137	150	163	173	184
FLAPS 15 (GEAR UP) VREF40+20	**PITCH ATT**	**5.5**	**6.0**	**6.0**	**6.5**	**6.5**
	%N1	**58.5**	**64.5**	**69.5**	**74.0**	**77.7**
	KIAS	127	140	153	163	174
FLAPS 25 (GEAR UP) VREF40+10	**PITCH ATT**	**7.0**	**7.0**	**7.0**	**7.5**	**7.0**
	%N1	**59.7**	**65.6**	**70.8**	**75.2**	**79.1**
	KIAS	117	130	143	153	164
FLAPS 15 (GEAR DOWN) VREF40+20	**PITCH ATT**	**6.0**	**6.0**	**6.0**	**6.5**	**6.5**
	%N1	**62.8**	**68.7**	**73.9**	**78.2**	**82.2**
	KIAS	127	140	153	163	174

Flight With Unreliable Airspeed/Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

TERMINAL AREA (5000FT)
%N1 for Level Flight
Airport Altitude = 6000 FT

FLAP POSITION (VREF + INCREMENT)		WEIGHT (1000 KG) 40	50	60	70	80
FLAPS UP (GEAR UP) VREF40+70	**PITCH ATT**	**5.0**	**5.5**	**6.0**	**6.0**	**6.5**
	%N1	**53.0**	**58.0**	**62.7**	**66.5**	**69.9**
	KIAS	177	190	203	213	225
FLAPS 1 (GEAR UP) VREF40+50	**PITCH ATT**	**5.0**	**5.5**	**6.0**	**6.0**	**6.5**
	%N1	**55.0**	**60.3**	**64.9**	**68.8**	**72.6**
	KIAS	157	170	183	193	205
FLAPS 5 (GEAR UP) VREF40+30	**PITCH ATT**	**5.5**	**6.0**	**6.5**	**6.5**	**7.0**
	%N1	**55.7**	**61.5**	**66.3**	**70.6**	**74.4**
	KIAS	137	150	163	173	185
FLAPS 10 (GEAR UP) VREF40+30	**PITCH ATT**	**5.0**	**5.5**	**5.5**	**6.0**	**6.0**
	%N1	**59.1**	**64.9**	**69.8**	**74.1**	**77.8**
	KIAS	137	150	163	173	185
FLAPS 15 (GEAR UP) VREF40+20	**PITCH ATT**	**5.5**	**6.0**	**6.0**	**6.5**	**6.5**
	%N1	**59.4**	**65.3**	**70.4**	**74.8**	**78.5**
	KIAS	127	140	153	163	175
FLAPS 25 (GEAR UP) VREF40+10	**PITCH ATT**	**7.0**	**7.0**	**7.0**	**7.0**	**7.0**
	%N1	**60.5**	**66.4**	**71.6**	**76.0**	**80.0**
	KIAS	117	130	143	153	165
FLAPS 15 (GEAR DOWN) VREF40+20	**PITCH ATT**	**6.0**	**6.0**	**6.0**	**6.5**	**6.5**
	%N1	**63.7**	**69.6**	**74.8**	**79.1**	**83.1**
	KIAS	127	140	153	163	175

Flight With Unreliable Airspeed/Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

TERMINAL AREA (5000FT)
%N1 for Level Flight
Airport Altitude = 7000 FT

FLAP POSITION (VREF + INCREMENT)		WEIGHT (1000 KG) 40	50	60	70	80
FLAPS UP (GEAR UP) VREF40+70	**PITCH ATT**	**5.0**	**5.5**	**6.0**	**6.0**	**6.5**
	%N1	**53.7**	**58.8**	**63.5**	**67.2**	**70.8**
	KIAS	177	190	203	214	225
FLAPS 1 (GEAR UP) VREF40+50	**PITCH ATT**	**5.0**	**5.5**	**5.5**	**6.0**	**6.5**
	%N1	**55.8**	**61.2**	**65.7**	**69.7**	**73.5**
	KIAS	157	170	183	194	205
FLAPS 5 (GEAR UP) VREF40+30	**PITCH ATT**	**5.5**	**6.0**	**6.5**	**6.5**	**6.5**
	%N1	**56.4**	**62.3**	**67.1**	**71.5**	**75.2**
	KIAS	137	150	163	174	185
FLAPS 10 (GEAR UP) VREF40+30	**PITCH ATT**	**5.0**	**5.5**	**5.5**	**6.0**	**6.0**
	%N1	**60.0**	**65.7**	**70.7**	**74.9**	**78.7**
	KIAS	137	150	163	174	185
FLAPS 15 (GEAR UP) VREF40+20	**PITCH ATT**	**5.5**	**6.0**	**6.0**	**6.5**	**6.5**
	%N1	**60.2**	**66.1**	**71.3**	**75.6**	**79.4**
	KIAS	127	140	153	164	175
FLAPS 25 (GEAR UP) VREF40+10	**PITCH ATT**	**7.0**	**7.0**	**7.0**	**7.0**	**7.0**
	%N1	**61.3**	**67.3**	**72.5**	**76.9**	**80.9**
	KIAS	117	130	143	154	165
FLAPS 15 (GEAR DOWN) VREF40+20	**PITCH ATT**	**6.0**	**6.0**	**6.0**	**6.5**	**6.5**
	%N1	**64.5**	**70.5**	**75.6**	**80.0**	**84.0**
	KIAS	127	140	153	164	175

Flight With Unreliable Airspeed/Turbulent Air Penetration
Altitude and/or vertical speed indications may also be unreliable.

TERMINAL AREA (5000FT)
%N1 for Level Flight
Airport Altitude = 8000 FT

FLAP POSITION (VREF + INCREMENT)		WEIGHT (1000 KG)				
		40	50	60	70	80
FLAPS UP (GEAR UP) VREF40+70	**PITCH ATT**	**5.0**	**5.5**	**6.0**	**6.0**	**6.5**
	%N1	**54.5**	**59.6**	**64.3**	**68.0**	**71.6**
	KIAS	177	191	204	214	225
FLAPS 1 (GEAR UP) VREF40+50	**PITCH ATT**	**5.0**	**5.5**	**5.5**	**6.0**	**6.5**
	%N1	**56.5**	**62.0**	**66.5**	**70.6**	**74.3**
	KIAS	157	171	184	194	205
FLAPS 5 (GEAR UP) VREF40+30	**PITCH ATT**	**5.5**	**6.0**	**6.5**	**6.5**	**6.5**
	%N1	**57.2**	**63.1**	**67.9**	**72.4**	**76.0**
	KIAS	137	151	164	174	185
FLAPS 10 (GEAR UP) VREF40+30	**PITCH ATT**	**5.0**	**5.5**	**5.5**	**6.0**	**6.0**
	%N1	**60.9**	**66.6**	**71.6**	**75.7**	**79.6**
	KIAS	137	151	164	174	185
FLAPS 15 (GEAR UP) VREF40+20	**PITCH ATT**	**5.5**	**6.0**	**6.0**	**6.5**	**6.5**
	%N1	**61.0**	**66.9**	**72.2**	**76.4**	**80.3**
	KIAS	127	141	154	164	175
FLAPS 25 (GEAR UP) VREF40+10	**PITCH ATT**	**7.0**	**7.0**	**7.0**	**7.0**	**7.0**
	%N1	**62.1**	**68.1**	**73.3**	**77.8**	**81.7**
	KIAS	117	131	144	154	165
FLAPS 15 (GEAR DOWN) VREF40+20	**PITCH ATT**	**6.0**	**6.0**	**6.0**	**6.5**	**6.5**
	%N1	**65.3**	**71.4**	**76.5**	**80.9**	**84.9**
	KIAS	127	141	154	164	175

Flight With Unreliable Airspeed/Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

TERMINAL AREA (5000FT)

%N1 for Level Flight

Airport Altitude = 9000 FT

FLAP POSITION (VREF + INCREMENT)		WEIGHT (1000 KG) 40	50	60	70	80
FLAPS UP (GEAR UP) VREF40+70	**PITCH ATT**	**5.0**	**5.5**	**6.0**	**6.0**	**6.5**
	%N1	**55.3**	**60.5**	**65.0**	**68.8**	**72.4**
	KIAS	177	191	204	214	226
FLAPS 1 (GEAR UP) VREF40+50	**PITCH ATT**	**5.0**	**5.5**	**5.5**	**6.0**	**6.5**
	%N1	**57.3**	**62.8**	**67.3**	**71.4**	**75.1**
	KIAS	157	171	184	194	206
FLAPS 5 (GEAR UP) VREF40+30	**PITCH ATT**	**5.5**	**6.0**	**6.0**	**6.5**	**6.5**
	%N1	**58.1**	**64.0**	**68.8**	**73.1**	**76.8**
	KIAS	137	151	164	174	186
FLAPS 10 (GEAR UP) VREF40+30	**PITCH ATT**	**5.0**	**5.5**	**5.5**	**6.0**	**6.0**
	%N1	**61.7**	**67.4**	**72.4**	**76.6**	**80.5**
	KIAS	137	151	164	174	186
FLAPS 15 (GEAR UP) VREF40+20	**PITCH ATT**	**5.5**	**6.0**	**6.0**	**6.5**	**6.5**
	%N1	**61.8**	**67.8**	**73.0**	**77.2**	**81.2**
	KIAS	127	141	154	164	176
FLAPS 25 (GEAR UP) VREF40+10	**PITCH ATT**	**7.0**	**7.0**	**7.0**	**7.0**	**7.0**
	%N1	**63.0**	**69.0**	**74.2**	**78.6**	**82.6**
	KIAS	117	131	144	154	166
FLAPS 15 (GEAR DOWN) VREF40+20	**PITCH ATT**	**6.0**	**6.0**	**6.0**	**6.5**	**6.5**
	%N1	**66.1**	**72.3**	**77.4**	**81.8**	**85.8**
	KIAS	127	141	154	164	176

Flight With Unreliable Airspeed/Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

TERMINAL AREA (5000FT)
%N1 for Level Flight
Airport Altitude = 10000 FT

FLAP POSITION (VREF + INCREMENT)		WEIGHT (1000 KG)				
		40	50	60	70	80
FLAPS UP (GEAR UP) VREF40+70	**PITCH ATT**	**5.0**	**5.5**	**6.0**	**6.0**	**6.5**
	%N1	**56.0**	**61.3**	**65.7**	**69.6**	**73.2**
	KIAS	177	191	204	215	226
FLAPS 1 (GEAR UP) VREF40+50	**PITCH ATT**	**5.0**	**5.5**	**5.5**	**6.0**	**6.0**
	%N1	**58.1**	**63.6**	**68.1**	**72.3**	**75.9**
	KIAS	157	171	184	195	206
FLAPS 5 (GEAR UP) VREF40+30	**PITCH ATT**	**5.5**	**6.0**	**6.0**	**6.5**	**6.5**
	%N1	**58.9**	**64.8**	**69.6**	**74.0**	**77.7**
	KIAS	137	151	164	175	186
FLAPS 10 (GEAR UP) VREF40+30	**PITCH ATT**	**5.0**	**5.5**	**5.5**	**6.0**	**6.0**
	%N1	**62.5**	**68.3**	**73.3**	**77.4**	**81.4**
	KIAS	137	151	164	175	186
FLAPS 15 (GEAR UP) VREF40+20	**PITCH ATT**	**5.5**	**6.0**	**6.0**	**6.0**	**6.0**
	%N1	**62.7**	**68.7**	**73.8**	**78.2**	**82.1**
	KIAS	127	141	154	165	176
FLAPS 25 (GEAR UP) VREF40+10	**PITCH ATT**	**7.0**	**7.0**	**7.0**	**7.0**	**7.0**
	%N1	**63.8**	**69.9**	**75.0**	**79.5**	**83.5**
	KIAS	117	131	144	155	166
FLAPS 15 (GEAR DOWN) VREF40+20	**PITCH ATT**	**6.0**	**6.0**	**6.0**	**6.5**	**6.5**
	%N1	**66.9**	**73.2**	**78.3**	**82.7**	**86.8**
	KIAS	127	141	154	165	176

Flight With Unreliable Airspeed/Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

TERMINAL AREA (5000FT)
%N1 for Level Flight
Airport Altitude = 11000 FT

FLAP POSITION (VREF + INCREMENT)		WEIGHT (1000 KG) 40	50	60	70	80
FLAPS UP (GEAR UP) VREF40+70	**PITCH ATT**	**5.0**	**5.5**	**6.0**	**6.0**	**6.5**
	%N1	**56.8**	**62.3**	**66.5**	**70.5**	**74.0**
	KIAS	177	191	205	215	227
FLAPS 1 (GEAR UP) VREF40+50	**PITCH ATT**	**5.0**	**5.5**	**5.5**	**6.0**	**6.0**
	%N1	**59.1**	**64.4**	**69.1**	**73.2**	**76.7**
	KIAS	157	171	185	195	207
FLAPS 5 (GEAR UP) VREF40+30	**PITCH ATT**	**5.5**	**6.0**	**6.0**	**6.5**	**6.5**
	%N1	**60.0**	**65.7**	**70.6**	**74.8**	**78.7**
	KIAS	137	151	165	175	187
FLAPS 10 (GEAR UP) VREF40+30	**PITCH ATT**	**5.0**	**5.5**	**5.5**	**6.0**	**6.0**
	%N1	**63.5**	**69.3**	**74.2**	**78.4**	**82.3**
	KIAS	137	151	165	175	187
FLAPS 15 (GEAR UP) VREF40+20	**PITCH ATT**	**5.5**	**6.0**	**6.0**	**6.0**	**6.0**
	%N1	**63.8**	**69.8**	**74.7**	**79.2**	**83.1**
	KIAS	127	141	155	165	177
FLAPS 25 (GEAR UP) VREF40+10	**PITCH ATT**	**7.0**	**7.0**	**7.0**	**7.0**	**7.0**
	%N1	**64.8**	**71.0**	**76.0**	**80.5**	**84.5**
	KIAS	117	131	145	155	167
FLAPS 15 (GEAR DOWN) VREF40+20	**PITCH ATT**	**5.5**	**6.0**	**6.0**	**6.5**	**6.5**
	%N1	**68.1**	**74.2**	**79.3**	**83.7**	**87.9**
	KIAS	127	141	155	165	177

Flight With Unreliable Airspeed/Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

TERMINAL AREA (5000FT)
%N1 for Level Flight
Airport Altitude = 12000 FT

FLAP POSITION (VREF + INCREMENT)		WEIGHT (1000 KG)				
		40	50	60	70	80
FLAPS UP (GEAR UP) VREF40+70	**PITCH ATT**	**5.0**	**5.5**	**5.5**	**6.0**	**6.5**
	%N1	**57.6**	**63.1**	**67.3**	**71.3**	**74.8**
	KIAS	178	192	205	216	227
FLAPS 1 (GEAR UP) VREF40+50	**PITCH ATT**	**5.0**	**5.5**	**5.5**	**6.0**	**6.0**
	%N1	**60.1**	**65.3**	**70.0**	**73.9**	**77.6**
	KIAS	158	172	185	196	207
FLAPS 5 (GEAR UP) VREF40+30	**PITCH ATT**	**5.5**	**6.0**	**6.0**	**6.5**	**6.5**
	%N1	**61.1**	**66.6**	**71.6**	**75.7**	**79.6**
	KIAS	138	152	165	176	187
FLAPS 10 (GEAR UP) VREF40+30	**PITCH ATT**	**5.0**	**5.5**	**5.5**	**6.0**	**6.0**
	%N1	**64.5**	**70.4**	**75.1**	**79.4**	**83.3**
	KIAS	138	152	165	176	187
FLAPS 15 (GEAR UP) VREF40+20	**PITCH ATT**	**5.5**	**6.0**	**6.0**	**6.0**	**6.0**
	%N1	**64.8**	**70.9**	**75.7**	**80.1**	**84.0**
	KIAS	128	142	155	166	177
FLAPS 25 (GEAR UP) VREF40+10	**PITCH ATT**	**7.0**	**7.0**	**7.0**	**7.0**	**7.0**
	%N1	**66.0**	**72.1**	**77.1**	**81.5**	**85.4**
	KIAS	118	132	145	156	167
FLAPS 15 (GEAR DOWN) VREF40+20	**PITCH ATT**	**5.5**	**6.0**	**6.0**	**6.0**	**6.0**
	%N1	**69.3**	**75.2**	**80.4**	**84.7**	**89.0**
	KIAS	128	142	155	166	177

Flight With Unreliable Airspeed/Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

TERMINAL AREA (5000FT)
%N1 for Level Flight
Airport Altitude = 13000 FT

FLAP POSITION (VREF + INCREMENT)		WEIGHT (1000 KG) 40	50	60	70	80
FLAPS UP (GEAR UP) VREF40+70	**PITCH ATT**	**5.0**	**5.5**	**5.5**	**6.0**	**6.5**
	%N1	**58.5**	**63.8**	**68.1**	**72.1**	**75.6**
	KIAS	178	192	205	216	228
FLAPS 1 (GEAR UP) VREF40+50	**PITCH ATT**	**5.0**	**5.5**	**5.5**	**6.0**	**6.0**
	%N1	**61.1**	**66.1**	**70.9**	**74.7**	**78.5**
	KIAS	158	172	185	196	208
FLAPS 5 (GEAR UP) VREF40+30	**PITCH ATT**	**5.5**	**6.0**	**6.0**	**6.5**	**6.5**
	%N1	**62.0**	**67.6**	**72.5**	**76.6**	**80.5**
	KIAS	138	152	165	176	188
FLAPS 10 (GEAR UP) VREF40+30	**PITCH ATT**	**5.0**	**5.5**	**5.5**	**6.0**	**6.0**
	%N1	**65.5**	**71.3**	**76.0**	**80.3**	**84.2**
	KIAS	138	152	165	176	188
FLAPS 15 (GEAR UP) VREF40+20	**PITCH ATT**	**5.5**	**6.0**	**6.0**	**6.0**	**6.0**
	%N1	**65.8**	**71.8**	**76.7**	**81.1**	**85.0**
	KIAS	128	142	155	166	178
FLAPS 25 (GEAR UP) VREF40+10	**PITCH ATT**	**7.0**	**7.0**	**6.5**	**7.0**	**6.5**
	%N1	**67.1**	**73.0**	**78.1**	**82.5**	**86.5**
	KIAS	118	132	145	156	168
FLAPS 15 (GEAR DOWN) VREF40+20	**PITCH ATT**	**5.5**	**6.0**	**6.0**	**6.0**	**6.0**
	%N1	**70.4**	**76.2**	**81.4**	**85.8**	**90.0**
	KIAS	128	142	155	166	178

Flight With Unreliable Airspeed/Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

TERMINAL AREA (5000FT)
%N1 for Level Flight
Airport Altitude = 13500 FT

FLAP POSITION (VREF + INCREMENT)		WEIGHT (1000 KG) 40	50	60	70	80
FLAPS UP (GEAR UP) VREF40+70	**PITCH ATT**	**5.0**	**5.5**	**5.5**	**6.0**	**6.5**
	%N1	**58.9**	**64.1**	**68.5**	**72.5**	**76.0**
	KIAS	178	192	205	216	228
FLAPS 1 (GEAR UP) VREF40+50	**PITCH ATT**	**5.0**	**5.5**	**5.5**	**6.0**	**6.0**
	%N1	**61.5**	**66.6**	**71.3**	**75.2**	**78.9**
	KIAS	158	172	185	196	208
FLAPS 5 (GEAR UP) VREF40+30	**PITCH ATT**	**5.5**	**6.0**	**6.0**	**6.5**	**6.5**
	%N1	**62.5**	**68.1**	**72.9**	**77.1**	**80.9**
	KIAS	138	152	165	176	188
FLAPS 10 (GEAR UP) VREF40+30	**PITCH ATT**	**5.0**	**5.5**	**5.5**	**6.0**	**6.0**
	%N1	**66.0**	**71.8**	**76.5**	**80.8**	**84.6**
	KIAS	138	152	165	176	188
FLAPS 15 (GEAR UP) VREF40+20	**PITCH ATT**	**5.5**	**6.0**	**6.0**	**6.0**	**6.0**
	%N1	**66.4**	**72.3**	**77.2**	**81.6**	**85.4**
	KIAS	128	142	155	166	178
FLAPS 25 (GEAR UP) VREF40+10	**PITCH ATT**	**7.0**	**6.5**	**6.5**	**7.0**	**6.5**
	%N1	**67.7**	**73.5**	**78.6**	**83.0**	**87.0**
	KIAS	118	132	145	156	168
FLAPS 15 (GEAR DOWN) VREF40+20	**PITCH ATT**	**5.5**	**6.0**	**6.0**	**6.0**	**6.0**
	%N1	**70.9**	**76.8**	**81.9**	**86.3**	**90.7**
	KIAS	128	142	155	166	178

Flight With Unreliable Airspeed/Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

FINAL APPROACH (1500 FT)

Gear Down, %N1 for 3° Glideslope

Airport Altitude = -2000 FT

FLAP POSITION (VREF + INCREMENT)		WEIGHT (1000 KG) 40	50	60	70	80
FLAPS 15 (VREF15 + 10)	**PITCH ATT**	**3.5**	**4.0**	**4.0**	**4.5**	**4.5**
	%N1	**41.3**	**45.6**	**49.5**	**53.0**	**56.2**
	KIAS	124	137	149	159	170
FLAPS 30 (VREF30 + 10)	**PITCH ATT**	**2.0**	**2.0**	**2.5**	**2.5**	**2.5**
	%N1	**45.9**	**50.7**	**55.0**	**58.6**	**62.2**
	KIAS	119	132	144	153	163
FLAPS 40 (VREF40 + 10)	**PITCH ATT**	**0.0**	**0.5**	**0.5**	**1.0**	**1.0**
	%N1	**52.0**	**57.2**	**61.9**	**65.8**	**69.3**
	KIAS	117	129	141	150	160

Flap placard speed exceeded in shaded area.

Airport Altitude = -1000 FT

FLAP POSITION (VREF + INCREMENT)		WEIGHT (1000 KG) 40	50	60	70	80
FLAPS 15 (VREF15 + 10)	**PITCH ATT**	**3.5**	**4.0**	**4.0**	**4.5**	**4.5**
	%N1	**41.8**	**46.3**	**50.2**	**53.7**	**56.9**
	KIAS	124	137	149	159	170
FLAPS 30 (VREF30 + 10)	**PITCH ATT**	**2.0**	**2.0**	**2.5**	**2.5**	**2.5**
	%N1	**46.6**	**51.4**	**55.7**	**59.4**	**63.0**
	KIAS	119	132	144	153	164
FLAPS 40 (VREF40 + 10)	**PITCH ATT**	**0.0**	**0.5**	**0.5**	**1.0**	**1.0**
	%N1	**52.6**	**58.0**	**62.6**	**66.6**	**70.2**
	KIAS	117	129	141	150	161

Flap placard speed exceeded in shaded area.

Flight With Unreliable Airspeed/Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

FINAL APPROACH (1500 FT)

Gear Down, %N1 for 3° Glideslope

Airport Altitude = SEA LEVEL

FLAP POSITION (VREF + INCREMENT)		WEIGHT (1000 KG) 40	50	60	70	80
FLAPS 15 (VREF15 + 10)	**PITCH ATT**	**3.5**	**4.0**	**4.0**	**4.5**	**4.5**
	%N1	**42.4**	**46.9**	**50.8**	**54.5**	**57.6**
	KIAS	124	137	149	159	170
FLAPS 30 (VREF30 + 10)	**PITCH ATT**	**2.0**	**2.0**	**2.5**	**2.5**	**2.5**
	%N1	**47.2**	**52.1**	**56.4**	**60.2**	**63.8**
	KIAS	119	132	144	153	164
FLAPS 40 (VREF40 + 10)	**PITCH ATT**	**0.0**	**0.5**	**0.5**	**1.0**	**1.0**
	%N1	**53.3**	**58.7**	**63.4**	**67.3**	**71.0**
	KIAS	117	129	141	151	161

Flap placard speed exceeded in shaded area.

Airport Altitude = 1000 FT

FLAP POSITION (VREF + INCREMENT)		WEIGHT (1000 KG) 40	50	60	70	80
FLAPS 15 (VREF15 + 10)	**PITCH ATT**	**3.5**	**4.0**	**4.0**	**4.0**	**4.5**
	%N1	**42.9**	**47.6**	**51.5**	**55.1**	**58.4**
	KIAS	124	137	149	159	170
FLAPS 30 (VREF30 + 10)	**PITCH ATT**	**2.0**	**2.0**	**2.5**	**2.5**	**2.5**
	%N1	**47.8**	**52.8**	**57.1**	**61.0**	**64.5**
	KIAS	119	132	144	153	164
FLAPS 40 (VREF40 + 10)	**PITCH ATT**	**0.0**	**0.5**	**0.5**	**1.0**	**1.0**
	%N1	**54.1**	**59.5**	**64.3**	**68.1**	**71.9**
	KIAS	117	129	141	151	161

Flap placard speed exceeded in shaded area.

Flight With Unreliable Airspeed/Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

FINAL APPROACH (1500 FT)

Gear Down, %N1 for 3° Glideslope

Airport Altitude = 2000 FT

FLAP POSITION (VREF + INCREMENT)		WEIGHT (1000 KG) 40	50	60	70	80
FLAPS 15 (VREF15 + 10)	**PITCH ATT**	**3.5**	**4.0**	**4.0**	**4.0**	**4.5**
	%N1	**43.5**	**48.2**	**52.2**	**55.8**	**59.1**
	KIAS	124	137	149	160	171
FLAPS 30 (VREF30 + 10)	**PITCH ATT**	**2.0**	**2.0**	**2.5**	**2.5**	**2.5**
	%N1	**48.4**	**53.5**	**57.8**	**61.8**	**65.3**
	KIAS	119	132	144	154	164
FLAPS 40 (VREF40 + 10)	**PITCH ATT**	**0.0**	**0.5**	**0.5**	**1.0**	**0.5**
	%N1	**54.8**	**60.3**	**65.1**	**68.9**	**72.8**
	KIAS	117	129	141	151	162

Flap placard speed exceeded in shaded area.

Airport Altitude = 3000 FT

FLAP POSITION (VREF + INCREMENT)		WEIGHT (1000 KG) 40	50	60	70	80
FLAPS 15 (VREF15 + 10)	FLAPS 15 (VREF15 + 10)	**3.5**	**4.0**	**4.0**	**4.0**	**4.0**
		44.1	**48.8**	**52.9**	**56.6**	**59.9**
		124	137	149	160	171
FLAPS 30 (VREF30 + 10)	FLAPS 30 (VREF30 + 10)	**2.0**	**2.0**	**2.5**	**2.5**	**2.5**
		49.1	**54.2**	**58.6**	**62.6**	**66.2**
		119	132	144	154	164
FLAPS 40 (VREF40 + 10)	FLAPS 40 (VREF40 + 10)	**0.0**	**0.5**	**0.5**	**0.5**	**0.5**
		55.5	**61.1**	**65.9**	**69.8**	**73.7**
		117	129	141	151	162

Flap placard speed exceeded in shaded area.

Flight With Unreliable Airspeed/Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

FINAL APPROACH (1500 FT)

Gear Down, %N1 for 3° Glideslope

Airport Altitude = 4000 FT

FLAP POSITION (VREF + INCREMENT)		WEIGHT (1000 KG)				
		40	50	60	70	80
FLAPS 15 (VREF15 + 10)	**PITCH ATT**	**3.5**	**4.0**	**4.0**	**4.0**	**4.0**
	%N1	**44.8**	**49.5**	**53.7**	**57.3**	**60.7**
	KIAS	124	137	149	160	171
FLAPS 30 (VREF30 + 10)	**PITCH ATT**	**2.0**	**2.0**	**2.5**	**2.5**	**2.5**
	%N1	**49.8**	**54.9**	**59.4**	**63.4**	**67.0**
	KIAS	119	132	144	154	164
FLAPS 40 (VREF40 + 10)	**PITCH ATT**	**0.0**	**0.5**	**0.5**	**0.5**	**0.5**
	%N1	**56.3**	**61.9**	**66.7**	**70.6**	**74.6**
	KIAS	117	129	141	151	162

Flap placard speed exceeded in shaded area.

Airport Altitude = 5000 FT

FLAP POSITION (VREF + INCREMENT)		WEIGHT (1000 KG)				
		40	50	60	70	80
FLAPS 15 (VREF15 + 10)	**PITCH ATT**	**3.5**	**4.0**	**4.0**	**4.0**	**4.0**
	%N1	**45.4**	**50.1**	**54.4**	**58.0**	**61.5**
	KIAS	124	137	150	160	171
FLAPS 30 (VREF30 + 10)	**PITCH ATT**	**2.0**	**2.0**	**2.5**	**2.5**	**2.5**
	%N1	**50.5**	**55.6**	**60.2**	**64.2**	**67.7**
	KIAS	119	132	144	154	165
FLAPS 40 (VREF40 + 10)	**PITCH ATT**	**0.0**	**0.5**	**0.5**	**0.5**	**0.5**
	%N1	**57.1**	**62.7**	**67.5**	**71.5**	**75.5**
	KIAS	117	129	141	152	162

Flap placard speed exceeded in shaded area.

Flight With Unreliable Airspeed/Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

FINAL APPROACH (1500 FT)

Gear Down, %N1 for 3° Glideslope

Airport Altitude = 6000 FT

FLAP POSITION (VREF + INCREMENT)		WEIGHT (1000 KG) 40	50	60	70	80
FLAPS 15 (VREF15 + 10)	**PITCH ATT**	**3.5**	**4.0**	**4.0**	**4.0**	**4.0**
	%N1	**46.1**	**50.8**	**55.1**	**58.7**	**62.3**
	KIAS	124	137	150	160	171
FLAPS 30 (VREF30 + 10)	**PITCH ATT**	**2.0**	**2.0**	**2.0**	**2.5**	**2.5**
	%N1	**51.2**	**56.4**	**61.0**	**65.0**	**68.5**
	KIAS	119	132	144	154	165
FLAPS 40 (VREF40 + 10)	**PITCH ATT**	**0.0**	**0.5**	**0.5**	**0.5**	**0.5**
	%N1	**57.8**	**63.5**	**68.3**	**72.4**	**76.3**
	KIAS	117	130	142	152	163

Flap placard speed exceeded in shaded area.

Airport Altitude = 7000 FT

FLAP POSITION (VREF + INCREMENT)		WEIGHT (1000 KG) 40	50	60	70	80
FLAPS 15 (VREF15 + 10)	**PITCH ATT**	**3.5**	**4.0**	**4.0**	**4.0**	**4.0**
	%N1	**46.8**	**51.5**	**55.8**	**59.5**	**63.1**
	KIAS	124	137	150	160	172
FLAPS 30 (VREF30 + 10)	**PITCH ATT**	**2.0**	**2.0**	**2.0**	**2.5**	**2.5**
	%N1	**51.9**	**57.1**	**61.9**	**65.8**	**69.3**
	KIAS	119	132	144	154	165
FLAPS 40 (VREF40 + 10)	**PITCH ATT**	**0.0**	**0.5**	**0.5**	**0.5**	**0.5**
	%N1	**58.6**	**64.4**	**69.2**	**73.3**	**77.1**
	KIAS	117	130	142	152	163

Flap placard speed exceeded in shaded area.

Flight With Unreliable Airspeed/Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

FINAL APPROACH (1500 FT)

Gear Down, %N1 for 3° Glideslope

Airport Altitude = 8000 FT

FLAP POSITION (VREF + INCREMENT)		WEIGHT (1000 KG) 40	50	60	70	80
FLAPS 15 (VREF15 + 10)	**PITCH ATT**	**3.5**	**4.0**	**4.0**	**4.0**	**4.0**
	%N1	**47.4**	**52.3**	**56.5**	**60.3**	**63.9**
	KIAS	124	137	150	161	172
FLAPS 30 (VREF30 + 10)	**PITCH ATT**	**2.0**	**2.0**	**2.0**	**2.5**	**2.5**
	%N1	**52.6**	**57.9**	**62.6**	**66.6**	**70.2**
	KIAS	119	132	144	155	165
FLAPS 40 (VREF40 + 10)	**PITCH ATT**	**0.0**	**0.5**	**0.5**	**0.5**	**0.5**
	%N1	**59.4**	**65.1**	**70.0**	**74.2**	**78.0**
	KIAS	117	130	142	152	163

Flap placard speed exceeded in shaded area.

Airport Altitude = 9000 FT

FLAP POSITION (VREF + INCREMENT)		WEIGHT (1000 KG) 40	50	60	70	80
FLAPS 15 (VREF15 + 10)	**PITCH ATT**	**3.5**	**4.0**	**4.0**	**4.0**	**4.0**
	%N1	**48.0**	**53.0**	**57.3**	**61.2**	**64.6**
	KIAS	124	137	150	161	172
FLAPS 30 (VREF30 + 10)	**PITCH ATT**	**2.0**	**2.0**	**2.0**	**2.5**	**2.5**
	%N1	**53.3**	**58.7**	**63.4**	**67.3**	**71.0**
	KIAS	119	132	145	155	165
FLAPS 40 (VREF40 + 10)	**PITCH ATT**	**0.0**	**0.5**	**0.5**	**0.5**	**0.5**
	%N1	**60.2**	**65.9**	**71.0**	**75.1**	**78.9**
	KIAS	117	130	142	153	164

Flap placard speed exceeded in shaded area.

Flight With Unreliable Airspeed/Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

FINAL APPROACH (1500 FT)

Gear Down, %N1 for 3° Glideslope

Airport Altitude = 10000 FT

FLAP POSITION (VREF + INCREMENT)		WEIGHT (1000 KG) 40	50	60	70	80
FLAPS 15 (VREF15 + 10)	**PITCH ATT**	**3.5**	**4.0**	**4.0**	**4.0**	**4.0**
	%N1	**48.7**	**53.7**	**58.0**	**62.0**	**65.3**
	KIAS	124	138	150	161	172
FLAPS 30 (VREF30 + 10)	**PITCH ATT**	**2.0**	**2.0**	**2.0**	**2.5**	**2.5**
	%N1	**54.1**	**59.5**	**64.3**	**68.2**	**71.9**
	KIAS	119	132	145	155	166
FLAPS 40 (VREF40 + 10)	**PITCH ATT**	**0.0**	**0.5**	**0.0**	**0.5**	**0.5**
	%N1	**61.0**	**66.8**	**71.9**	**75.9**	**79.9**
	KIAS	117	130	143	153	164

Flap placard speed exceeded in shaded area.

Airport Altitude = 11000 FT

FLAP POSITION (VREF + INCREMENT)		WEIGHT (1000 KG) 40	50	60	70	80
FLAPS 15 (VREF15 + 10)	**PITCH ATT**	**3.5**	**3.5**	**4.0**	**4.0**	**4.0**
	%N1	**49.4**	**54.4**	**58.8**	**62.8**	**66.0**
	KIAS	124	138	151	161	173
FLAPS 30 (VREF30 + 10)	**PITCH ATT**	**2.0**	**2.0**	**2.0**	**2.5**	**2.5**
	%N1	**54.8**	**60.4**	**65.1**	**69.0**	**72.7**
	KIAS	119	132	145	155	166
FLAPS 40 (VREF40 + 10)	**PITCH ATT**	**0.0**	**0.0**	**0.0**	**0.5**	**0.5**
	%N1	**61.9**	**67.6**	**72.8**	**76.8**	**80.8**
	KIAS	117	130	143	153	165

Flap placard speed exceeded in shaded area.

Flight With Unreliable Airspeed/Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

FINAL APPROACH (1500 FT)

Gear Down, %N1 for 3° Glideslope

Airport Altitude = 12000 FT

FLAP POSITION (VREF + INCREMENT)		WEIGHT (1000 KG) 40	50	60	70	80
FLAPS 15 (VREF15 + 10)	**PITCH ATT**	**3.5**	**3.5**	**4.0**	**4.0**	**4.0**
	%N1	**50.1**	**55.2**	**59.7**	**63.5**	**66.8**
	KIAS	124	138	151	162	173
FLAPS 30 (VREF30 + 10)	**PITCH ATT**	**2.0**	**2.0**	**2.0**	**2.5**	**2.5**
	%N1	**55.6**	**61.2**	**65.9**	**69.9**	**73.5**
	KIAS	119	133	145	155	166
FLAPS 40 (VREF40 + 10)	**PITCH ATT**	**0.0**	**0.0**	**0.0**	**0.5**	**0.5**
	%N1	**62.7**	**68.5**	**73.7**	**77.8**	**81.7**
	KIAS	117	130	143	154	165

Flap placard speed exceeded in shaded area.

Airport Altitude = 13000 FT

FLAP POSITION (VREF + INCREMENT)		WEIGHT (1000 KG) 40	50	60	70	80
FLAPS 15 (VREF15 + 10)	**PITCH ATT**	**3.5**	**3.5**	**3.5**	**4.0**	**4.0**
	%N1	**50.8**	**55.9**	**60.5**	**64.2**	**67.5**
	KIAS	124	138	151	162	173
FLAPS 30 (VREF30 + 10)	**PITCH ATT**	**2.0**	**2.0**	**2.0**	**2.5**	**2.5**
	%N1	**56.3**	**62.0**	**66.7**	**70.7**	**74.3**
	KIAS	119	133	145	156	166
FLAPS 40 (VREF40 + 10)	**PITCH ATT**	**0.0**	**0.0**	**0.0**	**0.5**	**0.0**
	%N1	**63.6**	**69.4**	**74.6**	**78.7**	**82.6**
	KIAS	117	131	144	154	165

Flap placard speed exceeded in shaded area.

Flight With Unreliable Airspeed/Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

FINAL APPROACH (1500 FT)

Gear Down, %N1 for 3° Glideslope

Airport Altitude = 13500 FT

FLAP POSITION (VREF + INCREMENT)		WEIGHT (1000 KG) 40	50	60	70	80
FLAPS 15 (VREF15 + 10)	**PITCH ATT**	**3.5**	**3.5**	**3.5**	**4.0**	**4.0**
	%N1	**51.2**	**56.3**	**60.9**	**64.6**	**67.9**
	KIAS	124	138	151	162	173
FLAPS 30 (VREF30 + 10)	**PITCH ATT**	**2.0**	**2.0**	**2.0**	**2.5**	**2.5**
	%N1	**56.7**	**62.4**	**67.1**	**71.2**	**74.7**
	KIAS	119	133	145	156	167
FLAPS 40 (VREF40 + 10)	**PITCH ATT**	**0.0**	**0.0**	**0.0**	**0.5**	**0.0**
	%N1	**63.9**	**69.9**	**75.0**	**79.2**	**83.1**
	KIAS	117	131	144	154	166

Flap placard speed exceeded in shaded area.

GO-AROUND

Flaps 15, Gear Up, Set Go-Around Thrust

PRESSURE ALTITUDE (FT)		WEIGHT (1000 KG) 40	50	60	70	80
13500	**PITCH ATT**	**17.0**	**14.0**	**11.5**	**10.0**	**9.0**
	V/S (FT/MIN)	3200	2400	1900	1400	1000
	KIAS	127	141	154	164	176
10000	**PITCH ATT**	**19.0**	**15.5**	**13.0**	**11.5**	**10.0**
	V/S (FT/MIN)	3500	2700	2200	1700	1300
	KIAS	127	140	153	163	174
5000	**PITCH ATT**	**21.5**	**17.5**	**14.5**	**13.0**	**11.5**
	V/S (FT/MIN)	3900	3100	2500	2000	1600
	KIAS	127	139	151	162	172
SEA LEVEL	**PITCH ATT**	**24.0**	**19.0**	**16.0**	**14.0**	**12.5**
	V/S (FT/MIN)	4200	3300	2700	2200	1800
	KIAS	127	139	151	161	171
-2000	**PITCH ATT**	**24.0**	**19.5**	**16.5**	**14.5**	**12.5**
	V/S (FT/MIN)	4100	3200	2600	2100	1700
	KIAS	127	139	151	160	170

Performance Inflight — Chapter PI
All Engine — Section 11

Long Range Cruise Maximum Operating Altitude
Max Cruise Thrust
ISA + 10°C and Below

WEIGHT (1000 KG)	OPTIMUM ALT (FT)	TAT (°C)	MARGIN TO INITIAL BUFFET 'G' (BANK ANGLE)				
			1.20 (33°)	1.25 (36°)	1.30 (39°)	1.40 (44°)	1.50 (48°)
70	34300	-14	37700*	37700*	37700*	36400	35100
65	35800	-18	39200*	39200*	39200*	38000	36600
60	37500	-18	40700*	40700*	40700*	39700	38300
55	39300	-18	41000	41000	41000	41000	40100
50	41000	-18	41000	41000	41000	41000	41000
45	41000	-18	41000	41000	41000	41000	41000
40	41000	-18	41000	41000	41000	41000	41000
35	41000	-18	41000	41000	41000	41000	41000

ISA + 15°C

WEIGHT (1000 KG)	OPTIMUM ALT (FT)	TAT (°C)	MARGIN TO INITIAL BUFFET 'G' (BANK ANGLE)				
			1.20 (33°)	1.25 (36°)	1.30 (39°)	1.40 (44°)	1.50 (48°)
70	34300	-9	37000*	37000*	37000*	36400	35100
65	35800	-12	38300*	38300*	38300*	38000	36600
60	37500	-13	39800*	39800*	39800*	39700	38300
55	39300	-13	41000	41000	41000	41000	40100
50	41000	-13	41000	41000	41000	41000	41000
45	41000	-13	41000	41000	41000	41000	41000
40	41000	-13	41000	41000	41000	41000	41000
35	41000	-13	41000	41000	41000	41000	41000

ISA + 20°C

WEIGHT (1000 KG)	OPTIMUM ALT (FT)	TAT (°C)	MARGIN TO INITIAL BUFFET 'G' (BANK ANGLE)				
			1.20 (33°)	1.25 (36°)	1.30 (39°)	1.40 (44°)	1.50 (48°)
70	34300	-3	35700*	35700*	35700*	35700*	35100
65	35800	-7	37200*	37200*	37200*	37200*	36600
60	37500	-7	38700*	38700*	38700*	38700*	38300
55	39300	-7	40200*	40200*	40200*	40200*	40100
50	41000	-7	41000	41000	41000	41000	41000
45	41000	-7	41000	41000	41000	41000	41000
40	41000	-7	41000	41000	41000	41000	41000
35	41000	-7	41000	41000	41000	41000	41000

***Denotes altitude thrust limited in level flight, 100 fpm residual rate of climb.**

Long Range Cruise Control

WEIGHT (1000 KG)		PRESSURE ALTITUDE (1000 FT)									
		23	25	27	29	31	33	35	37	39	41
70	%N1	79.8	81.2	82.7	84.0	85.2	86.4	87.9	90.6		
	MACH	.674	.699	.726	.750	.768	.781	.788	.791		
	KIAS	293	292	292	290	284	277	268	257		
	FF/ENG	1309	1303	1307	1304	1285	1265	1261	1290		
65	%N1	78.2	79.5	81.0	82.5	83.8	85.0	86.2	88.2	92.1	
	MACH	.655	.677	.704	.731	.754	.771	.783	.790	.791	
	KIAS	284	282	282	281	279	273	265	256	245	
	FF/ENG	1223	1211	1214	1216	1210	1189	1172	1181	1226	
60	%N1	76.7	77.9	79.2	80.7	82.2	83.5	84.7	86.3	88.9	93.4
	MACH	.637	.657	.679	.707	.734	.757	.773	.784	.790	.791
	KIAS	276	273	271	271	271	268	262	254	245	234
	FF/ENG	1142	1126	1120	1124	1124	1115	1094	1090	1107	1162
55	%N1	75.0	76.2	77.4	78.7	80.3	81.7	83.1	84.6	86.7	89.5
	MACH	.618	.637	.657	.680	.708	.736	.758	.774	.785	.791
	KIAS	267	264	262	260	260	259	256	250	243	234
	FF/ENG	1067	1044	1035	1030	1033	1031	1022	1010	1012	1030
50	%N1	72.9	74.4	75.6	76.8	78.1	79.7	81.2	82.9	84.9	87.0
	MACH	.592	.616	.635	.656	.679	.707	.735	.758	.774	.785
	KIAS	256	255	253	251	249	249	248	245	239	232
	FF/ENG	983	968	953	945	939	940	938	935	931	933
45	%N1	70.6	72.1	73.5	74.8	76.0	77.3	78.9	80.8	82.9	84.9
	MACH	.564	.587	.611	.632	.652	.675	.704	.733	.756	.773
	KIAS	243	243	243	241	238	237	236	236	233	228
	FF/ENG	895	884	877	865	856	849	848	851	855	859
40	%N1	67.7	69.4	71.0	72.5	73.8	75.0	76.3	78.2	80.5	82.7
	MACH	.532	.555	.579	.604	.626	.647	.669	.697	.726	.752
	KIAS	228	229	229	229	228	226	224	223	223	221
	FF/ENG	805	797	793	788	788	776	768	767	776	782
35	%N1	64.5	66.1	67.9	69.5	71.1	72.5	73.8	75.4	77.5	79.9
	MACH	.498	.520	.543	.567	.592	.617	.638	.660	.685	.715
	KIAS	213	214	214	215	215	215	212	210	209	209
	FF/ENG	728	722	718	715	709	700	688	682	683	691

Shaded area approximates optimum altitude.

Long Range Cruise Enroute Fuel and Time - Low Altitudes

Ground to Air Miles Conversions

AIR DISTANCE (NM) HEADWIND COMPONENT (KTS)					GROUND DISTANCE (NM)	AIR DISTANCE (NM) TAILWIND COMPONENT (KTS)				
100	80	60	40	20		20	40	60	80	100
302	275	251	231	215	200	190	180	172	164	158
455	413	377	347	322	300	285	271	258	247	238
608	552	504	464	430	400	380	362	345	330	317
762	692	631	580	538	500	475	452	431	413	396
917	832	758	697	646	600	570	543	518	495	475
1073	973	886	814	754	700	665	633	604	577	554
1229	1114	1014	931	861	800	760	723	690	660	633
1386	1255	1142	1048	969	900	855	814	776	742	711
1543	1397	1270	1165	1078	1000	950	904	862	824	790
1701	1539	1398	1283	1186	1100	1045	995	948	907	869
1859	1681	1527	1400	1294	1200	1140	1085	1034	989	948
2018	1824	1656	1518	1402	1300	1235	1175	1120	1071	1027
2178	1968	1785	1636	1511	1400	1330	1265	1206	1153	1105
2339	2112	1915	1754	1619	1500	1425	1355	1292	1235	1184
2500	2257	2045	1872	1727	1600	1520	1446	1378	1317	1262
2662	2401	2175	1990	1836	1700	1615	1536	1464	1399	1341
2824	2546	2305	2109	1945	1800	1709	1626	1550	1481	1419
2988	2692	2436	2227	2053	1900	1804	1716	1635	1562	1497
3152	2839	2567	2346	2162	2000	1899	1806	1721	1644	1575

Reference Fuel And Time Required at Check Point

AIR DIST (NM)	PRESSURE ALTITUDE (1000 FT)									
	10		14		20		24		28	
	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)
200	1.3	0:44	1.2	0:42	1.0	0:39	0.9	0:37	0.8	0:36
300	2.0	1:05	1.8	1:01	1.6	0:57	1.4	0:54	1.3	0:52
400	2.7	1:26	2.5	1:21	2.2	1:14	1.9	1:10	1.8	1:08
500	3.4	1:47	3.1	1:41	2.7	1:32	2.5	1:27	2.3	1:23
600	4.1	2:08	3.8	2:01	3.3	1:50	3.0	1:44	2.7	1:39
700	4.8	2:29	4.4	2:21	3.9	2:08	3.5	2:01	3.2	1:55
800	5.5	2:51	5.0	2:41	4.4	2:27	4.0	2:18	3.7	2:11
900	6.2	3:13	5.7	3:01	5.0	2:45	4.6	2:35	4.2	2:27
1000	6.8	3:34	6.3	3:22	5.6	3:03	5.1	2:52	4.7	2:43
1100	7.5	3:56	6.9	3:43	6.1	3:22	5.6	3:09	5.1	3:00
1200	8.2	4:19	7.6	4:03	6.7	3:41	6.1	3:27	5.6	3:16
1300	8.8	4:41	8.2	4:24	7.2	3:59	6.6	3:44	6.1	3:32
1400	9.5	5:03	8.8	4:45	7.8	4:18	7.1	4:02	6.5	3:49
1500	10.2	5:26	9.4	5:06	8.3	4:37	7.6	4:19	7.0	4:05
1600	10.8	5:49	10.0	5:28	8.9	4:57	8.1	4:37	7.5	4:21
1700	11.5	6:12	10.6	5:49	9.4	5:16	8.6	4:55	7.9	4:38
1800	12.1	6:35	11.2	6:11	9.9	5:35	9.1	5:13	8.4	4:55
1900	12.8	6:58	11.8	6:33	10.5	5:55	9.6	5:31	8.9	5:12
2000	13.4	7:22	12.4	6:55	11.0	6:15	10.1	5:49	9.3	5:28

Long Range Cruise Enroute Fuel and Time - Low Altitudes
Fuel Required Adjustments (1000 KG)

REFERENCE FUEL REQUIRED (1000 KG)	WEIGHT AT CHECK POINT (1000 KG)				
	30	40	50	60	70
2	-0.3	-0.1	0.0	0.2	0.3
4	-0.5	-0.3	0.0	0.4	0.7
6	-0.8	-0.4	0.0	0.5	1.1
8	-1.1	-0.6	0.0	0.7	1.5
10	-1.5	-0.7	0.0	0.9	1.9
12	-1.8	-0.8	0.0	1.1	2.3
14	-2.1	-1.0	0.0	1.3	2.6

Based on .78/280/250 descent.

Long Range Cruise Enroute Fuel and Time - High Altitudes
Ground to Air Miles Conversions

AIR DISTANCE (NM)					GROUND DISTANCE (NM)	AIR DISTANCE (NM)				
HEADWIND COMPONENT (KTS)						TAILWIND COMPONENT (KTS)				
100	80	60	40	20		20	40	60	80	100
544	508	476	448	423	400	382	365	350	335	323
814	761	713	671	634	600	573	548	525	504	485
1086	1015	951	895	845	800	764	731	701	673	648
1358	1269	1189	1119	1056	1000	956	914	876	842	810
1631	1524	1427	1343	1268	1200	1147	1097	1052	1010	972
1904	1779	1665	1567	1479	1400	1338	1280	1227	1178	1133
2178	2034	1904	1791	1691	1600	1529	1462	1401	1345	1294
2453	2290	2143	2016	1903	1800	1720	1645	1576	1513	1455
2729	2547	2383	2241	2114	2000	1910	1827	1750	1680	1616
3006	2805	2624	2466	2327	2200	2101	2009	1925	1847	1777
3285	3064	2865	2692	2539	2400	2292	2191	2099	2014	1937
3564	3323	3106	2917	2751	2600	2482	2373	2273	2181	2097
3844	3582	3347	3143	2963	2800	2673	2555	2446	2347	2257
4125	3843	3589	3369	3176	3000	2863	2737	2620	2513	2417
4408	4104	3832	3596	3388	3200	3054	2918	2793	2679	2576
4691	4367	4076	3823	3601	3400	3244	3099	2966	2845	2735
4977	4631	4320	4051	3814	3600	3434	3281	3139	3010	2893
5264	4895	4565	4279	4027	3800	3624	3462	3312	3175	3052
5552	5161	4810	4507	4241	4000	3814	3643	3485	3340	3210
5842	5428	5056	4736	4454	4200	4005	3824	3657	3505	3368
6134	5696	5303	4965	4668	4400	4194	4004	3829	3670	3525
6427	5965	5551	5194	4882	4600	4384	4185	4001	3834	3683
6722	6235	5799	5424	5096	4800	4574	4365	4173	3998	3840
7019	6507	6049	5655	5311	5000	4764	4546	4345	4162	3997

Long Range Cruise Enroute Fuel and Time - High Altitudes

Reference Fuel And Time Required at Check Point

AIR DIST (NM)	PRESSURE ALTITUDE (1000 FT)									
	29		31		33		35		37	
	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)
400	1.7	1:07	1.7	1:05	1.6	1:04	1.6	1:03	1.5	1:01
600	2.7	1:38	2.6	1:36	2.5	1:34	2.4	1:32	2.3	1:29
800	3.6	2:10	3.5	2:07	3.4	2:04	3.3	2:00	3.2	1:57
1000	4.6	2:42	4.4	2:38	4.3	2:34	4.1	2:29	4.0	2:25
1200	5.5	3:14	5.3	3:09	5.1	3:04	5.0	2:59	4.8	2:54
1400	6.4	3:46	6.2	3:41	6.0	3:35	5.8	3:29	5.6	3:22
1600	7.3	4:19	7.1	4:13	6.9	4:06	6.6	3:58	6.4	3:51
1800	8.2	4:51	8.0	4:45	7.7	4:37	7.5	4:29	7.2	4:20
2000	9.1	5:24	8.8	5:17	8.6	5:08	8.3	4:59	8.0	4:49
2200	10.0	5:58	9.7	5:49	9.4	5:40	9.1	5:30	8.8	5:19
2400	10.9	6:31	10.6	6:22	10.2	6:12	9.9	6:00	9.6	5:48
2600	11.8	7:05	11.4	6:55	11.0	6:44	10.7	6:32	10.4	6:18
2800	12.7	7:40	12.3	7:28	11.9	7:16	11.5	7:03	11.1	6:49
3000	13.6	8:14	13.1	8:01	12.7	7:48	12.3	7:34	11.9	7:19
3200	14.4	8:50	13.9	8:35	13.5	8:21	13.0	8:06	12.6	7:50
3400	15.3	9:25	14.8	9:09	14.3	8:54	13.8	8:38	13.4	8:21
3600	16.1	10:01	15.6	9:44	15.1	9:27	14.6	9:11	14.1	8:52
3800	17.0	10:38	16.4	10:19	15.8	10:01	15.3	9:43	14.9	9:23
4000	17.8	11:15	17.2	10:54	16.6	10:35	16.1	10:16	15.6	9:55
4200	18.6	11:52	18.0	11:30	17.4	11:09	16.8	10:49	16.3	10:27
4400	19.4	12:30	18.8	12:06	18.1	11:44	17.5	11:22	17.0	10:59
4600	20.2	13:08	19.6	12:42	18.9	12:19	18.3	11:56	17.7	11:32
4800	21.0	13:47	20.3	13:20	19.6	12:54	19.0	12:30	18.4	12:04
5000	21.8	14:26	21.1	13:57	20.4	13:30	19.7	13:04	19.1	12:37

Fuel Required Adjustments (1000 KG)

REFERENCE FUEL REQUIRED (1000 KG)	WEIGHT AT CHECK POINT (1000 KG)				
	30	40	50	60	70
2	-0.3	-0.1	0.0	0.2	0.5
4	-0.6	-0.3	0.0	0.4	1.0
6	-1.0	-0.4	0.0	0.6	1.5
8	-1.4	-0.6	0.0	0.9	2.0
10	-1.7	-0.8	0.0	1.1	2.5
12	-2.2	-0.9	0.0	1.3	3.0
14	-2.6	-1.1	0.0	1.5	3.4
16	-3.0	-1.3	0.0	1.7	3.8
18	-3.5	-1.6	0.0	1.9	4.2
20	-4.0	-1.8	0.0	2.1	4.6
22	-4.5	-2.0	0.0	2.3	5.0

Based on .78/280/250 descent.

Long Range Cruise Wind-Altitude Trade

PRESSURE ALTITUDE (1000 FT)	CRUISE WEIGHT (1000 KG)							
	70	65	60	55	50	45	40	35
41		63	24	4	0	8	23	43
39	50	19	3	0	7	20	37	56
37	13	2	0	7	19	34	51	67
35	1	1	8	19	33	48	63	76
33	2	9	20	32	46	60	72	82
31	11	21	33	46	58	70	79	86
29	24	35	46	58	68	78	85	89
27	37	48	58	68	76	83	88	90
25	50	59	68	76	82	87	89	89

The above wind factor tables are for calculation of wind required to maintain present range capability at new pressure altitude, i.e., break-even wind.

Method:

1. **Read wind factors for present and new altitudes from table.**
2. **Determine difference (new altitude wind factor minus present altitude wind factor); this difference may be negative or positive.**
3. **Break-even wind at new altitude is present altitude wind plus difference from step 2.**

Descent

.78/280/250

PRESSURE ALTITUDE (FT)	TIME (MIN)	FUEL (KG)	DISTANCE (NM) LANDING WEIGHT (1000 KG)		
			40	50	60
41000	25	280	106	123	135
39000	25	280	101	117	129
37000	24	270	96	112	123
35000	23	270	92	107	118
33000	22	270	88	102	113
31000	22	260	84	97	107
29000	21	260	79	91	100
27000	20	250	74	85	94
25000	19	250	69	79	87
23000	18	240	64	74	81
21000	17	240	59	68	75
19000	16	230	55	63	68
17000	15	220	50	57	62
15000	14	210	45	51	56
10000	10	180	32	35	37
5000	7	140	18	20	21
1500	4	100	9	9	9

Allowances for a straight-in approach are included.

Holding

Flaps Up

WEIGHT (1000 KG)		PRESSURE ALTITUDE (FT)								
		1500	5000	10000	15000	20000	25000	30000	35000	41000
70	%N1	58.9	61.8	65.8	69.8	74.0	78.5	82.7	87.2	
	KIAS	229	229	230	231	233	234	237	240	
	FF/ENG	1250	1220	1210	1200	1180	1170	1200	1240	
65	%N1	57.2	59.8	64.1	67.8	72.2	76.5	80.8	85.2	
	KIAS	221	221	222	223	224	225	227	230	
	FF/ENG	1170	1140	1130	1110	1100	1080	1100	1130	
60	%N1	55.3	57.8	62.0	65.9	70.1	74.4	78.8	83.2	92.7
	KIAS	212	212	213	214	215	216	218	220	224
	FF/ENG	1090	1060	1050	1030	1020	990	1010	1030	1170
55	%N1	53.2	55.8	59.6	63.9	67.8	72.2	76.6	81.0	88.9
	KIAS	203	203	204	204	205	207	208	210	214
	FF/ENG	1010	990	970	950	940	910	920	940	1020
50	%N1	51.0	53.6	57.2	61.5	65.4	69.9	74.2	78.7	86.0
	KIAS	193	194	194	195	196	197	198	200	203
	FF/ENG	930	910	890	870	860	840	840	850	910
45	%N1	48.6	51.1	54.8	58.7	63.0	67.1	71.5	76.0	83.3
	KIAS	183	183	184	185	185	186	187	189	191
	FF/ENG	860	830	820	810	790	780	770	770	810
40	%N1	46.1	48.5	52.2	55.9	60.2	64.2	68.7	73.1	80.3
	KIAS	177	177	177	177	177	177	177	178	180
	FF/ENG	800	770	750	730	710	700	690	680	710
35	%N1	43.5	45.8	49.4	53.1	56.9	61.3	65.5	69.9	77.0
	KIAS	170	170	170	170	170	170	170	170	170
	FF/ENG	720	700	670	650	640	630	620	610	620

This table includes 5% additional fuel for holding in a racetrack pattern.

Intentionally
Blank

ADVISORY INFORMATION

Normal Configuration Landing Distance

Flaps 15

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	50000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 50000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF15	ONE REV	NO REV

Dry Runway

MAX MANUAL	775	65/-45	15/20	-30/100	10/-5	15/-15	30	15	30
AUTOBRAKE MAX	1005	60/-65	20/30	-40/130	0/0	20/-20	50	0	0
AUTOBRAKE 3	1375	100/-105	35/50	-65/215	0/0	35/-35	85	0	0
AUTOBRAKE 2	1730	145/-150	50/70	-85/300	15/-25	50/-50	90	35	35
AUTOBRAKE 1	1905	175/-175	60/85	-100/350	45/-55	55/-55	85	190	205

Good Reported Braking Action

MAX MANUAL	1075	75/-70	25/35	-50/175	25/-20	25/-25	40	60	135
AUTOBRAKE MAX	1135	80/-80	25/40	-50/185	20/-15	25/-25	50	65	145
AUTOBRAKE 3	1375	100/-105	35/50	-65/220	5/0	35/-35	85	5	15
AUTOBRAKE 2	1730	145/-150	50/70	-85/300	15/-25	50/-50	90	35	35
AUTOBRAKE 1	1905	175/-175	60/85	-100/350	45/-55	55/-55	85	190	205

Medium Reported Braking Action

MAX MANUAL	1450	115/-115	40/60	-80/295	60/-50	35/-35	55	165	420
AUTOBRAKE MAX	1455	120/-115	40/60	-80/295	60/-45	35/-35	65	165	415
AUTOBRAKE 3	1520	120/-115	40/60	-80/300	45/-30	40/-40	85	130	390
AUTOBRAKE 2	1780	150/-155	50/75	-95/340	45/-40	50/-50	90	70	190
AUTOBRAKE 1	1915	175/-180	60/85	-105/365	65/-60	55/-55	85	205	270

Poor Reported Braking Action

MAX MANUAL	1880	170/-160	60/85	-120/465	150/-100	45/-50	65	365	1045
AUTOBRAKE MAX	1880	170/-160	60/90	-120/465	155/-100	45/-50	65	365	1045
AUTOBRAKE 3	1880	170/-160	60/90	-120/465	155/-95	45/-50	75	365	1045
AUTOBRAKE 2	1995	175/-170	60/90	-125/480	135/-90	50/-55	85	275	940
AUTOBRAKE 1	2080	190/-190	65/95	-130/495	145/-105	55/-60	85	340	875

Reference distance is based on sea level, standard day, no wind or slope, VREF15, two-engine detent No. 2 reverse thrust, and auto speedbrakes.
For max manual braking and manual speedbrakes, increase reference landing distance by 50 m.
For autobrake and manual speedbrakes, increase reference landing distance by 40 m.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Actual (unfactored) distances are shown.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Normal Configuration Landing Distance

Flaps 30

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	50000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 50000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF30	ONE REV	NO REV

Dry Runway

MAX MANUAL	750	55/-40	15/20	-30/95	5/-5	15/-15	30	10	25
AUTOBRAKE MAX	955	55/-60	20/25	-35/125	0/0	20/-20	50	0	0
AUTOBRAKE 3	1290	90/-95	30/45	-60/210	0/0	35/-35	80	0	0
AUTOBRAKE 2	1620	130/-135	45/65	-85/290	15/-25	45/-45	85	30	30
AUTOBRAKE 1	1780	160/-160	55/80	-95/340	40/-50	50/-50	80	160	185

Good Reported Braking Action

MAX MANUAL	1040	70/-70	25/35	-50/175	25/-20	25/-25	40	55	125
AUTOBRAKE MAX	1095	75/-75	25/35	-50/180	20/-20	25/-25	50	60	135
AUTOBRAKE 3	1295	95/-95	30/45	-60/210	5/0	35/-35	80	5	15
AUTOBRAKE 2	1620	130/-135	45/65	-85/290	15/-25	45/-45	85	30	30
AUTOBRAKE 1	1780	160/-160	55/80	-95/340	40/-50	50/-50	80	160	185

Medium Reported Braking Action

MAX MANUAL	1385	110/-105	40/55	-75/290	60/-45	35/-35	55	150	370
AUTOBRAKE MAX	1390	110/-105	40/55	-80/290	60/-40	35/-35	65	145	365
AUTOBRAKE 3	1440	110/-110	40/55	-80/295	45/-30	35/-35	80	125	355
AUTOBRAKE 2	1670	135/-140	45/65	-90/330	40/-40	45/-45	85	65	175
AUTOBRAKE 1	1790	160/-160	55/80	-100/355	60/-55	50/-50	80	175	245

Poor Reported Braking Action

MAX MANUAL	1775	155/-150	55/80	-115/455	145/-95	40/-50	65	320	895
AUTOBRAKE MAX	1780	160/-150	55/80	-115/455	145/-95	45/-50	65	320	895
AUTOBRAKE 3	1780	160/-150	55/80	-115/455	145/-90	45/-50	70	320	895
AUTOBRAKE 2	1880	165/-160	55/85	-120/470	130/-85	45/-50	80	250	805
AUTOBRAKE 1	1950	175/-175	60/90	-125/480	140/-95	50/-55	80	305	760

Reference distance is based on sea level, standard day, no wind or slope, VREF30, two-engine detent No. 2 reverse thrust, and auto speedbrakes.
For max manual braking and manual speedbrakes, increase reference landing distance by 50 m.
For autobrake and manual speedbrakes, increase reference landing distance by 40 m.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Actual (unfactored) distances are shown.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Normal Configuration Landing Distance

Flaps 40

BRAKING CONFIGURATION	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
	50000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 50000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF40	ONE REV	NO REV

Dry Runway

MAX MANUAL	750	55/-40	15/20	-30/95	10/-5	15/-15	30	10	25
AUTOBRAKE MAX	930	55/-55	20/25	-35/125	0/0	20/-20	50	0	0
AUTOBRAKE 3	1255	90/-90	30/45	-60/205	0/0	30/-30	80	0	0
AUTOBRAKE 2	1575	125/-130	45/65	-80/285	10/-25	40/-40	80	25	25
AUTOBRAKE 1	1735	155/-155	55/75	-95/335	40/-45	50/-50	75	145	170

Good Reported Braking Action

MAX MANUAL	1030	70/-65	25/35	-50/175	25/-20	20/-25	45	55	120
AUTOBRAKE MAX	1085	75/-75	25/40	-50/180	20/-20	25/-25	50	55	130
AUTOBRAKE 3	1260	90/-90	30/45	-60/210	5/-5	30/-30	80	5	15
AUTOBRAKE 2	1575	125/-130	45/65	-80/285	10/-25	40/-40	80	25	25
AUTOBRAKE 1	1735	155/-155	55/75	-95/335	40/-45	50/-50	75	145	170

Medium Reported Braking Action

MAX MANUAL	1360	105/-105	35/55	-75/285	60/-45	30/-35	55	140	350
AUTOBRAKE MAX	1370	110/-105	40/55	-75/285	60/-40	35/-35	65	140	345
AUTOBRAKE 3	1405	110/-105	40/55	-80/290	50/-30	35/-35	80	125	340
AUTOBRAKE 2	1625	130/-135	45/65	-90/325	40/-40	40/-45	80	60	165
AUTOBRAKE 1	1745	155/-155	55/75	-100/350	60/-55	50/-50	75	160	225

Poor Reported Braking Action

MAX MANUAL	1740	155/-145	50/80	-115/450	140/-95	40/-45	65	300	820
AUTOBRAKE MAX	1740	155/-145	55/80	-115/450	145/-95	40/-50	65	300	820
AUTOBRAKE 3	1740	155/-145	55/80	-115/450	145/-90	40/-50	70	300	820
AUTOBRAKE 2	1830	160/-155	55/85	-120/465	130/-85	45/-50	75	235	745
AUTOBRAKE 1	1900	170/-170	60/85	-125/475	135/-95	50/-55	75	285	700

Reference distance is based on sea level, standard day, no wind or slope, VREF40, two-engine detent No. 2 reverse thrust, and auto speedbrakes.
For max manual braking and manual speedbrakes, increase reference landing distance by 50 m.
For autobrake and manual speedbrakes, increase reference landing distance by 40 m.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Actual (unfactored) distances are shown.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

Airspeed Unreliable (Flaps 15)

VREF15

BRAKING CONFIGURATION	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
	55000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 55000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV
Dry Runway									
MAX MANUAL	910	65/-45	20/25	-35/115	10/-10	20/-20	N/A	20	45
AUTOBRAKE MAX	1170	65/-65	25/35	-45/145	0/0	25/-25	N/A	0	5
AUTOBRAKE 2	2045	155/-165	65/85	-95/325	30/-45	60/-60	N/A	110	110
Good Reported Braking Action									
MAX MANUAL	1225	75/-75	30/45	-55/190	25/-25	30/-30	N/A	75	170
AUTOBRAKE MAX	1305	80/-85	35/45	-55/195	25/-20	30/-30	N/A	80	185
AUTOBRAKE 2	2045	155/-165	65/85	-95/325	30/-45	60/-60	N/A	110	110
Medium Reported Braking Action									
MAX MANUAL	1660	120/-120	50/70	-85/310	70/-55	40/-45	N/A	200	510
AUTOBRAKE MAX	1680	125/-120	50/70	-85/315	65/-50	40/-45	N/A	200	510
AUTOBRAKE 3	1800	125/-125	50/70	-90/325	45/-30	45/-50	N/A	125	425
Poor Reported Braking Action									
MAX MANUAL	2135	170/-165	70/100	-130/490	165/-110	55/-60	N/A	420	1210
AUTOBRAKE MAX	2135	175/-165	70/100	-130/490	165/-110	55/-60	N/A	420	1210
AUTOBRAKE 3	2155	170/-165	70/100	-130/490	155/-95	55/-60	N/A	415	1205

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Actual (unfactored) distances are shown.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

Airspeed Unreliable (Flaps 30)

VREF30

BRAKING CONFIGURATION	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
	55000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 55000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV
Dry Runway									
MAX MANUAL	890	55/-45	20/25	-35/115	10/-10	20/-20	N/A	20	45
AUTOBRAKE MAX	1115	60/-60	25/35	-40/140	0/0	25/-25	N/A	0	5
AUTOBRAKE 2	1910	140/-145	60/80	-90/315	30/-40	55/-55	N/A	100	100
Good Reported Braking Action									
MAX MANUAL	1190	70/-75	30/40	-55/185	25/-25	25/-30	N/A	70	155
AUTOBRAKE MAX	1265	75/-80	30/45	-55/195	25/-20	30/-30	N/A	75	170
AUTOBRAKE 2	1910	140/-145	60/80	-90/315	30/-40	55/-55	N/A	100	100
Medium Reported Braking Action									
MAX MANUAL	1585	110/-110	45/65	-85/305	65/-50	40/-40	N/A	180	450
AUTOBRAKE MAX	1610	115/-115	45/65	-85/310	60/-50	40/-40	N/A	180	450
AUTOBRAKE 3	1705	115/-115	50/65	-90/320	45/-30	45/-45	N/A	115	385
Poor Reported Braking Action									
MAX MANUAL	2020	160/-155	65/90	-125/480	155/-105	50/-55	N/A	370	1030
AUTOBRAKE MAX	2025	160/-155	65/90	-125/480	160/-105	50/-55	N/A	370	1030
AUTOBRAKE 3	2045	160/-155	65/95	-125/480	150/-90	50/-55	N/A	365	1035

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Actual (unfactored) distances are shown.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

Airspeed Unreliable (Flaps 40)

VREF40

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	55000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 55000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	885	50/-45	20/25	-35/115	10/-10	20/-20	N/A	20	45
AUTOBRAKE MAX	1090	55/-60	25/35	-40/140	5/0	25/-25	N/A	0	5
AUTOBRAKE 2	1855	135/-140	55/80	-90/310	30/-35	50/-50	N/A	90	90

Good Reported Braking Action

MAX MANUAL	1180	70/-70	30/40	-55/185	25/-25	25/-30	N/A	65	150
AUTOBRAKE MAX	1255	75/-80	30/45	-55/195	25/-20	30/-30	N/A	70	165
AUTOBRAKE 2	1855	135/-140	55/80	-90/310	30/-35	50/-50	N/A	90	90

Medium Reported Braking Action

MAX MANUAL	1560	110/-110	45/65	-85/305	65/-55	40/-40	N/A	170	420
AUTOBRAKE MAX	1590	115/-115	45/65	-85/305	60/-50	40/-40	N/A	170	425
AUTOBRAKE 3	1670	115/-115	50/70	-85/315	45/-35	45/-45	N/A	120	375

Poor Reported Braking Action

MAX MANUAL	1980	155/-150	65/90	-125/475	155/-100	50/-55	N/A	345	945
AUTOBRAKE MAX	1985	155/-150	65/90	-125/475	155/-105	50/-55	N/A	345	945
AUTOBRAKE 3	2005	160/-150	65/90	-125/475	150/-95	50/-55	N/A	345	955

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Actual (unfactored) distances are shown.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

All Flaps Up Landing

VREF40 + 55

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	55000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 55000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	1155	115/-70	25/40	-40/135	15/-10	25/-25	35	35	70
AUTOBRAKE MAX	1645	85/-80	40/55	-55/180	5/-5	40/-40	65	5	10
AUTOBRAKE 2	2915	200/-220	100/135	-120/390	65/-70	90/-85	90	260	300

Good Reported Braking Action

MAX MANUAL	1555	90/-90	45/60	-60/210	30/-30	40/-40	40	100	225
AUTOBRAKE MAX	1765	90/-95	50/65	-65/230	25/-20	45/-45	65	75	200
AUTOBRAKE 2	2915	200/-220	100/135	-120/390	65/-70	90/-85	90	260	300

Medium Reported Braking Action

MAX MANUAL	2180	150/-150	70/95	-100/350	85/-70	60/-60	60	275	695
AUTOBRAKE MAX	2250	150/-155	70/100	-100/355	80/-65	60/-65	65	285	715
AUTOBRAKE 3	2575	145/-165	80/110	-110/385	50/-50	75/-75	100	140	455

Poor Reported Braking Action

MAX MANUAL	2875	220/-220	100/145	-150/555	205/-140	80/-85	75	605	1725
AUTOBRAKE MAX	2870	220/-220	100/145	-150/555	200/-130	80/-85	80	600	1710
AUTOBRAKE 3	2980	210/-215	100/145	-150/560	180/-120	85/-90	100	525	1655

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Actual (unfactored) distances are shown.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

ANTISKID INOPERATIVE (Flaps 15)

VREF15

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	55000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 55000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV
Dry Runway									
MAX MANUAL	1475	95/-100	40/55	-70/255	45/-35	35/-35	55	115	285
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								
Good Reported Braking Action									
MAX MANUAL	1645	115/-115	45/65	-85/310	65/-50	40/-40	60	175	445
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								
Medium Reported Braking Action									
MAX MANUAL	2095	165/-160	65/90	-125/490	155/-100	50/-55	75	380	1095
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								
Poor Reported Braking Action									
MAX MANUAL	2785	240/-230	90/135	-210/900	1160/-240	60/-80	85	945	3755
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Actual (unfactored) distances are shown.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

ANTISKID INOPERATIVE (Flaps 30)

VREF30

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	55000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 55000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	1410	90/-90	35/50	-70/250	40/-35	30/-35	55	105	255
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Good Reported Braking Action

MAX MANUAL	1570	110/-110	40/60	-85/305	60/-50	35/-40	60	155	390
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Medium Reported Braking Action

MAX MANUAL	1980	155/-150	60/85	-125/475	150/-95	45/-50	70	335	935
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Poor Reported Braking Action

MAX MANUAL	2615	220/-215	80/125	-205/875	1080/-225	55/-75	80	830	3135
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Actual (unfactored) distances are shown.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

ANTISKID INOPERATIVE (Flaps 40)

VREF40

BRAKING CONFIGURATION	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
	55000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 55000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV
Dry Runway									
MAX MANUAL	1390	90/-90	35/50	-70/250	40/-35	30/-30	55	100	240
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								
Good Reported Braking Action									
MAX MANUAL	1540	105/-105	40/60	-85/305	60/-50	35/-35	60	145	365
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								
Medium Reported Braking Action									
MAX MANUAL	1935	150/-145	60/85	-120/475	150/-95	45/-50	70	310	855
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								
Poor Reported Braking Action									
MAX MANUAL	2550	215/-205	80/120	-200/865	455/-220	55/-75	75	775	2850
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Actual (unfactored) distances are shown.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

Jammed or Restricted Flight Controls (Flaps 15)

VREF15

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	55000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 55000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	850	60/-45	15/25	-30/110	10/-10	15/-15	30	20	40
AUTOBRAKE MAX	1065	60/-65	25/30	-40/135	0/0	25/-25	50	0	5
AUTOBRAKE 2	1860	145/-150	55/75	-90/310	20/-30	50/-50	90	50	50

Good Reported Braking Action

MAX MANUAL	1140	70/-70	30/40	-50/185	25/-20	25/-25	45	65	150
AUTOBRAKE MAX	1205	75/-80	30/40	-55/190	25/-20	25/-30	50	70	165
AUTOBRAKE 2	1860	145/-150	55/75	-90/310	20/-30	50/-50	90	50	50

Medium Reported Braking Action

MAX MANUAL	1545	115/-110	45/65	-80/300	65/-50	35/-40	55	180	465
AUTOBRAKE MAX	1550	115/-115	45/65	-85/305	60/-45	40/-40	65	180	460
AUTOBRAKE 3	1625	115/-115	45/65	-85/310	45/-30	40/-45	85	130	420

Poor Reported Braking Action

MAX MANUAL	2000	165/-155	65/90	-125/480	160/-105	50/-55	70	395	1130
AUTOBRAKE MAX	2000	165/-155	65/95	-125/480	160/-105	50/-55	70	395	1130
AUTOBRAKE 3	2000	165/-155	65/95	-125/480	160/-100	50/-55	80	395	1130

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Actual (unfactored) distances are shown.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

LEADING EDGE FLAPS TRANSIT (Flaps 15)

VREF15 + 15

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	55000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 55000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV
Dry Runway									
MAX MANUAL	960	65/-50	20/30	-35/120	10/-10	20/-20	30	25	55
AUTOBRAKE MAX	1235	65/-70	30/40	-45/150	5/-5	30/-30	60	0	5
AUTOBRAKE 2	2185	160/-175	70/95	-100/340	30/-45	65/-60	95	105	105
Good Reported Braking Action									
MAX MANUAL	1305	80/-80	35/45	-55/195	30/-25	30/-30	45	85	200
AUTOBRAKE MAX	1395	85/-90	35/50	-60/205	25/-25	35/-35	55	95	220
AUTOBRAKE 2	2185	160/-170	70/95	-100/340	35/-45	65/-60	95	105	105
Medium Reported Braking Action									
MAX MANUAL	1775	130/-130	55/75	-90/325	75/-60	45/-45	60	230	595
AUTOBRAKE MAX	1795	130/-130	55/75	-90/325	70/-55	45/-50	70	230	595
AUTOBRAKE 3	1905	130/-130	55/80	-95/335	50/-35	50/-50	95	150	515
Poor Reported Braking Action									
MAX MANUAL	2290	185/-180	75/110	-135/505	175/-115	60/-65	75	485	1420
AUTOBRAKE MAX	2285	185/-180	75/110	-135/505	180/-120	60/-65	75	485	1415
AUTOBRAKE 3	2295	185/-175	75/110	-135/505	175/-105	60/-65	90	475	1410

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Actual (unfactored) distances are shown.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

LOSS OF SYSTEM A (Flaps 15)

VREF15

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	55000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 55000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	960	55/-55	20/30	-35/125	15/-15	20/-20	45	30	50
AUTOBRAKE MAX	1070	60/-65	25/30	-40/135	5/0	25/-25	50	15	40
AUTOBRAKE 2	1915	140/-145	55/75	-95/315	0/-5	55/-55	120	0	0

Good Reported Braking Action

MAX MANUAL	1315	85/-85	35/50	-60/205	35/-30	30/-30	60	105	210
AUTOBRAKE MAX	1310	90/-90	35/50	-60/205	30/-25	30/-30	65	100	205
AUTOBRAKE 2	1915	140/-145	55/75	-95/315	0/-5	55/-55	120	0	0

Medium Reported Braking Action

MAX MANUAL	1785	135/-135	55/80	-95/335	85/-70	45/-45	80	280	680
AUTOBRAKE MAX	1770	135/-130	55/80	-90/330	90/-70	45/-45	80	275	670
AUTOBRAKE 3	1770	135/-130	55/80	-90/330	90/-65	45/-45	80	275	670

Poor Reported Braking Action

MAX MANUAL	2305	195/-185	75/115	-140/520	200/-130	55/-65	90	575	1710
AUTOBRAKE MAX	2300	195/-185	80/115	-140/520	205/-135	60/-65	90	575	1705
AUTOBRAKE 3	2300	195/-185	80/115	-140/520	205/-135	60/-65	90	575	1705

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Actual (unfactored) distances are shown.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

LOSS OF SYSTEM A (Flaps 30)

VREF30

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	55000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 55000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV
Dry Runway									
MAX MANUAL	930	50/-50	20/30	-35/120	15/-15	20/-20	45	30	45
AUTOBRAKE MAX	1020	55/-60	20/30	-40/130	5/-5	20/-20	50	20	45
AUTOBRAKE 2	1785	130/-135	50/70	-90/305	0/-5	50/-50	115	0	0
Good Reported Braking Action									
MAX MANUAL	1260	80/-80	30/45	-55/200	35/-30	30/-30	60	95	190
AUTOBRAKE MAX	1260	85/-85	35/45	-55/200	30/-25	30/-30	65	95	185
AUTOBRAKE 2	1785	130/-135	50/70	-90/305	0/-5	50/-50	115	0	0
Medium Reported Braking Action									
MAX MANUAL	1695	125/-125	50/70	-90/325	85/-65	40/-45	75	245	585
AUTOBRAKE MAX	1685	125/-125	50/70	-90/325	85/-70	40/-45	75	245	585
AUTOBRAKE 3	1685	125/-125	50/70	-90/325	85/-65	40/-45	75	245	585
Poor Reported Braking Action									
MAX MANUAL	2170	180/-170	70/105	-135/510	190/-125	55/-60	85	500	1420
AUTOBRAKE MAX	2170	180/-170	70/105	-135/510	195/-125	55/-60	85	500	1420
AUTOBRAKE 3	2170	180/-170	70/105	-135/510	195/-125	55/-60	85	500	1420

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Actual (unfactored) distances are shown.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

LOSS OF SYSTEM A (Flaps 40)

VREF40

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	55000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 55000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	930	50/-50	20/30	-35/125	15/-15	20/-20	50	30	45
AUTOBRAKE MAX	1000	55/-55	20/30	-40/130	5/-5	20/-20	50	25	50
AUTOBRAKE 2	1730	125/-130	50/70	-85/300	0/-5	50/-50	115	0	0

Good Reported Braking Action

MAX MANUAL	1250	80/-80	30/45	-55/200	35/-30	30/-30	65	90	180
AUTOBRAKE MAX	1250	85/-80	35/45	-55/200	35/-25	30/-30	65	90	180
AUTOBRAKE 2	1730	125/-130	50/70	-85/300	0/-5	50/-50	115	0	0

Medium Reported Braking Action

MAX MANUAL	1660	125/-120	50/70	-90/325	85/-65	40/-45	75	230	540
AUTOBRAKE MAX	1655	125/-120	50/75	-90/325	85/-70	40/-45	75	230	535
AUTOBRAKE 3	1655	125/-120	50/75	-90/325	85/-65	40/-45	75	230	535

Poor Reported Braking Action

MAX MANUAL	2110	175/-165	70/100	-130/500	185/-120	50/-60	85	455	1260
AUTOBRAKE MAX	2110	175/-165	70/100	-130/500	190/-125	50/-60	85	455	1260
AUTOBRAKE 3	2110	175/-165	70/100	-130/500	190/-125	50/-60	85	455	1260

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Actual (unfactored) distances are shown.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

LOSS OF SYSTEM A AND SYSTEM B (Flaps 15)

VREF15

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	55000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 55000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	1375	80/-80	30/45	-60/195	35/-30	30/-30	70	-10	60
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Good Reported Braking Action

MAX MANUAL	1840	120/-120	50/70	-85/300	75/-60	45/-45	90	50	320
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Medium Reported Braking Action

MAX MANUAL	2430	185/-175	75/105	-130/465	165/-120	60/-65	105	255	1125
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Poor Reported Braking Action

MAX MANUAL	3015	250/-235	100/145	-185/695	370/-205	70/-80	115	615	2870
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Actual (unfactored) distances are shown.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

LOSS OF SYSTEM B (Flaps 15)

VREF15

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	55000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 55000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	965	55/-55	20/30	-40/135	15/-15	20/-20	35	35	55
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Good Reported Braking Action

MAX MANUAL	1335	90/-90	35/50	-65/225	40/-35	30/-30	55	110	230
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Medium Reported Braking Action

MAX MANUAL	1790	135/-135	55/75	-100/365	95/-70	45/-45	65	280	680
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Poor Reported Braking Action

MAX MANUAL	2280	190/-180	75/110	-145/570	230/-135	55/-65	80	555	1620
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Actual (unfactored) distances are shown.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

MANUAL REVERSION (Flaps 15)

VREF15

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	55000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 55000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV
Dry Runway									
MAX MANUAL	1375	80/-80	30/45	-60/195	35/-30	30/-30	70	-10	60
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								
Good Reported Braking Action									
MAX MANUAL	1840	120/-120	50/70	-85/300	75/-60	45/-45	90	50	320
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								
Medium Reported Braking Action									
MAX MANUAL	2430	185/-175	75/105	-130/465	165/-120	60/-65	105	255	1125
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								
Poor Reported Braking Action									
MAX MANUAL	3015	250/-235	100/145	-185/695	370/-205	70/-80	115	615	2870
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Actual (unfactored) distances are shown.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

One Engine Inoperative Landing (Flaps 15)

VREF15

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	55000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 55000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	860	60/-45	15/25	-30/110	10/-10	15/-15	30	0	20
AUTOBRAKE MAX	1065	60/-65	25/30	-40/135	0/0	25/-25	50	0	0
AUTOBRAKE 2	1915	140/-145	55/75	-95/315	0/-10	55/-55	115	0	0

Good Reported Braking Action

MAX MANUAL	1185	75/-75	30/40	-55/190	30/-25	30/-30	45	0	80
AUTOBRAKE MAX	1260	80/-85	30/45	-55/200	25/-20	30/-30	55	0	90
AUTOBRAKE 2	1915	140/-145	55/75	-95/315	0/-10	55/-55	115	0	0

Medium Reported Braking Action

MAX MANUAL	1680	125/-125	50/65	-90/330	85/-65	45/-45	65	0	260
AUTOBRAKE MAX	1690	125/-125	50/70	-90/330	80/-60	45/-45	75	0	260
AUTOBRAKE 3	1720	125/-130	50/70	-90/335	80/-50	45/-45	85	0	265

Poor Reported Braking Action

MAX MANUAL	2290	190/-185	75/100	-145/540	225/-145	60/-65	80	0	660
AUTOBRAKE MAX	2285	190/-185	75/105	-145/540	230/-145	60/-65	80	0	660
AUTOBRAKE 3	2290	190/-185	75/105	-145/540	225/-135	60/-65	90	0	660

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Actual (unfactored) distances are shown.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

One Engine Inoperative Landing (Flaps 30)

VREF30

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	55000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 55000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV
Dry Runway									
MAX MANUAL	835	55/-45	15/25	-30/110	10/-10	15/-15	30	0	20
AUTOBRAKE MAX	1010	55/-60	20/30	-40/130	0/0	20/-20	50	0	0
AUTOBRAKE 2	1780	125/-130	50/70	-90/305	5/-10	50/-50	105	0	0
Good Reported Braking Action									
MAX MANUAL	1140	70/-70	30/40	-55/190	30/-25	25/-25	45	0	75
AUTOBRAKE MAX	1210	75/-80	30/40	-55/195	25/-20	30/-30	55	0	80
AUTOBRAKE 2	1780	125/-130	50/70	-90/305	5/-10	50/-50	105	0	0
Medium Reported Braking Action									
MAX MANUAL	1590	115/-115	45/60	-90/320	80/-60	40/-40	65	0	225
AUTOBRAKE MAX	1605	120/-120	45/65	-90/320	75/-55	40/-45	75	0	225
AUTOBRAKE 3	1630	120/-120	45/65	-90/325	75/-50	40/-45	80	0	235
Poor Reported Braking Action									
MAX MANUAL	2135	170/-170	65/95	-135/520	210/-130	55/-60	80	0	550
AUTOBRAKE MAX	2135	175/-170	65/95	-135/520	215/-135	55/-60	80	0	555
AUTOBRAKE 3	2145	175/-170	65/95	-135/525	210/-130	55/-60	85	0	555

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Actual (unfactored) distances are shown.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

Stabilizer Trim Inoperative (Flaps 15)

VREF15

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	55000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 55000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	850	60/-45	15/25	-30/110	10/-10	15/-15	30	20	40
AUTOBRAKE MAX	1065	60/-65	25/30	-40/135	0/0	25/-25	50	0	5
AUTOBRAKE 2	1860	145/-150	55/75	-90/310	20/-30	50/-50	90	50	50

Good Reported Braking Action

MAX MANUAL	1140	70/-70	30/40	-50/185	25/-20	25/-25	45	65	150
AUTOBRAKE MAX	1205	75/-80	30/40	-55/190	25/-20	25/-30	50	70	165
AUTOBRAKE 2	1860	145/-150	55/75	-90/310	20/-30	50/-50	90	50	50

Medium Reported Braking Action

MAX MANUAL	1545	115/-110	45/65	-80/300	65/-50	35/-40	55	180	465
AUTOBRAKE MAX	1550	115/-115	45/65	-85/305	60/-45	40/-40	65	180	460
AUTOBRAKE 3	1625	115/-115	45/65	-85/310	45/-30	40/-45	85	130	420

Poor Reported Braking Action

MAX MANUAL	2000	165/-155	65/90	-125/480	160/-105	50/-55	70	395	1130
AUTOBRAKE MAX	2000	165/-155	65/95	-125/480	160/-105	50/-55	70	395	1130
AUTOBRAKE 3	2000	165/-155	65/95	-125/480	160/-100	50/-55	80	395	1130

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Actual (unfactored) distances are shown.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

Trailing Edge Flap Asymmetry (1 ≤ Flap Lever <15)

VREF40 + 30

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	55000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 55000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	980	70/-50	20/30	-35/120	10/-10	20/-20	35	25	55
AUTOBRAKE MAX	1330	65/-70	30/45	-45/155	5/-5	30/-30	60	0	5
AUTOBRAKE 2	2320	165/-175	75/105	-105/350	45/-50	65/-65	85	165	170

Good Reported Braking Action

MAX MANUAL	1330	80/-80	35/50	-55/195	30/-25	30/-35	45	80	190
AUTOBRAKE MAX	1455	80/-85	40/55	-60/205	25/-20	35/-35	60	85	205
AUTOBRAKE 2	2325	165/-175	75/105	-105/350	45/-55	65/-65	85	165	170

Medium Reported Braking Action

MAX MANUAL	1825	125/-125	55/80	-90/325	75/-60	45/-50	55	225	570
AUTOBRAKE MAX	1870	130/-130	60/80	-90/330	70/-55	50/-50	65	230	580
AUTOBRAKE 3	2045	125/-130	60/85	-95/345	45/-35	55/-55	100	125	430

Poor Reported Braking Action

MAX MANUAL	2370	185/-180	80/115	-135/510	175/-120	60/-65	70	480	1380
AUTOBRAKE MAX	2365	185/-180	80/115	-135/510	175/-115	60/-65	70	475	1375
AUTOBRAKE 3	2410	180/-175	80/115	-135/515	160/-100	65/-70	95	455	1360

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Actual (unfactored) distances are shown.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

Trailing Edge Flap Asymmetry (Flap Lever 15 or 25)

VREF15

BRAKING CONFIGURATION	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
	55000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 55000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV
Dry Runway									
MAX MANUAL	850	60/-45	15/25	-30/110	10/-10	15/-15	30	20	40
AUTOBRAKE MAX	1065	60/-65	25/30	-40/135	0/0	25/-25	50	0	5
AUTOBRAKE 2	1860	145/-150	55/75	-90/310	20/-30	50/-50	90	50	50
Good Reported Braking Action									
MAX MANUAL	1140	70/-70	30/40	-50/185	25/-20	25/-25	45	65	150
AUTOBRAKE MAX	1205	75/-80	30/40	-55/190	25/-20	25/-30	50	70	165
AUTOBRAKE 2	1860	145/-150	55/75	-90/310	20/-30	50/-50	90	50	50
Medium Reported Braking Action									
MAX MANUAL	1545	115/-110	45/65	-80/300	65/-50	35/-40	55	180	465
AUTOBRAKE MAX	1550	115/-115	45/65	-85/305	60/-45	40/-40	65	180	460
AUTOBRAKE 3	1625	115/-115	45/65	-85/310	45/-30	40/-45	85	130	420
Poor Reported Braking Action									
MAX MANUAL	2000	165/-155	65/90	-125/480	160/-105	50/-55	70	395	1130
AUTOBRAKE MAX	2000	165/-155	65/95	-125/480	160/-105	50/-55	70	395	1130
AUTOBRAKE 3	2000	165/-155	65/95	-125/480	160/-100	50/-55	80	395	1130

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Actual (unfactored) distances are shown.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

Trailing Edge Flap Asymmetry (Flap Lever 30)

VREF30

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	55000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 55000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	825	50/-45	15/25	-30/110	10/-10	15/-15	30	15	35
AUTOBRAKE MAX	1010	55/-60	20/30	-40/130	0/0	20/-20	50	0	5
AUTOBRAKE 2	1740	130/-135	50/70	-85/300	15/-30	50/-50	85	45	45

Good Reported Braking Action

MAX MANUAL	1100	70/-70	25/35	-50/180	25/-20	25/-25	45	60	140
AUTOBRAKE MAX	1160	75/-75	30/40	-55/185	20/-20	25/-25	50	65	150
AUTOBRAKE 2	1740	130/-135	50/70	-85/300	15/-30	50/-50	85	45	45

Medium Reported Braking Action

MAX MANUAL	1470	105/-105	40/60	-80/295	65/-50	35/-35	55	165	410
AUTOBRAKE MAX	1480	110/-105	45/60	-80/295	60/-45	35/-40	65	160	405
AUTOBRAKE 3	1540	110/-110	45/60	-85/305	50/-30	40/-40	85	130	380

Poor Reported Braking Action

MAX MANUAL	1890	150/-145	60/85	-120/465	150/-100	45/-50	65	345	965
AUTOBRAKE MAX	1890	155/-145	60/85	-120/465	155/-100	45/-50	65	345	965
AUTOBRAKE 3	1890	155/-145	60/85	-120/465	155/-95	45/-50	75	345	965

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Actual (unfactored) distances are shown.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance
Trailing Edge Flap Disagree (1 ≤ Indicated Flaps <15)
VREF40 + 30

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	55000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 55000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	980	70/-50	20/30	-35/120	10/-10	20/-20	35	25	55
AUTOBRAKE MAX	1330	65/-70	30/45	-45/155	5/-5	30/-30	60	0	5
AUTOBRAKE 2	2320	165/-175	75/105	-105/350	45/-50	65/-65	85	165	170

Good Reported Braking Action

MAX MANUAL	1330	80/-80	35/50	-55/195	30/-25	30/-35	45	80	190
AUTOBRAKE MAX	1455	80/-85	40/55	-60/205	25/-20	35/-35	60	85	205
AUTOBRAKE 2	2325	165/-175	75/105	-105/350	45/-55	65/-65	85	165	170

Medium Reported Braking Action

MAX MANUAL	1825	125/-125	55/80	-90/325	75/-60	45/-50	55	225	570
AUTOBRAKE MAX	1870	130/-130	60/80	-90/330	70/-55	50/-50	65	230	580
AUTOBRAKE 3	2045	125/-130	60/85	-95/345	45/-35	55/-55	100	125	430

Poor Reported Braking Action

MAX MANUAL	2370	185/-180	80/115	-135/510	175/-120	60/-65	70	480	1380
AUTOBRAKE MAX	2365	185/-180	80/115	-135/510	175/-115	60/-65	70	475	1375
AUTOBRAKE 3	2410	180/-175	80/115	-135/515	160/-100	65/-70	95	455	1360

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Actual (unfactored) distances are shown.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

Trailing Edge Flap Disagree (15 ≤ Indicated Flaps <30)

VREF15

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	55000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 55000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	850	60/-45	15/25	-30/110	10/-10	15/-15	30	20	40
AUTOBRAKE MAX	1065	60/-65	25/30	-40/135	0/0	25/-25	50	0	5
AUTOBRAKE 2	1860	145/-150	55/75	-90/310	20/-30	50/-50	90	50	50

Good Reported Braking Action

MAX MANUAL	1140	70/-70	30/40	-50/185	25/-20	25/-25	45	65	150
AUTOBRAKE MAX	1205	75/-80	30/40	-55/190	25/-20	25/-30	50	70	165
AUTOBRAKE 2	1860	145/-150	55/75	-90/310	20/-30	50/-50	90	50	50

Medium Reported Braking Action

MAX MANUAL	1545	115/-110	45/65	-80/300	65/-50	35/-40	55	180	465
AUTOBRAKE MAX	1550	115/-115	45/65	-85/305	60/-45	40/-40	65	180	460
AUTOBRAKE 3	1625	115/-115	45/65	-85/310	45/-30	40/-45	85	130	420

Poor Reported Braking Action

MAX MANUAL	2000	165/-155	65/90	-125/480	160/-105	50/-55	70	395	1130
AUTOBRAKE MAX	2000	165/-155	65/95	-125/480	160/-105	50/-55	70	395	1130
AUTOBRAKE 3	2000	165/-155	65/95	-125/480	160/-100	50/-55	80	395	1130

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Actual (unfactored) distances are shown.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance
Trailing Edge Flap Disagree (30 ≤ Indicated Flaps <40)
VREF30

BRAKING CONFIGURATION	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
	55000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 55000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV
Dry Runway									
MAX MANUAL	825	50/-45	15/25	-30/110	10/-10	15/-15	30	15	35
AUTOBRAKE MAX	1010	55/-60	20/30	-40/130	0/0	20/-20	50	0	5
AUTOBRAKE 2	1740	130/-135	50/70	-85/300	15/-30	50/-50	85	45	45
Good Reported Braking Action									
MAX MANUAL	1100	70/-70	25/35	-50/180	25/-20	25/-25	45	60	140
AUTOBRAKE MAX	1160	75/-75	30/40	-55/185	20/-20	25/-25	50	65	150
AUTOBRAKE 2	1740	130/-135	50/70	-85/300	15/-30	50/-50	85	45	45
Medium Reported Braking Action									
MAX MANUAL	1470	105/-105	40/60	-80/295	65/-50	35/-35	55	165	410
AUTOBRAKE MAX	1480	110/-105	45/60	-80/295	60/-45	35/-40	65	160	405
AUTOBRAKE 3	1540	110/-110	45/60	-85/305	50/-30	40/-40	85	130	380
Poor Reported Braking Action									
MAX MANUAL	1890	150/-145	60/85	-120/465	150/-100	45/-50	65	345	965
AUTOBRAKE MAX	1890	155/-145	60/85	-120/465	155/-100	45/-50	65	345	965
AUTOBRAKE 3	1890	155/-145	60/85	-120/465	155/-95	45/-50	75	345	965

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Actual (unfactored) distances are shown.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

Trailing Edge Flaps Up Landing

VREF40 + 40

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	55000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 55000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV
Dry Runway									
MAX MANUAL	1040	85/-55	25/35	-35/125	10/-10	25/-25	35	25	55
AUTOBRAKE MAX	1455	75/-75	35/50	-50/165	5/-5	35/-35	60	0	5
AUTOBRAKE 2	2535	180/-190	85/115	-110/365	55/-60	75/-75	85	200	230
Good Reported Braking Action									
MAX MANUAL	1400	80/-85	40/50	-60/200	30/-25	35/-35	40	85	190
AUTOBRAKE MAX	1575	85/-90	40/55	-60/215	20/-20	40/-40	60	70	185
AUTOBRAKE 2	2535	180/-190	85/115	-110/365	55/-60	75/-75	85	200	230
Medium Reported Braking Action									
MAX MANUAL	1940	135/-135	60/85	-95/335	75/-60	50/-55	55	230	575
AUTOBRAKE MAX	2005	135/-135	60/85	-95/340	70/-60	55/-55	65	240	590
AUTOBRAKE 3	2250	135/-145	65/95	-100/360	50/-45	60/-65	95	125	395
Poor Reported Braking Action									
MAX MANUAL	2540	195/-195	85/125	-140/525	185/-125	70/-75	70	500	1410
AUTOBRAKE MAX	2540	195/-195	85/125	-140/525	185/-120	70/-75	80	495	1400
AUTOBRAKE 3	2620	190/-190	85/125	-140/530	165/-110	70/-75	95	450	1370

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Actual (unfactored) distances are shown.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Recommended Brake Cooling Schedule

Reference Brake Energy Per Brake (Millions of Foot Pounds)

		WIND CORRECTED BRAKES ON SPEED (KIAS)																	
		80			100			120			140			160			180		
WEIGHT (1000 KG)	OAT (°C)	PRESSURE ALTITUDE (1000 FT)																	
		0	5	10	0	5	10	0	5	10	0	5	10	0	5	10	0	5	10
70	0	13.0	15.1	17.6	19.6	22.9	26.6	27.2	31.6	36.8	35.6	41.4	48.2	44.9	52.1	60.7	54.4	63.0	73.4
	10	13.4	15.6	18.2	20.3	23.6	27.5	28.1	32.6	38.0	36.8	42.7	49.8	46.3	53.8	62.7	56.1	65.0	75.8
	15	13.6	15.9	18.5	20.6	24.0	28.0	28.5	33.2	38.6	37.4	43.4	50.6	47.1	54.6	63.6	57.0	66.0	76.9
	20	13.8	16.1	18.8	20.9	24.4	28.4	29.0	33.7	39.2	38.0	44.1	51.4	47.8	55.4	64.6	57.9	67.0	78.1
	30	14.3	16.7	19.4	21.6	25.1	29.3	29.8	34.7	40.4	39.1	45.4	52.9	49.2	57.1	66.5	59.6	68.9	80.3
	40	14.6	17.1	19.9	22.1	25.8	30.0	30.6	35.6	41.4	40.1	46.6	54.2	50.5	58.5	68.2	61.1	70.7	82.4
	50	14.7	17.2	20.0	22.3	26.0	30.3	30.9	36.0	42.0	40.6	47.2	55.1	51.2	59.5	69.5	62.2	72.1	84.2
60	0	11.5	13.5	15.7	17.3	20.2	23.5	23.8	27.7	32.2	31.0	36.1	42.0	39.0	45.2	52.7	47.6	55.1	64.3
	10	11.9	13.9	16.2	17.9	20.8	24.3	24.6	28.6	33.3	32.0	37.3	43.4	40.2	46.7	54.5	49.1	56.9	66.4
	15	12.1	14.1	16.5	18.2	21.2	24.7	25.0	29.1	33.8	32.6	37.8	44.1	40.9	47.5	55.3	49.9	57.8	67.4
	20	12.3	14.4	16.7	18.5	21.5	25.0	25.4	29.5	34.4	33.1	38.4	44.8	41.5	48.2	56.1	50.7	58.7	68.4
	30	12.7	14.8	17.3	19.0	22.2	25.8	26.1	30.4	35.4	34.1	39.6	46.1	42.8	49.6	57.8	52.2	60.4	70.4
	40	13.0	15.2	17.7	19.5	22.7	26.5	26.8	31.2	36.3	34.9	40.6	47.3	43.9	50.9	59.3	53.5	62.0	72.2
	50	13.1	15.3	17.8	19.7	22.9	26.7	27.1	31.5	36.7	35.3	41.1	48.0	44.4	51.7	60.3	54.3	63.1	73.6
50	0	10.1	11.8	13.8	15.0	17.5	20.3	20.4	23.7	27.6	26.4	30.7	35.8	33.0	38.4	44.7	40.1	46.6	54.3
	10	10.5	12.2	14.3	15.5	18.0	21.0	21.1	24.5	28.6	27.3	31.8	37.0	34.1	39.7	46.2	41.5	48.1	56.1
	15	10.7	12.4	14.5	15.7	18.3	21.4	21.4	24.9	29.0	27.7	32.3	37.6	34.7	40.3	46.9	42.1	48.9	56.9
	20	10.8	12.6	14.7	16.0	18.6	21.7	21.7	25.3	29.5	28.2	32.8	38.2	35.2	40.9	47.6	42.8	49.6	57.8
	30	11.2	13.0	15.2	16.5	19.2	22.4	22.4	26.1	30.4	29.0	33.8	39.3	36.3	42.1	49.1	44.0	51.1	59.5
	40	11.5	13.4	15.6	16.9	19.7	22.9	23.0	26.7	31.1	29.8	34.6	40.3	37.2	43.2	50.3	45.2	52.4	61.0
	50	11.5	13.4	15.7	17.0	19.9	23.1	23.2	27.0	31.5	30.1	35.0	40.8	37.6	43.8	51.1	45.8	53.2	62.1
40	0	8.8	10.2	11.9	12.7	14.8	17.2	17.0	19.8	23.0	21.7	25.3	29.5	27.0	31.4	36.6	32.6	37.9	44.2
	10	9.1	10.6	12.3	13.1	15.3	17.8	17.5	20.4	23.8	22.5	26.2	30.5	27.9	32.4	37.8	33.7	39.2	45.7
	15	9.2	10.7	12.5	13.3	15.5	18.1	17.8	20.8	24.2	22.8	26.6	31.0	28.3	32.9	38.4	34.3	39.8	46.4
	20	9.4	10.9	12.7	13.5	15.8	18.3	18.1	21.1	24.6	23.2	27.0	31.4	28.8	33.5	39.0	34.8	40.4	47.1
	30	9.7	11.3	13.1	13.9	16.3	18.9	18.7	21.7	25.3	23.9	27.8	32.4	29.7	34.5	40.2	35.9	41.7	48.5
	40	9.9	11.5	13.4	14.3	16.7	19.4	19.1	22.3	25.9	24.5	28.5	33.2	30.4	35.3	41.2	36.8	42.7	49.7
	50	9.9	11.6	13.5	14.4	16.8	19.5	19.3	22.5	26.2	24.7	28.8	33.6	30.7	35.8	41.7	37.2	43.3	50.5

***To correct for wind, enter table with the brakes on speed minus one half the headwind or plus 1.5 times the tailwind. If ground speed is used for brakes on speed, ignore wind and enter table with sea level, 15°C.**

Adjusted Brake Energy Per Brake (Millions of Foot Pounds)
No Reverse Thrust

		REFERENCE BRAKE ENERGY PER BRAKE (MILLIONS OF FOOT POUNDS)								
EVENT		10	20	30	40	50	60	70	80	90
RTO MAX MAN		10	20	30	40	50	60	70	80	90
LANDING	MAX MAN	8.0	16.5	25.4	34.7	44.3	54.2	64.1	74.1	84.1
	MAX AUTO	7.6	15.6	24.0	32.8	42.0	51.6	61.8	72.4	83.5
	AUTOBRAKE 3	7.3	14.8	22.4	30.4	38.7	47.6	57.0	67.2	78.1
	AUTOBRAKE 2	6.8	13.7	20.6	27.7	35.1	42.8	50.9	59.6	68.9
	AUTOBRAKE 1	6.4	12.7	18.9	25.2	31.7	38.6	46.0	54.1	63.0

ADVISORY INFORMATION

Recommended Brake Cooling Schedule

Adjusted Brake Energy Per Brake (Millions of Foot Pounds)

Two Engine Reverse Thrust

		REFERENCE BRAKE ENERGY PER BRAKE (MILLIONS OF FOOT POUNDS)								
	EVENT	10	20	30	40	50	60	70	80	90
	RTO MAX MAN	10	20	30	40	50	60	70	80	90
LANDING	MAX MAN	7.3	15.2	23.5	32.2	41.2	50.4	59.7	69.0	78.3
	MAX AUTO	6.3	13.1	20.5	28.3	36.7	45.7	55.2	65.3	76.0
	AUTOBRAKE 3	4.7	9.9	15.6	21.9	28.7	36.0	43.9	52.3	61.2
	AUTOBRAKE 2	2.7	6.1	10.0	14.5	19.5	24.9	30.8	37.0	43.6
	AUTOBRAKE 1	1.8	4.0	6.5	9.4	12.8	16.6	21.0	25.9	31.5

Cooling Time (Minutes) - Category D Steel and Carbon Brakes

	EVENT ADJUSTED BRAKE ENERGY (MILLIONS OF FOOT POUNDS)								
	16 & BELOW	17	19	20.9	23.5	26.9	29.4	30 TO 41	41 & ABOVE
	BRAKE TEMPERATURE MONITOR SYSTEM INDICATION ON CDS								
	UP TO 2.5	2.6	3	3.3	3.8	4.5	4.9	5.0 TO 7.1	7.1 & ABOVE
INFLIGHT GEAR DOWN	NO SPECIAL PROCEDURE REQUIRED	1	4	5	6	7	7.6	CAUTION	MELT ZONE FUSE PLUG
GROUND		6.7	16.0	24.1	34.2	45.9	53.3		

Observe maximum quick turnaround limit.

Table shows energy per brake added by a single stop with all brakes operating. Energy is assumed to be equally distributed among the operating brakes. Total energy is the sum of residual energy plus energy added.

Add 1.0 million foot pounds per brake for each taxi mile.

When in caution zone, wheel fuse plugs may melt. Delay takeoff and inspect after one hour. If overheat occurs after takeoff, extend gear soon for at least 7 minutes.

When in fuse plug melt zone, clear runway immediately. Unless required, do not set parking brake. Do not approach gear or attempt to taxi for one hour. Tire, wheel and brake replacement may be required. If overheat occurs after takeoff, extend gear soon for at least 12 minutes.

Brake temperature monitor system (BTMS) indication on CDS systems page may be used 10 to 15 minutes after airplane has come to a complete stop or inflight with gear retracted to determine recommended cooling schedule.

Performance Inflight — Chapter PI
Engine Inoperative — Section 13

ENGINE INOP

Initial Max Continuous %N1
Based on .79M, A/C high and anti-ice off

TAT (°C)	PRESSURE ALTITUDE (1000 FT)								
	25	27	29	31	33	35	37	39	41
20	96.0	95.8	95.6	95.4	95.1	94.7	94.2	93.9	93.1
15	96.6	96.4	96.1	96.0	95.9	95.4	95.0	94.7	94.0
10	97.2	97.1	96.7	96.6	96.6	96.2	95.7	95.5	94.9
5	97.4	97.8	97.5	97.3	97.3	96.9	96.5	96.3	95.8
0	96.7	98.0	98.4	98.2	98.1	97.7	97.4	97.1	96.7
-5	95.9	97.2	98.4	99.1	99.0	98.5	98.2	98.0	97.7
-10	95.1	96.4	97.6	98.9	99.8	99.4	99.1	98.9	98.6
-15	94.3	95.7	96.9	98.1	99.4	100.3	100.0	99.8	99.6
-20	93.5	94.9	96.1	97.3	98.6	99.8	100.3	100.1	99.9
-25	92.7	94.1	95.3	96.5	97.8	98.9	99.5	99.3	99.1
-30	91.8	93.3	94.5	95.7	96.9	98.1	98.6	98.4	98.2
-35	91.0	92.5	93.6	94.8	96.1	97.2	97.8	97.6	97.4
-40	90.1	91.7	92.8	94.0	95.3	96.4	96.9	96.7	96.5

%N1 Adjustments for Engine Bleed

BLEED CONFIGURATION	PRESSURE ALTITUDE (1000 FT)								
	25	27	29	31	33	35	37	39	41
ENGINE ANTI-ICE	-1.2	-1.1	-1.0	-0.9	-0.8	-0.8	-0.8	-0.8	-0.8
ENGINE & WING ANTI-ICE	-4.2	-4.4	-4.5	-4.7	-5.0	-4.8	-4.8	-4.8	-4.8

ENGINE INOP

Max Continuous %N1

37000 FT to 29000 FT Pressure Altitudes

37000 FT PRESS ALT		TAT (°C)											
KIAS	M	-55	-50	-45	-40	-35	-30	-25	-20	-15	-10	-5	0
160	.51	96.0	96.9	97.8	98.7	99.5	98.9	98.0	96.8	95.5	93.9	92.4	91.1
200	.63	95.3	96.2	97.1	98.0	98.8	99.7	99.4	98.6	97.7	96.7	95.5	94.4
240	.74	94.4	95.3	96.1	97.0	97.9	98.7	99.6	100.0	99.2	98.4	97.6	96.6
280	.86	93.6	94.5	95.4	96.3	97.1	98.0	98.8	99.6	100.4	100.1	99.2	98.4
35000 FT PRESS ALT		TAT (°C)											
KIAS	M	-55	-50	-45	-40	-35	-30	-25	-20	-15	-10	-5	0
160	.49	95.8	96.7	97.6	98.5	99.4	99.1	98.3	97.2	96.0	94.6	93.2	92.0
200	.60	95.4	96.4	97.2	98.1	99.0	99.9	99.8	98.8	97.9	96.9	95.7	94.6
240	.71	94.3	95.2	96.1	97.0	97.9	98.7	99.6	100.1	99.4	98.8	97.9	96.9
280	.82	93.1	94.0	94.8	95.7	96.5	97.4	98.2	99.0	99.8	99.6	98.8	98.0
33000 FT PRESS ALT		TAT (°C)											
KIAS	M	-50	-45	-40	-35	-30	-25	-20	-15	-10	-5	0	5
160	.47	96.7	97.6	98.4	99.3	100.1	99.3	98.4	97.2	95.9	94.5	93.1	91.9
200	.58	96.3	97.2	98.1	99.0	99.8	100.7	99.8	98.9	97.9	96.7	95.5	94.4
240	.68	95.2	96.1	97.0	97.8	98.7	99.5	100.4	100.1	99.5	98.6	97.6	96.6
280	.79	93.6	94.4	95.3	96.1	97.0	97.8	98.6	99.4	99.8	99.0	98.1	97.3
320	.89	92.9	93.8	94.7	95.5	96.3	97.2	98.0	98.8	99.6	100.3	100.0	99.1
31000 FT PRESS ALT		TAT (°C)											
KIAS	M	-50	-45	-40	-35	-30	-25	-20	-15	-10	-5	0	5
160	.45	96.7	97.5	98.4	99.3	100.2	100.3	99.5	98.4	97.2	95.8	94.4	93.1
200	.55	96.4	97.3	98.1	99.0	99.9	100.7	100.9	100.0	99.0	97.9	96.6	95.4
240	.66	94.9	95.8	96.7	97.5	98.4	99.2	100.1	100.6	99.8	99.0	98.0	97.0
280	.76	93.1	94.0	94.8	95.6	96.5	97.3	98.1	98.9	99.7	99.0	98.1	97.2
320	.85	91.7	92.5	93.4	94.2	95.0	95.8	96.6	97.4	98.2	99.0	99.2	98.3
29000 FT PRESS ALT		TAT (°C)											
KIAS	M	-45	-40	-35	-30	-25	-20	-15	-10	-5	0	5	10
160	.43	97.4	98.3	99.2	100.0	100.9	100.5	99.5	98.4	97.1	95.6	94.3	93.0
200	.53	96.8	97.7	98.6	99.4	100.3	101.1	100.6	99.6	98.6	97.4	96.2	95.0
240	.63	95.6	96.4	97.3	98.1	99.0	99.8	100.6	100.3	99.4	98.5	97.4	96.5
280	.73	93.5	94.3	95.2	96.0	96.8	97.6	98.4	99.2	99.3	98.4	97.4	96.7
320	.82	91.3	92.2	93.0	93.8	94.6	95.4	96.2	97.0	97.7	98.5	97.7	96.9
360	.91	91.3	92.2	93.0	93.8	94.6	95.4	96.2	97.0	97.7	98.5	99.2	99.3

%N1 Adjustments for Engine Bleeds

BLEED CONFIGURATION	PRESSURE ALTITUDE (1000 FT)				
	29	31	33	35	37
ENGINE ANTI-ICE ON	-0.9	-0.9	-0.8	-0.8	-0.8
ENGINE & WING ANTI-ICE ON	-4.1	-4.3	-4.5	-4.7	-4.7

ENGINE INOP

Max Continuous %N1
27000 FT to 20000 FT Pressure Altitudes

27000 FT PRESS ALT		TAT (°C)											
KIAS	M	-45	-40	-35	-30	-25	-20	-15	-10	-5	0	5	10
160	.41	97.3	98.1	99.0	99.9	100.7	101.5	100.5	99.5	98.3	96.9	95.6	94.3
200	.51	96.2	97.1	98.0	98.8	99.7	100.5	101.0	100.1	99.1	98.0	96.8	95.6
240	.60	94.9	95.8	96.7	97.5	98.3	99.2	100.0	100.6	99.6	98.6	97.6	96.7
280	.70	92.9	93.7	94.6	95.4	96.2	97.0	97.8	98.6	99.4	98.6	97.6	96.8
320	.79	90.8	91.6	92.5	93.3	94.1	94.9	95.6	96.4	97.2	97.9	97.8	97.1
360	.88	90.0	90.9	91.7	92.5	93.4	94.2	95.0	95.7	96.5	97.3	98.0	98.6

25000 FT PRESS ALT		TAT (°C)											
KIAS	M	-40	-35	-30	-25	-20	-15	-10	-5	0	5	10	15
160	.39	98.1	98.9	99.8	100.7	101.5	101.6	100.6	99.5	98.3	96.9	95.7	94.4
200	.49	96.7	97.6	98.5	99.3	100.1	100.9	100.8	99.8	98.8	97.6	96.5	95.4
240	.58	95.0	95.8	96.7	97.5	98.3	99.1	99.9	99.7	98.8	97.8	96.8	95.9
280	.67	93.1	94.0	94.8	95.6	96.4	97.2	98.0	98.7	98.8	97.8	96.8	96.1
320	.76	90.8	91.7	92.5	93.3	94.1	94.9	95.7	96.5	97.2	97.8	97.1	96.4
360	.85	89.5	90.3	91.2	92.0	92.9	93.7	94.5	95.3	96.1	96.9	97.6	97.4

24000 FT PRESS ALT		TAT (°C)											
KIAS	M	-40	-35	-30	-25	-20	-15	-10	-5	0	5	10	15
160	.38	97.3	98.2	99.1	99.9	100.7	101.5	100.4	99.3	98.1	96.8	95.6	94.4
200	.48	96.1	96.9	97.8	98.6	99.4	100.2	100.6	99.6	98.6	97.4	96.3	95.3
240	.57	94.5	95.3	96.1	96.9	97.8	98.6	99.3	99.7	98.7	97.6	96.7	95.8
280	.66	92.7	93.5	94.3	95.1	95.9	96.7	97.5	98.3	98.8	97.7	96.7	96.0
320	.75	90.2	91.1	91.9	92.7	93.5	94.4	95.2	95.9	96.7	97.5	96.9	96.2
360	.83	88.7	89.6	90.4	91.2	92.1	92.9	93.7	94.5	95.3	96.1	96.9	96.9

22000 FT PRESS ALT		TAT (°C)											
KIAS	M	-35	-30	-25	-20	-15	-10	-5	0	5	10	15	20
160	.37	96.7	97.6	98.4	99.2	100.1	100.2	99.0	97.8	96.6	95.5	94.4	93.3
200	.46	95.5	96.4	97.2	98.0	98.8	99.6	99.3	98.1	97.0	96.0	95.0	94.0
240	.55	94.1	94.9	95.8	96.5	97.3	98.1	98.9	98.5	97.3	96.4	95.5	94.7
280	.63	92.5	93.3	94.1	94.9	95.7	96.4	97.2	97.9	97.6	96.7	95.8	95.1
320	.72	90.1	91.0	91.8	92.7	93.5	94.3	95.1	95.9	96.7	96.8	96.0	95.3
360	.80	88.4	89.2	90.1	90.9	91.7	92.6	93.4	94.2	95.0	95.8	96.3	95.8

20000 FT PRESS ALT		TAT (°C)											
KIAS	M	-35	-30	-25	-20	-15	-10	-5	0	5	10	15	20
160	.35	95.3	96.1	97.0	97.8	98.6	99.4	98.8	97.4	96.2	95.2	94.2	93.2
200	.44	94.2	95.0	95.8	96.6	97.4	98.2	98.9	97.8	96.4	95.5	94.6	93.7
240	.53	92.8	93.6	94.4	95.2	96.0	96.8	97.5	98.2	97.0	95.9	95.1	94.3
280	.61	91.1	92.0	92.8	93.6	94.4	95.2	96.0	96.8	97.4	96.5	95.6	94.9
320	.69	89.1	90.0	90.8	91.6	92.5	93.3	94.1	94.9	95.7	96.5	95.8	95.1
360	.77	87.4	88.3	89.1	90.0	90.8	91.6	92.4	93.2	94.0	94.8	95.6	95.4

%N1 Adjustments for Engine Bleeds

BLEED CONFIGURATION	PRESSURE ALTITUDE (1000 FT)				
	20	22	24	25	27
ENGINE ANTI-ICE ON	-0.9	-0.9	-1.0	-1.0	-1.0
ENGINE & WING ANTI-ICE ON	-3.6	-3.8	-3.8	-3.9	-4.0

ENGINE INOP

Max Continuous %N1
18000 FT to 12000 FT Pressure Altitudes

18000 FT PRESS ALT		TAT (°C)											
KIAS	M	-30	-25	-20	-15	-10	-5	0	5	10	15	20	25
160	.34	94.5	95.3	96.1	96.9	97.7	98.4	97.3	95.9	94.9	94.0	93.0	92.1
200	.42	93.4	94.2	95.0	95.8	96.6	97.3	97.6	96.3	95.2	94.4	93.5	92.6
240	.51	91.9	92.7	93.5	94.3	95.1	95.9	96.7	96.7	95.6	94.7	94.0	93.2
280	.59	90.4	91.3	92.1	92.9	93.8	94.6	95.4	96.1	96.1	95.2	94.4	93.7
320	.67	88.9	89.7	90.5	91.4	92.2	93.0	93.8	94.6	95.4	95.5	94.8	94.1
360	.75	87.3	88.2	89.0	89.8	90.7	91.5	92.3	93.1	93.9	94.7	95.1	94.5
16000 FT PRESS ALT		TAT (°C)											
KIAS	M	-30	-25	-20	-15	-10	-5	0	5	10	15	20	25
160	.33	93.0	93.8	94.6	95.4	96.1	96.9	97.2	96.0	94.8	94.0	93.1	92.2
200	.41	91.6	92.4	93.2	94.0	94.8	95.6	96.4	96.1	95.0	94.1	93.3	92.5
240	.49	90.3	91.1	92.0	92.8	93.6	94.4	95.2	96.0	95.4	94.5	93.7	92.9
280	.57	89.0	89.9	90.7	91.5	92.4	93.2	94.0	94.8	95.6	94.9	94.1	93.4
320	.64	87.8	88.6	89.5	90.3	91.1	91.9	92.7	93.5	94.3	95.1	94.5	93.8
360	.72	86.5	87.3	88.2	89.0	89.8	90.6	91.4	92.2	93.0	93.8	94.6	94.2
14000 FT PRESS ALT		TAT (°C)											
KIAS	M	-25	-20	-15	-10	-5	0	5	10	15	20	25	30
160	.31	92.4	93.2	94.1	94.9	95.7	96.4	96.4	95.5	94.6	93.8	92.9	92.0
200	.39	91.0	91.9	92.7	93.5	94.3	95.1	95.9	95.1	94.2	93.4	92.6	91.8
240	.47	90.0	90.9	91.7	92.5	93.3	94.1	94.9	95.4	94.6	93.7	93.0	92.3
280	.54	88.9	89.8	90.6	91.4	92.3	93.1	93.9	94.7	94.9	94.1	93.4	92.7
320	.62	87.8	88.7	89.5	90.3	91.2	92.0	92.8	93.5	94.3	94.5	93.8	93.1
360	.69	86.7	87.5	88.3	89.1	90.0	90.8	91.5	92.3	93.1	93.9	94.2	93.6
12000 FT PRESS ALT		TAT (°C)											
KIAS	M	-20	-15	-10	-5	0	5	10	15	20	25	30	35
160	.30	91.8	92.6	93.4	94.2	95.0	95.8	95.5	94.8	94.0	93.2	92.4	91.5
200	.38	90.7	91.5	92.3	93.1	93.9	94.7	95.2	94.3	93.5	92.7	92.0	91.2
240	.45	89.8	90.7	91.5	92.3	93.1	93.9	94.7	94.7	93.8	93.1	92.4	91.6
280	.52	88.9	89.8	90.6	91.4	92.2	93.0	93.8	94.6	94.2	93.5	92.8	92.1
320	.60	87.9	88.8	89.6	90.4	91.2	92.0	92.8	93.6	94.3	93.9	93.2	92.5
360	.67	86.8	87.7	88.5	89.3	90.1	90.9	91.6	92.4	93.2	93.9	93.5	92.9

%N1 Adjustments for Engine Bleeds

BLEED CONFIGURATION	PRESSURE ALTITUDE (1000 FT)			
	12	14	16	18
ENGINE ANTI-ICE ON	-0.9	-0.9	-0.9	-0.9
ENGINE & WING ANTI-ICE ON	-3.2	-3.4	-3.4	-3.5

ENGINE INOP

Max Continuous %N1
10000 FT to 1000 FT Pressure Altitudes

10000 FT PRESS ALT		TAT (°C)											
KIAS	M	-20	-15	-10	-5	0	5	10	15	20	25	30	35
160	.29	90.5	91.4	92.2	93.0	93.8	94.6	95.4	94.7	94.1	93.3	92.5	91.7
200	.36	89.6	90.4	91.3	92.1	92.9	93.7	94.5	94.5	93.7	92.9	92.2	91.4
240	.43	88.9	89.7	90.6	91.4	92.2	93.0	93.8	94.5	94.0	93.1	92.4	91.7
280	.51	88.1	89.0	89.8	90.6	91.4	92.2	93.0	93.8	94.4	93.6	92.8	92.2
320	.58	87.2	88.0	88.8	89.6	90.4	91.2	92.0	92.8	93.5	93.9	93.2	92.5
360	.65	86.2	87.0	87.8	88.6	89.4	90.2	91.0	91.7	92.5	93.2	93.6	92.9
5000 FT PRESS ALT		TAT (°C)											
KIAS	M	-10	-5	0	5	10	15	20	25	30	35	40	45
160	.26	89.1	89.9	90.7	91.5	92.3	93.1	93.7	93.5	93.2	92.5	91.8	91.0
200	.33	88.7	89.5	90.3	91.1	91.8	92.6	93.4	93.3	92.9	92.3	91.6	90.8
240	.40	88.1	88.9	89.7	90.5	91.3	92.0	92.8	93.3	92.5	91.8	91.1	90.3
280	.46	87.5	88.3	89.1	89.8	90.6	91.4	92.2	92.9	92.9	92.1	91.4	90.7
320	.53	86.8	87.6	88.3	89.1	89.9	90.7	91.4	92.2	92.9	92.5	91.8	91.1
360	.59	86.0	86.7	87.5	88.3	89.1	89.8	90.6	91.3	92.0	92.8	92.2	91.5
3000 FT PRESS ALT		TAT (°C)											
KIAS	M	-5	0	5	10	15	20	25	30	35	40	45	50
160	.26	88.8	89.6	90.4	91.2	91.9	92.7	93.1	92.9	92.6	91.8	91.1	90.3
200	.32	88.5	89.3	90.0	90.8	91.6	92.3	93.1	92.8	92.5	91.8	91.1	90.3
240	.38	87.9	88.7	89.5	90.3	91.0	91.8	92.5	92.6	91.8	91.0	90.3	89.6
280	.45	87.4	88.1	88.9	89.7	90.5	91.2	92.0	92.7	92.2	91.4	90.7	90.0
320	.51	86.7	87.5	88.3	89.0	89.8	90.5	91.3	92.0	92.5	91.8	91.1	90.4
360	.57	85.9	86.7	87.5	88.2	89.0	89.7	90.5	91.2	91.9	92.2	91.5	90.7
1000 FT PRESS ALT		TAT (°C)											
KIAS	M	-5	0	5	10	15	20	25	30	35	40	45	50
160	.25	87.7	88.5	89.3	90.0	90.8	91.6	92.3	92.3	91.8	91.2	90.5	89.7
200	.31	87.4	88.2	89.0	89.7	90.5	91.3	92.0	92.4	92.0	91.5	90.8	90.0
240	.37	86.9	87.7	88.5	89.3	90.0	90.8	91.5	92.3	91.9	91.2	90.4	89.7
280	.43	86.4	87.2	87.9	88.7	89.5	90.2	90.9	91.7	92.1	91.4	90.7	89.9
320	.49	85.8	86.6	87.4	88.1	88.9	89.6	90.4	91.1	91.8	91.8	91.1	90.3
360	.55	85.1	85.9	86.7	87.4	88.1	88.9	89.6	90.3	91.1	91.8	91.4	90.7

%N1 Adjustments for Engine Bleeds

BLEED CONFIGURATION	PRESSURE ALTITUDE (1000 FT)			
	1	3	5	10
ENGINE ANTI-ICE ON	-0.6	-0.8	-0.8	-0.8
ENGINE & WING ANTI-ICE ON	-2.9	-3.0	-3.1	-3.2

ENGINE INOP

MAX CONTINUOUS THRUST

Driftdown Speed/Level Off Altitude

100 ft/min residual rate of climb

WEIGHT (1000 KG)		OPTIMUM DRIFTDOWN SPEED (KIAS)	LEVEL OFF ALTITUDE (FT)		
START DRIFTDOWN	LEVEL OFF		ISA + 10°C & BELOW	ISA + 15°C	ISA + 20°C
70	67	241	21800	20300	18100
65	62	233	24300	22900	21300
60	57	225	26500	25500	24300
55	53	215	28800	27800	26700
50	48	205	30900	30100	29100
45	43	195	33000	32300	31400
40	38	184	35400	34700	33800
35	33	172	38000	37300	36500

Includes APU fuel burn.

ENGINE INOP

MAX CONTINUOUS THRUST

Driftdown/LRC Cruise Range Capability

Ground to Air Miles Conversion

AIR DISTANCE (NM)					GROUND DISTANCE (NM)	AIR DISTANCE (NM)				
HEADWIND COMPONENT (KTS)						TAILWIND COMPONENT (KTS)				
100	80	60	40	20		20	40	60	80	100
140	130	121	113	106	100	95	90	85	81	78
280	259	241	226	212	200	189	180	171	163	156
419	388	362	339	318	300	284	269	256	244	234
559	518	482	451	424	400	378	359	342	326	312
698	647	602	564	530	500	473	449	427	408	390
837	776	723	677	636	600	568	539	513	489	468
976	905	843	789	742	700	663	629	599	571	546
1115	1033	963	902	848	800	757	719	684	653	624
1253	1162	1083	1014	954	900	852	809	770	734	702
1392	1291	1203	1127	1060	1000	947	899	855	816	780
1531	1420	1324	1240	1166	1100	1041	989	941	898	858
1670	1549	1444	1352	1272	1200	1136	1079	1027	980	936
1809	1677	1564	1465	1377	1300	1231	1169	1112	1061	1015
1948	1806	1684	1577	1483	1400	1325	1258	1198	1143	1093
2087	1936	1805	1690	1589	1500	1420	1348	1283	1224	1171
2227	2065	1925	1803	1695	1600	1515	1438	1369	1306	1249

Driftdown/Cruise Fuel and Time

AIR DIST (NM)	FUEL REQUIRED (1000 KG)								TIME (HR:MIN)
	WEIGHT AT START OF DRIFTDOWN (1000 KG)								
	35	40	45	50	55	60	65	70	
100	0.3	0.3	0.3	0.4	0.4	0.4	0.5	0.5	0:17
200	0.7	0.8	0.8	0.9	0.9	1.0	1.1	1.1	0:34
300	1.1	1.2	1.3	1.4	1.5	1.6	1.7	1.8	0:51
400	1.5	1.6	1.8	1.9	2.1	2.3	2.4	2.5	1:08
500	1.9	2.0	2.2	2.4	2.6	2.8	3.0	3.2	1:25
600	2.2	2.4	2.7	2.9	3.2	3.4	3.6	3.9	1:42
700	2.6	2.8	3.1	3.4	3.7	4.0	4.2	4.5	1:59
800	2.9	3.2	3.5	3.9	4.2	4.5	4.8	5.1	2:15
900	3.3	3.6	4.0	4.3	4.7	5.1	5.4	5.8	2:32
1000	3.6	4.0	4.4	4.8	5.2	5.6	6.0	6.4	2:49
1100	3.9	4.4	4.8	5.3	5.7	6.2	6.6	7.0	3:06
1200	4.3	4.7	5.2	5.7	6.2	6.7	7.2	7.6	3:23
1300	4.6	5.1	5.6	6.2	6.7	7.2	7.7	8.3	3:39
1400	4.9	5.5	6.0	6.6	7.2	7.8	8.3	8.9	3:56
1500	5.3	5.8	6.4	7.1	7.7	8.3	8.9	9.5	4:13
1600	5.6	6.2	6.8	7.5	8.2	8.8	9.4	10.1	4:30

Includes APU fuel burn.
Driftdown at optimum driftdown speed and cruise at Long Range Cruise speed.

ENGINE INOP

MAX CONTINUOUS THRUST

Long Range Cruise Altitude Capability

100 ft/min residual rate of climb

WEIGHT (1000 KG)	PRESSURE ALTITUDE (FT)		
	ISA + 10°C & BELOW	ISA + 15°C	ISA + 20°C
70	16400	13800	11300
65	20600	17200	14300
60	23800	21300	18200
55	26600	25100	22200
50	29200	28000	26300
45	31600	30800	29500
40	34000	33200	32100
35	36600	35900	34800

With engine anti-ice on, decrease altitude capability by 2000 ft.
With engine and wing anti-ice on, decrease altitude capability by 7000 ft.

ENGINE INOP

Long Range Cruise Control

WEIGHT (1000 KG)		PRESSURE ALTITUDE (1000 FT)											
		10	15	17	19	21	23	25	27	29	31	33	35
70	%N1	86.2	90.5	92.1	93.8								
	MACH	.510	.562	.582	.595								
	KIAS	282	284	283	278								
	FF/ENG	2470	2497	2499	2463								
65	%N1	84.1	88.4	90.2	91.9	93.7	96.2						
	MACH	.491	.542	.563	.584	.596	.612						
	KIAS	271	274	274	273	268	265						
	FF/ENG	2280	2305	2309	2310	2279	2303						
60	%N1	82.0	86.3	88.0	89.8	91.6	93.5	96.2					
	MACH	.471	.521	.543	.564	.585	.597	.614					
	KIAS	261	263	263	263	263	258	254					
	FF/ENG	2097	2115	2119	2121	2123	2098	2132					
55	%N1	79.7	83.9	85.7	87.4	89.2	91.1	93.1	95.9				
	MACH	.453	.498	.520	.541	.563	.585	.597	.614				
	KIAS	250	251	252	252	253	252	247	244				
	FF/ENG	1924	1926	1929	1931	1935	1940	1922	1958				
50	%N1	77.3	81.3	83.1	84.9	86.7	88.5	90.4	92.4	95.4			
	MACH	.434	.475	.495	.516	.538	.561	.583	.596	.613			
	KIAS	240	239	239	240	241	241	241	236	233			
	FF/ENG	1760	1740	1741	1743	1746	1750	1759	1750	1779			
45	%N1	74.9	78.6	80.2	82.0	83.8	85.6	87.5	89.4	91.5	94.4	98.2	
	MACH	.415	.452	.469	.489	.511	.533	.556	.578	.593	.610	.632	
	KIAS	229	227	227	227	228	229	229	229	225	222	220	
	FF/ENG	1602	1569	1560	1556	1559	1563	1569	1583	1578	1599	1673	
40	%N1	72.2	75.7	77.3	78.9	80.6	82.5	84.3	86.1	88.0	90.3	93.1	96.7
	MACH	.395	.429	.445	.462	.480	.502	.525	.548	.571	.589	.604	.626
	KIAS	218	215	215	214	214	215	216	216	216	214	210	208
	FF/ENG	1448	1407	1392	1381	1373	1377	1384	1394	1406	1409	1417	1475
35	%N1	69.1	72.7	74.1	75.6	77.3	79.0	80.7	82.5	84.4	86.3	88.6	91.3
	MACH	.375	.406	.420	.435	.452	.469	.490	.513	.536	.560	.584	.597
	KIAS	207	203	202	202	201	201	201	202	203	203	202	198
	FF/ENG	1302	1255	1236	1219	1205	1197	1200	1211	1219	1228	1241	1237

ENGINE INOP

MAX CONTINUOUS THRUST

Long Range Cruise Diversion Fuel and Time

Ground to Air Miles Conversion

AIR DISTANCE (NM)					GROUND DISTANCE (NM)	AIR DISTANCE (NM)				
HEADWIND COMPONENT (KTS)						TAILWIND COMPONENT (KTS)				
100	80	60	40	20		20	40	60	80	100
309	279	253	233	215	200	190	180	172	164	157
625	564	511	467	432	400	379	360	342	326	312
943	850	769	703	648	600	568	539	513	489	468
1263	1137	1027	939	865	800	757	718	683	651	623
1585	1425	1287	1175	1082	1000	947	897	853	813	777
1910	1716	1547	1412	1299	1200	1136	1076	1023	975	932
2237	2008	1810	1649	1517	1400	1324	1255	1193	1136	1087
2567	2302	2072	1887	1734	1600	1513	1434	1362	1297	1240
2899	2597	2336	2126	1952	1800	1702	1613	1531	1459	1394

Reference Fuel and Time Required at Check Point

AIR DIST (NM)	PRESSURE ALTITUDE (1000 FT)									
	10		14		18		22		26	
	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)
200	1.2	0:46	1.1	0:43	1.0	0:41	0.9	0:39	0.8	0:38
400	2.6	1:30	2.3	1:25	2.1	1:20	2.0	1:15	1.8	1:12
600	3.8	2:14	3.5	2:07	3.3	2:00	3.0	1:52	2.8	1:46
800	5.1	2:59	4.7	2:50	4.4	2:39	4.1	2:29	3.8	2:21
1000	6.4	3:45	5.9	3:33	5.5	3:20	5.1	3:07	4.8	2:56
1200	7.7	4:31	7.1	4:16	6.6	4:01	6.1	3:45	5.7	3:31
1400	8.9	5:18	8.3	5:00	7.7	4:42	7.1	4:23	6.7	4:07
1600	10.1	6:05	9.4	5:45	8.7	5:24	8.1	5:02	7.6	4:43
1800	11.3	6:53	10.5	6:30	9.8	6:06	9.1	5:41	8.6	5:19

Fuel Required Adjustments (1000 KG)

REFERENCE FUEL REQUIRED (1000 KG)	WEIGHT AT CHECK POINT (1000 KG)				
	30	40	50	60	70
1	-0.1	-0.1	0.0	0.1	0.3
2	-0.3	-0.2	0.0	0.2	0.6
3	-0.5	-0.2	0.0	0.4	1.0
4	-0.6	-0.3	0.0	0.5	1.3
5	-0.8	-0.4	0.0	0.7	1.7
6	-1.0	-0.5	0.0	0.8	2.0
7	-1.1	-0.6	0.0	0.9	2.3
8	-1.3	-0.7	0.0	1.0	2.5
9	-1.5	-0.7	0.0	1.2	2.8
10	-1.7	-0.8	0.0	1.3	3.0
11	-1.8	-0.9	0.0	1.4	3.3
12	-2.0	-1.0	0.0	1.5	3.5

Includes APU fuel burn.

ENGINE INOP

MAX CONTINUOUS THRUST

Holding

Flaps Up

WEIGHT (1000 KG)		PRESSURE ALTITUDE (FT)							
		1500	5000	10000	15000	20000	25000	30000	35000
70	%N1	75.7	78.5	82.7	87.1	92.3			
	KIAS	229	229	230	231	233			
	FF/ENG	2240	2230	2230	2250	2290			
65	%N1	73.6	76.5	80.7	85.0	89.7	98.0		
	KIAS	221	221	222	223	224	225		
	FF/ENG	2080	2070	2060	2070	2090	2260		
60	%N1	71.3	74.4	78.4	82.8	87.4	94.0		
	KIAS	212	212	213	214	215	216		
	FF/ENG	1930	1910	1900	1900	1910	1990		
55	%N1	69.0	71.9	76.0	80.4	84.9	90.1		
	KIAS	203	203	204	204	205	207		
	FF/ENG	1770	1750	1740	1730	1730	1770		
50	%N1	66.5	69.2	73.6	77.7	82.2	87.0	95.2	
	KIAS	193	194	194	195	196	197	198	
	FF/ENG	1620	1600	1580	1570	1560	1580	1700	
45	%N1	63.7	66.5	70.6	74.9	79.3	84.0	89.7	
	KIAS	183	183	184	185	185	186	187	
	FF/ENG	1470	1450	1430	1420	1400	1400	1460	
40	%N1	60.5	63.6	67.5	71.9	76.1	80.7	85.6	94.4
	KIAS	177	177	177	177	177	177	177	178
	FF/ENG	1330	1310	1280	1270	1240	1240	1270	1370
35	%N1	57.3	60.1	64.3	68.4	72.9	77.3	81.9	87.7
	KIAS	170	170	170	170	170	170	170	170
	FF/ENG	1180	1160	1150	1130	1100	1090	1110	1140

This table includes 5% additional fuel for holding in a racetrack pattern.

ENGINE INOP

ADVISORY INFORMATION

Gear Down Landing Rate of Climb Available

Flaps 15

TAT (°C)	RATE OF CLIMB (FT/MIN)					
	PRESSURE ALTITUDE (FT)					
	-2000	0	2000	4000	6000	8000
52	90	30				
50	120	60	-30			
48	150	90	0			
46	180	120	20	-70		
44	210	150	50	-40		
42	240	180	80	-20	-120	
40	270	210	110	10	-100	
38	300	240	140	40	-70	-210
36	330	270	170	70	-40	-180
34	340	300	200	100	-20	-150
32	340	330	230	120	10	-130
30	340	340	260	150	30	-110
20	350	350	290	240	170	40
10	370	360	300	250	170	100
0	380	370	310	260	180	100
-20	400	390	330	270	190	110
-40	420	410	350	290	200	120

Rate of climb capability shown is valid for 45000 kg, gear down at VREF15+5.
Decrease rate of climb 140 ft/min per 5000 kg greater than 45000 kg.
Increase rate of climb 190 ft/min per 5000 kg less than 45000 kg.

Flaps 30

TAT (°C)	RATE OF CLIMB (FT/MIN)					
	PRESSURE ALTITUDE (FT)					
	-2000	0	2000	4000	6000	8000
52	-80	-140				
50	-60	-120	-210			
48	-30	-90	-180			
46	0	-60	-160	-250		
44	30	-40	-130	-230		
42	60	-10	-110	-200	-310	
40	90	20	-80	-180	-290	
38	120	50	-50	-150	-260	-390
36	150	80	-20	-120	-240	-370
34	150	110	10	-100	-210	-350
32	150	140	40	-70	-190	-320
30	150	150	70	-40	-160	-300
20	160	150	100	40	-30	-160
10	170	160	100	50	-30	-110
0	180	170	110	50	-30	-110
-20	190	180	120	60	-20	-110
-40	200	190	130	60	-20	-110

Rate of climb capability shown is valid for 45000 kg, gear down at VREF30+5.
Decrease rate of climb 150 ft/min per 5000 kg greater than 45000 kg.
Increase rate of climb 190 ft/min per 5000 kg less than 45000 kg.

GEAR DOWN

Long Range Cruise Altitude Capability

Max Cruise Thrust, 100 ft/min residual rate of climb

WEIGHT (1000 KG)	PRESSURE ALTITUDE (FT)		
	ISA + 10°C & BELOW	ISA + 15°C	ISA + 20°C
70	23100	19900	16300
65	25900	24000	20200
60	28400	26900	25100
55	30700	29500	27900
50	32800	31800	30600
45	35000	34000	32900
40	37400	36400	35300
35	40100	39200	38100

Long Range Cruise Control

WEIGHT (1000 KG)		PRESSURE ALTITUDE (1000 FT)										
		10	21	23	25	27	29	31	33	35	37	39
70	%N1	80.7	90.0	92.0								
	MACH	.440	.541	.557								
	KIAS	243	242	240								
	FF/ENG	1980	1970	1959								
65	%N1	78.7	88.1	89.7	91.9	94.8						
	MACH	.425	.524	.543	.560	.578						
	KIAS	235	234	233	231	229						
	FF/ENG	1835	1820	1814	1812	1845						
60	%N1	76.6	85.8	87.6	89.3	91.6	94.7					
	MACH	.409	.504	.525	.544	.562	.580					
	KIAS	226	225	225	224	222	220					
	FF/ENG	1694	1666	1667	1664	1669	1703					
55	%N1	74.4	83.4	85.2	87.0	88.7	91.1	94.4				
	MACH	.393	.484	.504	.525	.545	.562	.581				
	KIAS	217	216	216	216	215	213	211				
	FF/ENG	1554	1517	1515	1519	1522	1527	1561				
50	%N1	71.8	80.9	82.6	84.4	86.2	88.0	90.4	93.7			
	MACH	.376	.463	.482	.502	.523	.544	.561	.580			
	KIAS	207	206	206	206	206	205	203	201			
	FF/ENG	1417	1371	1368	1370	1377	1381	1383	1415			
45	%N1	69.0	78.1	79.8	81.5	83.3	85.1	86.9	89.3	92.7		
	MACH	.358	.441	.458	.477	.498	.520	.541	.559	.578		
	KIAS	197	196	196	196	196	196	195	193	191		
	FF/ENG	1285	1229	1222	1224	1231	1236	1239	1240	1267		
40	%N1	66.1	74.9	76.7	78.4	80.1	81.9	83.8	85.6	87.8	91.6	
	MACH	.340	.417	.434	.452	.471	.491	.513	.535	.554	.573	
	KIAS	187	185	185	185	185	185	185	185	183	181	
	FF/ENG	1158	1094	1081	1081	1088	1091	1095	1097	1098	1122	
35	%N1	63.0	71.6	73.2	74.9	76.7	78.4	80.2	82.0	83.9	86.4	90.2
	MACH	.321	.392	.408	.425	.442	.461	.481	.503	.526	.547	.566
	KIAS	177	174	174	173	173	173	173	173	173	172	170
	FF/ENG	1034	964	949	944	949	950	952	953	955	962	982

GEAR DOWN

Long Range Cruise Enroute Fuel and Time

Ground to Air Miles Conversion

AIR DISTANCE (NM) HEADWIND COMPONENT (KTS)					GROUND DISTANCE (NM)	AIR DISTANCE (NM) TAILWIND COMPONENT (KTS)				
100	80	60	40	20		20	40	60	80	100
343	302	267	240	219	200	187	176	166	157	150
694	610	538	483	438	400	376	353	333	316	300
1052	921	811	726	658	600	563	530	499	472	449
1416	1238	1087	971	879	800	750	705	664	629	598
1788	1559	1365	1217	1101	1000	937	880	829	785	746
2166	1884	1646	1465	1322	1200	1124	1056	994	940	893
2554	2215	1930	1714	1545	1400	1311	1230	1158	1095	1040
2950	2551	2217	1965	1768	1600	1497	1405	1322	1249	1186
3355	2893	2507	2217	1992	1800	1683	1578	1485	1402	1331

Reference Fuel and Time Required at Check Point

AIR DIST (NM)	PRESSURE ALTITUDE (1000 FT)									
	10		14		18		22		26	
	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)
200	2.2	0:53	2.0	0:51	1.8	0:49	1.6	0:47	1.5	0:45
400	4.5	1:45	4.1	1:39	3.8	1:34	3.5	1:29	3.2	1:25
600	6.7	2:37	6.2	2:29	5.7	2:21	5.3	2:13	4.9	2:06
800	8.9	3:31	8.3	3:20	7.6	3:08	7.0	2:57	6.6	2:47
1000	11.0	4:27	10.3	4:12	9.5	3:57	8.8	3:43	8.2	3:29
1200	13.1	5:23	12.2	5:05	11.3	4:46	10.5	4:29	9.8	4:12
1400	15.2	6:21	14.1	5:59	13.1	5:37	12.1	5:16	11.4	4:56
1600	17.2	7:21	16.0	6:55	14.8	6:29	13.7	6:04	12.9	5:41
1800	19.1	8:22	17.8	7:52	16.5	7:22	15.3	6:53	14.4	6:26

Fuel Required Adjustments (1000 KG)

REFERENCE FUEL REQUIRED (1000 KG)	WEIGHT AT CHECK POINT (1000 KG)				
	30	40	50	60	70
2	-0.4	-0.2	0.0	0.2	0.5
4	-0.8	-0.4	0.0	0.5	1.0
6	-1.2	-0.6	0.0	0.7	1.5
8	-1.6	-0.8	0.0	0.9	2.0
10	-1.9	-1.0	0.0	1.2	2.5
12	-2.3	-1.2	0.0	1.4	3.0
14	-2.7	-1.4	0.0	1.7	3.5
16	-3.0	-1.6	0.0	1.9	3.9
18	-3.4	-1.8	0.0	2.2	4.4
20	-3.7	-2.0	0.0	2.4	4.9

GEAR DOWN

Descent
VREF40 + 70 KIAS

PRESSURE ALTITUDE (FT)	TIME (MIN)	FUEL (KG)	DISTANCE (NM)
41000	22	240	89
39000	21	240	85
37000	21	240	80
35000	20	230	76
33000	19	230	72
31000	18	230	68
29000	17	220	64
27000	17	220	60
25000	16	210	56
23000	15	210	52
21000	14	200	48
19000	13	190	44
17000	12	190	40
15000	11	180	36
10000	9	150	26
5000	6	120	16
1500	4	100	9

Allowances for a straight-in approach are included.

GEAR DOWN

Holding

Flaps Up

WEIGHT (1000 KG)		PRESSURE ALTITUDE (FT)								
		1500	5000	10000	15000	20000	25000	30000	35000	40000
70	%N1	70.4	73.4	77.4	81.8	86.3	92.0			
	KIAS	213	213	213	213	213	213			
	FF/ENG	1860	1840	1830	1830	1830	1870			
65	%N1	68.6	71.5	75.7	79.9	84.4	89.3			
	KIAS	208	208	208	208	208	208			
	FF/ENG	1740	1720	1710	1700	1700	1720			
60	%N1	66.7	69.5	73.8	77.8	82.3	87.0	94.5		
	KIAS	203	203	203	203	203	203	203		
	FF/ENG	1630	1600	1590	1580	1570	1580	1670		
55	%N1	64.7	67.4	71.6	75.7	80.1	84.7	90.4		
	KIAS	196	196	196	196	196	196	196		
	FF/ENG	1510	1490	1470	1460	1440	1440	1490		
50	%N1	62.3	65.2	69.1	73.4	77.7	82.2	87.0		
	KIAS	190	190	190	190	190	190	190		
	FF/ENG	1400	1380	1350	1340	1320	1310	1340		
45	%N1	59.8	62.8	66.7	71.0	75.2	79.7	84.3	91.4	
	KIAS	183	183	183	183	183	183	183	183	
	FF/ENG	1280	1260	1240	1220	1200	1190	1210	1260	
40	%N1	57.4	60.1	64.3	68.3	72.7	77.0	81.5	86.7	
	KIAS	177	177	177	177	177	177	177	177	
	FF/ENG	1170	1160	1140	1120	1090	1070	1090	1100	
35	%N1	54.9	57.4	61.6	65.6	70.0	74.2	78.7	83.3	92.4
	KIAS	170	170	170	170	170	170	170	170	170
	FF/ENG	1070	1050	1030	1010	990	960	970	980	1060

This table includes 5% additional fuel for holding in a racetrack pattern.

Performance Inflight — Chapter PI
Gear Down, Engine Inop — Section 15

GEAR DOWN

ENGINE INOP

MAX CONTINUOUS THRUST

Driftdown Speed/Level Off Altitude

100 ft/min residual rate of climb

WEIGHT (1000 KG)		OPTIMUM DRIFTDOWN SPEED (KIAS)	LEVEL OFF ALTITUDE (FT)		
START DRIFTDOWN	LEVEL OFF		ISA + 10°C & BELOW	ISA + 15°C	ISA + 20°C
70	66	212	3400	1300	
65	62	207	6600	4800	3000
60	57	202	9900	8000	6300
55	52	196	13000	11300	9500
50	48	190	16300	14800	13000
45	43	183	19500	18100	16500
40	38	176	22700	21600	20300
35	34	170	25700	25000	24100

Includes APU fuel burn.

Long Range Cruise Altitude Capability

100 ft/min residual rate of climb

WEIGHT (1000 KG)	PRESSURE ALTITUDE (FT)		
	ISA + 10°C & BELOW	ISA + 15°C	ISA + 20°C
60	4300	1300	
55	8700	6400	4000
50	12900	10700	8400
45	17000	15300	13100
40	21300	19800	18000
35	25000	23900	22600

GEAR DOWN

ENGINE INOP

MAX CONTINUOUS THRUST

Long Range Cruise Control

WEIGHT (1000 KG)		PRESSURE ALTITUDE (1000 FT)								
		5	7	9	11	13	15	17	19	21
60	%N1	90.2								
	MACH	.364								
	KIAS	220								
	FF/ENG	3193								
55	%N1	87.7	89.3	91.0						
	MACH	.351	.362	.374						
	KIAS	212	211	210						
	FF/ENG	2922	2910	2908						
50	%N1	85.2	86.7	88.2	90.0	91.7				
	MACH	.338	.348	.359	.371	.384				
	KIAS	204	203	202	201	200				
	FF/ENG	2665	2644	2630	2627	2634				
45	%N1	82.5	83.9	85.4	86.9	88.6	90.4	92.7		
	MACH	.325	.334	.344	.355	.367	.380	.393		
	KIAS	196	195	193	192	191	190	189		
	FF/ENG	2419	2391	2369	2354	2350	2352	2359		
40	%N1	79.6	81.0	82.4	83.8	85.3	87.0	88.8	90.8	94.1
	MACH	.311	.320	.329	.339	.349	.361	.374	.387	.402
	KIAS	188	186	184	183	182	181	180	179	179
	FF/ENG	2188	2152	2122	2100	2085	2075	2068	2065	2101
35	%N1	76.5	77.8	79.1	80.4	81.9	83.4	85.0	87.0	88.9
	MACH	.296	.305	.313	.322	.331	.342	.353	.367	.383
	KIAS	179	178	176	174	172	171	170	170	170
	FF/ENG	1959	1929	1891	1861	1838	1818	1800	1802	1808

GEAR DOWN

ENGINE INOP

MAX CONTINUOUS THRUST

Long Range Cruise Diversion Fuel and Time

Ground to Air Miles Conversion

AIR DISTANCE (NM)					GROUND DISTANCE (NM)	AIR DISTANCE (NM)				
HEADWIND COMPONENT (KTS)						TAILWIND COMPONENT (KTS)				
100	80	60	40	20		20	40	60	80	100
178	156	137	122	110	100	94	87	82	76	72
361	314	274	244	220	200	186	173	161	152	143
546	473	412	366	331	300	278	258	241	226	214
732	634	551	489	441	400	370	344	321	301	285
920	796	691	613	552	500	463	430	401	376	355
1109	958	832	737	663	600	555	515	480	450	425
1300	1122	973	861	774	700	648	601	560	525	495
1493	1287	1115	986	885	800	740	686	639	599	565
1687	1452	1256	1110	997	900	832	772	719	673	635
1883	1619	1399	1235	1108	1000	924	857	797	747	704

Reference Fuel and Time Required at Check Point

AIR DIST (NM)	PRESSURE ALTITUDE (1000 FT)							
	6		10		14		18	
	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)
100	1.1	0:29	1.0	0:28	0.9	0:27	0.8	0:26
200	2.3	0:56	2.1	0:54	2.0	0:52	1.9	0:50
300	3.5	1:24	3.3	1:21	3.0	1:17	2.9	1:14
400	4.7	1:52	4.4	1:47	4.1	1:42	4.0	1:37
500	5.9	2:20	5.5	2:14	5.1	2:08	4.9	2:01
600	7.1	2:49	6.6	2:41	6.2	2:33	5.9	2:26
700	8.2	3:17	7.6	3:09	7.2	3:00	6.9	2:50
800	9.3	3:47	8.7	3:36	8.2	3:26	7.8	3:15
900	10.4	4:16	9.7	4:04	9.2	3:52	8.8	3:40
1000	11.5	4:46	10.8	4:33	10.1	4:19	9.7	4:05

Fuel Required Adjustments (1000 KG)

REFERENCE FUEL REQUIRED (1000 KG)	WEIGHT AT CHECK POINT (1000 KG)				
	30	40	50	60	70
1	-0.2	-0.1	0.0	0.2	0.4
2	-0.4	-0.2	0.0	0.4	0.9
3	-0.6	-0.3	0.0	0.7	1.3
4	-0.8	-0.4	0.0	0.9	1.8
5	-1.0	-0.5	0.0	1.1	2.3
6	-1.2	-0.6	0.0	1.3	2.7
7	-1.4	-0.7	0.0	1.5	3.1
8	-1.6	-0.8	0.0	1.7	3.5
9	-1.8	-0.9	0.0	1.9	4.0
10	-2.0	-1.0	0.0	2.1	4.4
11	-2.2	-1.1	0.0	2.3	4.7
12	-2.4	-1.2	0.0	2.4	5.1

Includes APU fuel burn.

GEAR DOWN

ENGINE INOP

MAX CONTINUOUS THRUST

Holding

Flaps Up

WEIGHT (1000 KG)		PRESSURE ALTITUDE (FT)					
		1500	5000	10000	15000	20000	25000
70	%N1	89.1					
	KIAS	213					
	FF/ENG	3570					
65	%N1	87.1	90.2				
	KIAS	208	208				
	FF/ENG	3310	3340				
60	%N1	84.8	87.9				
	KIAS	203	203				
	FF/ENG	3060	3070				
55	%N1	82.4	85.5	90.1			
	KIAS	196	196	196			
	FF/ENG	2820	2820	2840			
50	%N1	79.9	82.9	87.3	92.4		
	KIAS	190	190	190	190		
	FF/ENG	2580	2570	2580	2630		
45	%N1	77.3	80.2	84.6	89.3		
	KIAS	183	183	183	183		
	FF/ENG	2360	2340	2340	2360		
40	%N1	74.6	77.4	81.7	86.2	91.7	
	KIAS	177	177	177	177	177	
	FF/ENG	2140	2120	2110	2120	2140	
35	%N1	71.5	74.5	78.7	83.1	88.0	96.8
	KIAS	170	170	170	170	170	170
	FF/ENG	1930	1910	1890	1890	1900	2030

This table includes 5% additional fuel for holding in a racetrack pattern.

Performance Inflight — Chapter PI
Text — Section 16

Introduction

This chapter contains information to supplement performance data from the Flight Management Computer (FMC). In addition, sufficient inflight data is provided to complete a flight with the FMC inoperative. In the event of conflict between data presented in this chapter and that contained in the approved Airplane Flight Manual, the Flight Manual shall always take precedence.

General

Takeoff Speeds

The speeds presented in the Takeoff Speeds table as well as FMC computed takeoff speeds can be used for all performance conditions except where adjustments must be made for anti-skid inoperative, thrust reversers inoperative, improved climb, contaminated runway situations, or brake energy limits.

V1 adjustments are not necessary for equal amounts of clearway and stopway. V1 for takeoff limit weights based on unequal clearway and stopway should be obtained from computerized takeoff speeds calculations for the specific takeoff conditions.

These speeds may be used for weights less than or equal to the performance limited weight subject to the restrictions noted above.

The FMC will protect for minimum control speeds by increasing V1, VR and V2 as required. However, the FMC will not compute takeoff speeds for weights where the required speed increase exceeds the maximum certified speed increase. This typically occurs at full rated thrust and light weights. In this case, the message "V SPEEDS UNAVAILABLE" will appear on the FMC scratchpad and the takeoff speed entries will be blank. In this situation, manually verify takeoff speeds using an approved source of takeoff performance information. Upon verifying the takeoff speeds, takeoff is permitted. When selected takeoff speeds cannot be verified, the options are to select a lower number flap setting, select derate thrust and/or increase airplane gross weight (e.g. add fuel). Selecting derate thrust is the preferred method as this will reduce the minimum control speeds. Note that the assumed temperature method will not help this condition as the minimum control speeds are determined at the actual temperature and therefore are not reduced by an assumed temperature selection.

Normal takeoff speeds, V1, VR, and V2 are read from either the dry or wet table by entering with takeoff flap setting and brake release weight. Use the tables provided to adjust takeoff speeds for altitude and actual temperature or assumed temperature for reduced thrust takeoffs. Slope and wind adjustments to V1 are obtained by entering the Slope and Wind V1 Adjustment table.

V1(MCG)

Regulations prohibit scheduling takeoff with a V1 less than minimum V1 for control on the ground, V1(MCG). It is therefore necessary to compare the adjusted V1 to V1(MCG). The V1(MCG) presented in this manual is conservative for all weight and bleed configurations.

To find V1(MCG) enter the V1(MCG) table with the airport pressure altitude and actual OAT. If the adjusted V1 is less than V1(MCG), set V1 equal to V1(MCG). If the adjusted VR is less than V1(MCG), set VR equal to V1(MCG), and determine a new V2 by adding the difference between the normal VR and V1(MCG) to the normal V2. No takeoff weight adjustment is necessary provided that the actual field length exceeds the minimum field length shown in the Field and Climb Limit Weight table in chapter Performance Dispatch.

Stab Trim

To find takeoff stabilizer trim setting, enter Stab Trim Setting table with anticipated brake release weight and center of gravity (C.G. % MAC) and read required stabilizer trim units.

VREF

This table contains flaps 40, 30 and 15 reference speeds for a given weight.

Flap Maneuver Speeds

This table provides flap maneuver speeds for various flap settings. During flap retraction, selection of the next flap position is initiated when reaching the maneuver speed for the existing flap position. During flap retraction, at least adequate maneuver capability or 30° of bank (15° of bank and 15° overshoot) to stick shaker is provided at the flap retraction speed. Full maneuver capability or at least 40° of bank (25° of bank and 15° overshoot) is provided when the airplane has accelerated to the recommended maneuver speed for the selected flap position.

During flap extension, selection of the flaps to the next flap position should be made when approaching, and before decelerating below, the maneuver speed for the existing flap position. The flap extension speed schedule varies with airplane weight and provides full maneuver capability or at least 40° of bank (25° of bank and 15° overshoot) to stick shaker at all weights.

Slush/Standing Water Takeoff

Experience has shown that aircraft performance may deteriorate significantly on runways covered with snow, slush, standing water or ice. Therefore, reductions in field/obstacle limited takeoff weight and revised takeoff speeds are necessary. The tables are intended for guidance in accordance with advisory material and assume an engine failure at the critical point during the takeoff.

The entire runway is assumed to be completely covered by a contaminant of uniform thickness and density. Therefore this information is conservative when operating under typical cold weather conditions where patches of slush exist and some degree of sanding is common. Takeoffs in slush or standing water depths greater than 13 mm (0.5 inches) are not recommended because of possible airplane damage as a result of spray impingement on the airplane structure. The use of assumed temperature for reduced thrust is not allowed on contaminated runways. Interpolation for slush/standing water depths between the values shown is permitted.

Takeoff weight determination:

1. Enter the Weight Adjustment table with the dry field/obstacle limit weight to obtain the weight reduction for the slush/standing water depth and airport pressure altitude.
2. Adjust field length available for temperature by amount shown beneath V1(MCG) limit weight table.
3. Enter the V1(MCG) Limit Weight table with the adjusted field length and pressure altitude to obtain the slush/standing water limit weight with respect to minimum field length required for V1(MCG) speed.
4. The maximum allowable takeoff weight in slush/standing water is the lesser of the limit weights found in steps 1 and 3.

Takeoff speed determination:

1. Determine takeoff speeds V1, VR and V2 for actual brake release weight using the Dry Runway Takeoff Speeds table for the appropriate flap setting and thrust rating.
2. If V1(MCG) limited, set V1=V1(MCG). If not limited by V1(MCG) considerations, enter the V1 Adjustment table with actual brake release weight to determine the V1 reduction to apply to V1 speed. If the adjusted V1 is less than V1(MCG), set V1=V1(MCG).

Slippery Runway Takeoff

Airplane braking action is reported as good, medium or poor, depending on existing runway conditions. If braking action is reported as good, conditions should not be expected to be as good as on clean, dry runways. The value “good” is comparative and is intended to mean that airplanes should not experience braking or directional control difficulties when stopping. The performance level used to calculate the “good” data is consistent with wet runway testing done on early Boeing jets. The performance level used to calculate the “poor” data reflects a runway covered with wet ice. Performance is based on a 15 ft screen height at the end of the runway. The tables provided are used in the same manner as the Slush/Standing Water tables.

Anti-Skid Inoperative

When operating with anti-skid inoperative, the field limit weight and V1 must be reduced to account for the effect on accelerate-stop performance. Anti-skid inoperative is only allowed on a dry runway. A simplified method which conservatively accounts for the effects of anti-skid inoperative is to reduce the normal dry field/obstacle limited weight by 7050 kg and the V1 associated with the reduced weight by the amount shown in the table below.

ANTI-SKID INOPERATIVE V1 ADJUSTMENTS	
FIELD LENGTH (M)	V1 ADJUSTMENT (KIAS)
2000	-16
2500	-14
3000	-12
3500	-11
4000	-10

If the resulting V1 is less than V1(MCG), takeoff is permitted with V1 set equal to V1(MCG) provided the dry accelerate-stop distance adjusted for wind and slope exceeds approximately 2300 m.

Detailed analysis for the specific case from the Airplane Flight Manual may yield a less restrictive penalty.

Thrust Reverser Inoperative

When dispatching on a wet runway with both thrust reversers operative, an operative anti-skid system, and all brakes operating, regulations allow deceleration credit for one thrust reverser in the engine failure case and two thrust reversers in the all engine stop case.

When dispatching on a wet runway with one thrust reverser inoperative, the field/obstacle limited weight and V1 speed must be reduced to account for the effect on accelerate-stop performance. A simplified method, which conservatively accounts for this, is to reduce the normal wet runway/field/obstacle limited weight by 1000 kg and the V1 associated with the reduced weight by 2 knots.

If the resulting V1 is less than minimum V1, takeoff is permitted with V1 set equal to V1(MCG) provided the accelerate-stop distance available adjusted for wind and slope exceeds approximately 1650 m.

Detailed analysis for the specific case from the Airplane Flight Manual may yield a less restrictive penalty.

Takeoff %N1

To find Max Takeoff %N1 based on normal engine bleed for air conditioning packs on, enter Takeoff %N1 Table with airport pressure altitude and airport OAT and read %N1. Apply %N1 adjustments as provided when applicable.

Assumed Temperature Reduced Thrust

Regulations permit the use of up to 25% takeoff thrust reduction for operation with assumed temperature reduced thrust. Use of assumed temperature reduced thrust is not allowed with anti-skid inoperative or on runways contaminated with standing water, ice, slush, or snow. Use of assumed temperature reduced thrust is not recommended if potential windshear conditions exist.

To find the maximum allowable assumed temperature enter the Maximum Assumed Temperature table with airport pressure altitude and OAT. Compare this temperature to that at which the airplane is performance limited as determined from available takeoff performance data. Next, enter the Maximum Takeoff %N1 table with airport pressure altitude and the lower of the two temperatures previously determined, to obtain a maximum takeoff %N1. Do not use an assumed temperature less than the minimum assumed temperature shown. Enter the %N1 Adjustment table with OAT and the difference between the assumed and actual OAT to obtain a %N1 adjustment. Subtract the %N1 adjustment from the maximum takeoff %N1 found previously to determine the assumed temperature reduced thrust %N1.

Apply %N1 adjustments as provided when applicable.

Max Climb %N1

This table shows Max Climb %N1 for a 280/.78 climb speed schedule, normal engine bleed for packs on or off and anti-ice off. Enter the table with airport pressure altitude and TAT and read %N1. %N1 adjustments are shown for anti-ice operation.

Go-around %N1

To find Max Go-around %N1 based on normal engine bleed for packs on (AUTO) and anti-ice on or off, enter the Go-around %N1 table with airport pressure altitude and reported OAT or TAT and read %N1. For packs OFF or HIGH operation, apply the %N1 adjustment shown below the table.

Flight with Unreliable Airspeed / Turbulent Air Penetration

Pitch attitude and average %N1 information is provided for use in all phases of flight in the event of unreliable airspeed/Mach indications resulting from blocking or freezing of the pitot system. Loss of radome or turbulent air may also cause unreliable airspeed/Mach indications. The cruise table in this section may also be used for turbulent air penetration.

Pitch attitude is shown in bold type for emphasis since altitude and/or vertical speed indications may also be unreliable.

All Engines

Long Range Cruise Maximum Operating Altitude

These tables provide the maximum operating altitude in the same manner as the FMC. Maximum altitudes are shown for a given cruise weight and maneuver capability. This table considers both thrust and buffet limits, providing the more limiting of the two. Any data that is thrust limited is denoted by an asterisk and represents only a thrust limited condition in level flight with 100 ft/min residual rate of climb. Flying above these altitudes with sustained banks in excess of approximately 15° may cause the airplane to lose speed and/or altitude. The altitudes shown in the table are limited to the maximum certified altitude of 41000 ft.

Long Range Cruise Control

These tables provide target %N1, Long Range Cruise Mach number, IAS and standard day fuel flow per engine for the airplane weight and pressure altitude. As indicated by the shaded area, at optimum altitude .79M approximates the Long Range Cruise Mach schedule.

Long Range Cruise Enroute Fuel and Time

Long Range Cruise Enroute Fuel and Time tables are provided to determine remaining time and fuel required to destination. The data is based on Long Range Cruise and .78/280/250 descent. Tables are presented for low altitudes and high altitudes.

To determine remaining fuel and time required, first enter the Ground to Air Miles Conversion table to convert ground distance and enroute wind to an equivalent still air distance for use with the Reference Fuel and Time tables. Next, enter the Reference Fuel and Time table with air distance from the Ground to Air Miles Conversion table and the desired altitude and read Reference Fuel and Time Required. Lastly, enter the Fuel Required Adjustment table with the Reference Fuel and the actual weight at checkpoint to obtain fuel required to destination.

APU Operation During Flight

For APU operation during flight, increase fuel flow according to the table in the Engine Inoperative text section.

Long Range Cruise Wind-Altitude Trade

Wind is a factor which may justify operations considerably below optimum altitude. For example, a favorable wind component may have an effect on ground speed which more than compensates for the loss in air range.

Using this table, it is possible to determine the break-even wind (advantage necessary or disadvantage that can be tolerated) to maintain the same range at another altitude and long range cruise speed. The tables make no allowance for climb or descent time, fuel or distance, and are based on comparing ground fuel mileage.

Descent

Time, fuel, and distance for descent are shown for a .78/280/250 descent speed schedule. Enter the table with top of descent pressure altitude and read distance, time and fuel. Data is based on flight idle thrust descent in zero wind. Allowances are included for a straight-in approach with gear down and landing flaps at the outer marker.

Holding

Target %N1, indicated airspeed and fuel flow per engine information is tabulated for holding with flaps up based on the FMC optimum holding speed schedule. This is the higher of the maximum endurance speed and the maneuvering speed. Small variations in airspeed will not appreciably affect the overall endurance time. Enter the table with weight and pressure altitude to read %N1, IAS and fuel flow per engine.

Advisory Information

Normal Configuration Landing Distance

The normal configuration distance tables are provided as advisory information to help determine the actual landing distance performance of the airplane for different runway surface conditions and brake configurations.

Flaps 15, 30, and 40 landing distances and adjustments are provided for dry runways as well as runways with good, medium, and poor reported braking action, which are commonly referred to as slippery runway conditions.

If the surface is affected by water, snow or ice, and the braking action is reported as "good", conditions should not be expected to be as good as on clean, dry runways. The value "good" is comparative and is intended to mean that airplanes should not experience braking or directional control difficulties when landing. The performance level used to calculate the "good" data is consistent with wet runway testing done on early Boeing jets. The performance level used to calculate "poor" data reflects runways covered with wet ice.

Dry runway landing performance is shown for max manual braking configuration and autobrake settings max, 3, 2, and 1. The autobrake performance may be used to assist in the selection of the most desirable autobrake setting for a given field length. Selection of an autobrake setting results in a constant rate of deceleration. Maximum effort manual braking should achieve shorter landing distance than the max autobrake setting. The reference landing distance is a reference distance from 50 ft above the threshold to stop based on a reference landing weight and normal approach speed for the selected landing flap at sea level, zero wind, zero slope, and two engine detent reverse thrust. Subsequent columns provide adjustments for off-reference landing weight, altitude, wind, slope, temperature, speed, and reverse thrust. Each adjustment is independently added to the reference landing distance.

Non-normal Configuration Landing Distance

Advisory information is provided to support non-normal configurations that affect the landing performance of the airplane. Landing distances and adjustments are provided for dry runways and runways with good, medium, and poor reported braking action.

Enter the table with the applicable non-normal configuration and read the normal approach speed. The reference landing distance is a reference distance from 50 ft above the threshold to stop based on a reference landing weight and speed at sea level, zero wind, and zero slope. Subsequent columns provide adjustments for off-reference landing weight, altitude, wind, slope, and speed conditions. Each adjustment is independently added to the reference landing distance. Landing distance includes the effect of reverse thrust.

Recommended Brake Cooling Schedule

Advisory information is provided to assist in avoiding the problems associated with hot brakes. For normal operation, most landings are at weights below the AFM quick turnaround limit weight.

Use of the recommended cooling schedule will help avoid brake overheat and fuse plug problems that could result from repeated landings at short time intervals or a rejected takeoff.

Enter the Recommended Brake Cooling Schedule table with the airplane weight and brakes on speed, adjusted for wind at the appropriate temperature and altitude condition. Instructions for applying wind adjustments are included below the table. Linear interpolation may be used to obtain intermediate values. The resulting number is the reference brake energy per brake in millions of foot-pounds, and represents the amount of energy absorbed by each brake during a rejected takeoff. Notes providing adjustments for wind are included below the table.

To determine the energy per brake absorbed during landing, enter the appropriate Adjusted Brake Energy Per Brake table (No Reverse Thrust or 2 Engine Reverse) with the reference brake energy per brake and the type of braking used during landing (Max Manual, Max Auto, or Autobrake). The resulting number is the adjusted brake energy per brake and represents the energy absorbed in each brake during the landing.

The recommended cooling time is found in the appropriate (steel or carbon brakes) final table by entering with the adjusted brake energy per brake. Times are provided for ground cooling and inflight gear down cooling.

Brake Temperature Monitor System (BTMS) indications are also shown. If brake cooling is determined from the BTMS, use the hottest brake indication 10 to 15 minutes after the airplane has come to a complete stop, or inflight with gear retracted to determine recommended cooling schedule.

Engine Inoperative

Initial Max Continuous %N1

The Initial Max Continuous %N1 setting for use following an engine failure is shown. The table is based on the typical all engine cruise speed of .79M to provide a target %N1 setting at the start of driftdown. Once driftdown is established, the Max Continuous %N1 table should be used to determine %N1 for the given conditions.

Max Continuous %N1

Power setting is based on one engine operating with one A/C pack operating and all anti-ice bleeds off. Enter the table with pressure altitude, TAT, and IAS or Mach to read %N1.

It is desirable to maintain engine thrust level within the limits of the Max Cruise thrust rating. However, where thrust level in excess of Max Cruise rating is required, such as for meeting terrain clearance, ATC altitude assignments, or to attain maximum range capability, it is permissible to use the thrust needed up to the Max Continuous thrust rating. The Max Continuous thrust rating is intended primarily for emergency use at the discretion of the pilot and is the maximum thrust that may be used continuously.

Driftdown Speed/Level Off Altitude

The table shows optimum driftdown speed as a function of cruise weight at start of driftdown. Also shown are the approximate weight and pressure altitude at which the airplane will level off considering 100 ft/min residual rate of climb.

The level off altitude is dependent on air temperature (ISA deviation).

Driftdown/LRC Range Capability

This table shows the range capability from the start of driftdown. Driftdown is continued to level off altitude. As weight decreases due to fuel burn, the airplane is accelerated to Long Range Cruise speed. Cruise is continued at level off altitude and Long Range Cruise speed.

To determine fuel required, enter the Ground to Air Miles Conversion table with the desired ground distance and adjust for anticipated winds to obtain air distance to destination. Then enter the Driftdown/Cruise Fuel and Time table with air distance and weight at start of driftdown to determine fuel and time required. If altitudes other than the level off altitude is used, fuel and time required may be obtained by using the Engine Inoperative Long Range Cruise Enroute Fuel and Time table.

Long Range Cruise Altitude Capability

The table shows the maximum altitude that can be maintained at a given weight and air temperature (ISA deviation), based on Long Range Cruise speed, Max Continuous thrust, and 100 ft/min residual rate of climb.

Long Range Cruise Control

The table provides target %N1, engine inoperative Long Range Cruise Mach number, IAS and fuel flow for the airplane weight and pressure altitude. The fuel flow values in this table reflect single engine fuel burn.

APU Operation During Flight

For APU operation during flight, increase fuel flow according to the following table. These increments include the APU fuel flow and the effect of increased drag from the APU door.

PRESSURE ALTITUDE (1000 FT)	APU FUEL FLOW (KG/HR)
39	45
35	45
31	50
25	60
20	65
15	75
10	85
5	95

Long Range Cruise Diversion Fuel and Time

Tables are provided for crews to determine the fuel and time required to proceed to an alternate airfield with one engine inoperative. The data is based on single engine Long Range Cruise speed and .78/280/250 descent. Enter with Air Distance as determined from the Ground to Air Miles Conversion table and read Fuel and Time required at the cruise pressure altitude. Adjust the fuel obtained for deviation from the reference weight at checkpoint as required by entering the off reference fuel adjustments table with the fuel required for the reference weight and the actual weight at checkpoint. Read fuel required and time for the actual weight.

Holding

Single engine holding data is provided in the same format as the all engine holding data and is based on the same assumptions.

Gear Down Landing Rate of Climb Available

Rate of climb data is provided as guidance information in the event an engine inoperative landing (manual or autoland) is planned. The tables show gear down rate of climb available for Flaps 15 and Flaps 30. Enter the table with TAT and pressure altitude to read rate of climb available. Apply adjustments shown to correct for weight.

Alternate Mode EEC

Introduction

No takeoff speed adjustments or other performance adjustments are required of Electronic Engine Control (EEC) in the alternate mode (ALTN EEC switch illuminated) for the 7B18, -7B20, -7B22, -7B24 and -7B24A engine thrust ratings.

Operation with derate and/or assumed temperature reduced thrust is not permitted with the EEC in alternate mode.

Gear Down

This section contains performance for airplane operation with the landing gear extended. The data is based on engine bleeds for normal air conditioning.

Note: The Flight Management Computer System (FMCS) does not contain special provisions for operation with landing gear extended. As a result, the FMCS may generate inappropriate enroute speed schedules, display non-conservative predictions of fuel burn, estimated time of arrival (ETA), maximum altitude, and compute overly shallow descent path. An accurate estimated time of arrival (ETA) is available if current speed or Mach is entered into the VNAV cruise page.

Tables for gear down performance in this section are identical in format and used in the same manner as tables for the gear up configuration previously described.

Performance Inflight — Chapter PI

Table of Contents — Section 20

737-700 CFM56-7B24 LB FAA CATF/M

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Performance Inflight — Chapter PI
Pkg Model Identification — Section 20

General

The table below shows the airplanes that have been identified with the following performance package. Note, some airplanes may be identified with more than one performance package. This configuration table information reflects the Boeing delivered configuration updated for service bulletin incorporations in conformance with the policy stated in the introduction section of the FCOM. The performance data is prepared for the owner/operator named on the title page. The intent of this information is to assist flight crews and airlines in knowing which performance package is applicable to a given airplane. The performance package model identification information is based on Boeing's knowledge of the airline's fleet at a point in time approximately three months prior to the page date. Notice of Errata (NOE) will not be provided to airlines to identify airplanes that are moved between performance packages within this manual or airplanes added to the airline's fleet whose performance packages are already represented in this manual. These types of changes will be updated in the next block revision. Owners/operators are responsible for ensuring the operational documentation they are using is complete and matches the current configuration of their airplanes, and the accuracy and validity of all information furnished by the owner/operator or any other party. Owners/operators receiving active revision service are responsible to ensure that any modifications to the listed airplanes are properly reflected in this manual.

Serial and tabulation number are supplied by Boeing.

Registry Number	Serial Number	Tabulation Number
YX700	YX700	YX700

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Performance Inflight — Chapter PI
General — Section 20

Takeoff Speeds - Dry Runway
Flaps 1 and 5
V1, VR, V2 for Max Takeoff Thrust

WEIGHT (1000 LB)	FLAPS 1			FLAPS 5		
	V1	VR	V2	V1	VR	V2
180	154	156	160	150	152	156
170	149	150	156	145	147	152
160	144	146	152	140	142	148
150	139	140	147	135	137	144
140	132	134	142	129	132	139
130	126	128	137	123	125	134
120	120	122	131	117	119	128
110	113	115	126	110	113	123
100	106	108	120	103	106	117

Check V1(MCG).

V1, VR, V2 Adjustments*

TEMP		V1							VR							V2						
		PRESS ALT (1000 FT)							PRESS ALT (1000 FT)							PRESS ALT (1000 FT)						
°C	°F	-2	0	2	4	6	8	10	-2	0	2	4	6	8	10	-2	0	2	4	6	8	10
70	158	8	9						6	7						0	0					
60	140	5	6	8	9				4	5	7	8				0	0	0	0			
50	122	3	4	6	7	9	11	12	3	4	5	7	8	9	11	0	0	0	0	0	0	0
40	104	1	2	4	5	7	9	10	1	2	3	5	7	8	9	0	0	0	0	0	0	0
30	86	0	0	2	3	5	7	9	0	0	2	3	5	7	8	0	0	0	0	0	0	0
20	68	0	0	1	2	3	5	7	0	0	1	2	3	5	7	0	0	0	0	1	1	1
-60	-76	0	0	1	2	3	4	6	0	0	1	2	3	4	5	0	0	0	0	1	1	1

Slope and Wind V1 Adjustments*

WEIGHT (1000 LB)	SLOPE (%)					WIND (KTS)							
	-2	-1	0	1	2	-15	-10	-5	0	10	20	30	40
190	-3	-2	0	2	2	-1	-1	0	0	0	1	1	1
180	-3	-1	0	2	2	-1	-1	0	0	0	1	1	1
160	-3	-1	0	1	2	-1	-1	0	0	0	1	1	1
140	-2	-1	0	1	2	-1	-1	0	0	0	1	1	1
120	-2	-1	0	1	2	-2	-1	0	0	0	1	1	1
100	-1	-1	0	1	1	-2	-1	-1	0	0	1	1	2

***V1 not to exceed VR.**

V1(MCG)
Max Takeoff Thrust

TEMP		PRESSURE ALTITUDE (FT)						
°C	°F	-2000	0	2000	4000	6000	8000	10000
70	158	102	99					
60	140	102	99	97	96			
50	122	104	101	98	96	94	92	90
40	104	109	106	102	99	95	92	90
30	86	112	111	107	103	99	95	92
20	68	112	112	109	107	103	99	96
-60	-76	114	113	110	108	105	102	100

Takeoff Speeds - Dry Runway
Flaps 10, 15 and 25
V1, VR, V2 for Max Takeoff Thrust

WEIGHT (1000 LB)	FLAPS 10			FLAPS 15			FLAPS 25		
	V1	VR	V2	V1	VR	V2	V1	VR	V2
180	143	144	148						
170	139	140	145	136	136	141	134	134	140
160	134	135	141	132	132	138	130	130	136
150	130	131	137	128	128	135	126	126	133
140	124	126	133	123	123	131	121	122	129
130	119	121	129	118	118	126	116	117	125
120	113	115	124	112	113	122	111	111	121
110	107	109	119	106	107	117	105	106	116
100	101	103	114	100	101	112	99	100	111
90	94	97	109	93	95	107	92	94	106

Check V1(MCG).

V1, VR, V2 Adjustments*

TEMP		V1							VR							V2						
		PRESS ALT (1000 FT)							PRESS ALT (1000 FT)							PRESS ALT (1000 FT)						
°C	°F	-2	0	2	4	6	8	10	-2	0	2	4	6	8	10	-2	0	2	4	6	8	10
70	158	6	6						4	5						-2	-3					
60	140	4	5	6	7				3	4	5	6				-2	-2	-2	-3			
50	122	3	3	4	6	7	8	9	2	3	4	5	5	6	8	-1	-1	-2	-2	-3	-3	-3
40	104	1	2	3	4	5	6	8	1	1	3	4	5	5	6	0	-1	-1	-2	-2	-2	-3
30	86	0	0	1	3	4	5	6	0	0	1	2	3	4	5	0	0	0	-1	-1	-2	-2
20	68	0	0	1	1	2	4	5	0	0	1	1	2	3	4	0	0	0	0	-1	-1	-2
-60	-76	0	0	1	1	2	3	4	0	0	1	1	2	3	4	0	0	0	0	-1	-1	-1

Slope and Wind V1 Adjustments*

WEIGHT (1000 LB)	SLOPE (%)					WIND (KTS)							
	-2	-1	0	1	2	-15	-10	-5	0	10	20	30	40
180	-2	-1	0	1	1	-1	-1	0	0	0	1	1	1
160	-2	-1	0	1	1	-1	-1	0	0	0	1	1	1
140	-2	-1	0	1	1	-1	-1	0	0	0	1	1	1
120	-2	-1	0	1	1	-2	-1	-1	0	0	1	1	1
100	-1	-1	0	1	1	-2	-1	-1	0	0	1	1	1
90	-1	-1	0	0	1	-2	-2	-1	0	0	1	1	1

***V1 not to exceed VR.**

V1(MCG)
Max Takeoff Thrust

TEMP		PRESSURE ALTITUDE (FT)						
°C	°F	-2000	0	2000	4000	6000	8000	10000
70	158	102	99					
60	140	102	99	97	96			
50	122	104	101	98	96	94	92	90
40	104	109	106	102	99	95	92	90
30	86	112	111	107	103	99	95	92
20	68	112	112	109	107	103	99	96
-60	-76	114	113	110	108	105	102	100

Takeoff Speeds - Wet Runway
Flaps 1 and 5
V1, VR, V2 for Max Takeoff Thrust

WEIGHT (1000 LB)	FLAPS 1			FLAPS 5		
	V1	VR	V2	V1	VR	V2
180	149	156	160	145	152	156
170	143	150	156	139	147	152
160	137	146	152	134	142	148
150	131	140	147	128	137	144
140	125	134	142	122	132	139
130	118	128	137	115	125	134
120	112	122	131	109	119	128
110	104	115	126	102	113	123
100	97	108	120	94	106	117
90	89	101	114	87	98	111

Check V1(MCG).

V1, VR, V2 Adjustments*

TEMP		V1							VR							V2						
		PRESS ALT (1000 FT)							PRESS ALT (1000 FT)							PRESS ALT (1000 FT)						
°C	°F	-2	0	2	4	6	8	10	-2	0	2	4	6	8	10	-2	0	2	4	6	8	10
70	158	10	11						6	7						0	0					
60	140	7	8	10	12				4	5	7	8				0	0	0	0			
50	122	4	5	7	9	11	13	16	3	4	5	7	8	9	11	0	0	0	0	0	0	0
40	104	2	3	5	7	9	11	13	1	2	3	5	7	8	9	0	0	0	0	0	0	0
30	86	0	0	2	4	6	8	10	0	0	2	3	5	7	8	0	0	0	0	0	0	0
20	68	0	0	1	2	4	6	8	0	0	1	2	3	5	7	0	0	0	0	1	1	1
-60	-76	0	0	1	2	3	5	7	0	0	1	2	3	4	5	0	0	0	0	1	1	1

Slope and Wind V1 Adjustments*

WEIGHT (1000 LB)	SLOPE (%)					WIND (KTS)							
	-2	-1	0	1	2	-15	-10	-5	0	10	20	30	40
180	-5	-2	0	3	5	-3	-2	-1	0	1	1	2	3
170	-4	-2	0	2	5	-3	-2	-1	0	1	1	2	3
160	-4	-2	0	2	4	-3	-2	-1	0	1	1	2	3
150	-4	-2	0	2	4	-3	-2	-1	0	1	1	2	3
140	-4	-2	0	2	4	-4	-2	-1	0	1	1	2	3
130	-3	-2	0	2	3	-4	-2	-1	0	1	1	2	3
120	-3	-2	0	2	3	-4	-3	-1	0	1	2	2	3
110	-3	-1	0	1	3	-4	-3	-1	0	1	2	3	3
100	-2	-1	0	1	2	-4	-3	-1	0	1	2	3	4
90	-2	-1	0	1	2	-5	-3	-1	0	1	2	3	4

***V1 not to exceed VR.**

V1(MCG)
Max Takeoff Thrust

TEMP		PRESSURE ALTITUDE (FT)						
°C	°F	-2000	0	2000	4000	6000	8000	10000
70	158	102	99					
60	140	102	99	97	96			
50	122	104	101	98	96	94	92	90
40	104	109	106	102	99	95	92	90
30	86	112	111	107	103	99	95	92
20	68	112	112	109	107	103	99	96
-60	-76	114	113	110	108	105	102	100

Takeoff Speeds - Wet Runway
Flaps 10, 15 and 25
V1, VR, V2 for Max Takeoff Thrust

WEIGHT (1000 LB)	FLAPS 10			FLAPS 15			FLAPS 25		
	V1	VR	V2	V1	VR	V2	V1	VR	V2
180	138	144	148						
170	133	140	145	133	136	141	133	134	140
160	128	135	141	128	132	138	126	130	136
150	123	131	137	123	128	135	121	126	133
140	118	126	133	117	123	131	115	122	129
130	111	121	129	111	118	126	109	117	125
120	105	115	124	105	113	122	103	111	121
110	99	109	119	98	107	117	97	106	116
100	92	103	114	92	101	112	90	100	111
90	86	97	109	85	95	107	84	94	106

Check V1(MCG).

V1, VR, V2 Adjustments*

TEMP		V1							VR							V2						
		PRESS ALT (1000 FT)							PRESS ALT (1000 FT)							PRESS ALT (1000 FT)						
°C	°F	-2	0	2	4	6	8	10	-2	0	2	4	6	8	10	-2	0	2	4	6	8	10
70	158	8	9						4	5						-2	-3					
60	140	6	7	8	10				3	4	5	6				-2	-2	-2	-3			
50	122	4	5	6	8	9	11	13	2	3	4	5	5	6	8	-1	-1	-2	-2	-3	-3	-3
40	104	1	2	4	5	7	9	10	1	1	3	4	5	5	6	0	-1	-1	-2	-2	-2	-3
30	86	0	0	2	3	5	7	8	0	0	1	2	3	4	5	0	0	0	-1	-1	-2	-2
20	68	0	0	1	2	3	5	6	0	0	1	1	2	3	4	0	0	0	0	-1	-1	-2
-60	-76	0	0	1	2	3	4	5	0	0	1	1	2	3	4	0	0	0	0	-1	-1	-1

Slope and Wind V1 Adjustments*

WEIGHT (1000 LB)	SLOPE (%)					WIND (KTS)							
	-2	-1	0	1	2	-15	-10	-5	0	10	20	30	40
180	-4	-2	0	2	4	-3	-2	-1	0	1	1	2	2
170	-4	-2	0	2	4	-3	-2	-1	0	1	1	2	2
160	-4	-2	0	2	4	-3	-2	-1	0	1	1	2	2
150	-4	-2	0	2	4	-3	-2	-1	0	1	1	2	2
140	-3	-2	0	2	3	-4	-2	-1	0	1	1	2	3
130	-3	-2	0	1	3	-4	-2	-1	0	1	1	2	3
120	-3	-2	0	1	3	-4	-3	-1	0	1	1	2	3
110	-3	-1	0	1	2	-4	-3	-1	0	1	2	2	3
100	-2	-1	0	1	2	-4	-3	-1	0	1	2	3	3
90	-2	-1	0	1	2	-5	-3	-1	0	1	2	3	4

***V1 not to exceed VR.**

V1(MCG)
Max Takeoff Thrust

TEMP		PRESSURE ALTITUDE (FT)						
°C	°F	-2000	0	2000	4000	6000	8000	10000
70	158	102	99					
60	140	102	99	97	96			
50	122	104	101	98	96	94	92	90
40	104	109	106	102	99	95	92	90
30	86	112	111	107	103	99	95	92
20	68	112	112	109	107	103	99	96
-60	-76	114	113	110	108	105	102	100

Stab Trim Setting
Max Takeoff Thrust
Flaps 1 and 5

WEIGHT (1000 LB)	C.G. (%MAC)								
	9	11	13	16	20	24	28	30	33
160-180	8 1/2	8 1/2	8 1/2	7 3/4	6 3/4	6	5 1/4	4 3/4	4 1/4
140	8 1/2	8 1/2	8	7 1/4	6 1/2	5 1/2	4 3/4	4 1/2	3 3/4
120	8 1/2	8	7 1/2	6 1/2	5 3/4	5	4 1/4	4	3 1/4
80-100	6 3/4	6 1/2	6	5 1/2	5	4 1/4	3 1/2	3 1/4	2 3/4

Flaps 10, 15 and 25

WEIGHT (1000 LB)	C.G. (%MAC)								
	9	11	13	16	20	24	28	30	33
160-180	8 1/2	8 1/2	8 1/2	7 1/4	6 1/2	5 1/2	4 1/2	4 1/4	3 1/2
140	8 1/2	8 1/2	7 3/4	6 3/4	6	5	4 1/4	3 3/4	3
120	8 1/2	7 3/4	7	6	5 1/4	4 1/2	3 3/4	3 1/4	2 3/4
80-100	6 1/4	6	5 1/2	5	4 1/2	3 3/4	3	2 3/4	2 3/4

VREF

Based on 10000 ft reference pressure altitude

WEIGHT (1000 LB)	FLAPS		
	40	30	15
170	151	153	159
160	147	149	155
150	142	144	150
140	137	140	145
130	132	134	139
120	126	129	133
110	120	123	127
100	114	117	121
90	108	111	115

Flap Maneuver Speeds

FLAP POSITION	MANEUVER SPEED
UP	VREF40 + 70
1	VREF40 + 50
5	VREF40 + 30
10	VREF40 + 30
15	VREF40 + 20
25	VREF40 + 10
30	VREF30
40	VREF40

ADVISORY INFORMATION

Slush/Standing Water Takeoff

Maximum Reverse Thrust

Weight Adjustments (1000 LB)

DRY FIELD/OBSTACLE LIMIT WEIGHT (1000 LB)	SLUSH/STANDING WATER DEPTH								
	0.12 INCHES (3 mm)			0.25 INCHES (6 mm)			0.50 INCHES (13 mm)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
180	-21.9	-27.4	-32.9	-26.4	-31.9	-37.4	-37.5	-43.0	-48.5
170	-19.3	-24.8	-30.3	-22.8	-28.3	-33.8	-31.1	-36.6	-42.1
160	-17.0	-22.5	-28.0	-19.7	-25.2	-30.7	-25.8	-31.3	-36.8
150	-15.0	-20.5	-26.0	-17.2	-22.7	-28.2	-21.7	-27.2	-32.7
140	-13.3	-18.8	-24.3	-15.1	-20.6	-26.1	-18.8	-24.3	-29.8
130	-11.9	-17.4	-22.9	-13.4	-18.9	-24.4	-16.6	-22.1	-27.6
120	-10.5	-16.0	-21.5	-11.7	-17.2	-22.7	-14.4	-19.9	-25.4
110	-9.1	-14.6	-20.1	-10.0	-15.5	-21.0	-12.2	-17.7	-23.2
100	-7.6	-13.1	-18.6	-8.2	-13.7	-19.2	-10.0	-15.5	-21.0
90	-6.2	-11.7	-17.2	-6.5	-12.0	-17.5	-7.8	-13.3	-18.8

V1(MCG) Limit Weight (1000 LB)

ADJUSTED FIELD LENGTH (FT)	SLUSH/STANDING WATER DEPTH								
	0.12 INCHES (3 mm)			0.25 INCHES (6 mm)			0.50 INCHES (13 mm)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
4600							74.3		
5000	75.8			82.9			93.3		
5400	94.0			100.9			111.9		
5800	112.6			119.4	73.9		130.1	83.9	
6200	131.5	84.9		138.2	91.9		147.9	102.7	
6600	150.8	103.2		157.4	110.1		165.4	121.1	74.3
7000	170.6	122.0	75.8	177.0	128.7	82.9	182.6	139.1	93.3
7400	190.9	141.1	94.0	197.0	147.7	100.9	199.5	156.7	111.9
7800		160.7	112.6		167.1	119.4		174.0	130.1
8200		180.7	131.5		186.9	138.2		191.0	147.9
8600			150.8			157.4			165.4
9000			170.6			177.0			182.6
9400			190.9			197.0			199.5

1. **Enter Weight Adjustment table with slush/standing water depth and dry field/obstacle limit weight to obtain slush/standing water weight adjustment.**
2. **Adjust field length available by -120 ft/+110 ft for every 5°C above/below 4°C.**
3. **Find V1(MCG) limit weight for adjusted field length and pressure altitude.**
4. **Max allowable slush/standing water limited weight is lesser of weights from 1 and 3.**

ADVISORY INFORMATION

Slush/Standing Water Takeoff
Maximum Reverse Thrust
V1 Adjustment (KIAS)

WEIGHT (1000 LB)	SLUSH/STANDING WATER DEPTH								
	0.12 INCHES (3 mm)			0.25 INCHES (6 mm)			0.50 INCHES (13 mm)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
180	-15	-12	-10	-8	-5	-3	-3	0	0
170	-16	-13	-11	-10	-7	-5	-3	-1	0
160	-17	-15	-12	-12	-10	-7	-4	-2	0
150	-18	-16	-13	-14	-11	-9	-6	-3	-1
140	-19	-16	-14	-15	-13	-10	-8	-5	-3
130	-20	-17	-15	-17	-14	-12	-10	-7	-5
120	-20	-18	-15	-18	-16	-13	-12	-10	-7
110	-21	-19	-16	-19	-17	-14	-15	-12	-10
100	-23	-20	-18	-21	-18	-16	-17	-14	-12
90	-24	-21	-19	-22	-20	-17	-19	-17	-14

1. **Obtain V1, VR and V2 for the actual weight using the Dry Runway Takeoff Speeds table.**
2. **If V1(MCG) limited, set V1 = V1(MCG). If not V1(MCG) limited, enter V1 Adjustment table with the actual weight to obtain V1 speed adjustment. If adjusted V1 is less than V1(MCG), set V1 = V1(MCG). V1 not to exceed VR.**

ADVISORY INFORMATION

Slush/Standing Water Takeoff
No Reverse Thrust
Weight Adjustments (1000 LB)

DRY FIELD/OBSTACLE LIMIT WEIGHT (1000 LB)	SLUSH/STANDING WATER DEPTH								
	0.12 INCHES (3 mm)			0.25 INCHES (6 mm)			0.50 INCHES (13 mm)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
180	-26.4	-34.9	-43.4	-30.8	-39.3	-47.8	-39.8	-48.3	-56.8
170	-23.4	-31.9	-40.4	-27.0	-35.5	-44.0	-34.4	-42.9	-51.4
160	-20.7	-29.2	-37.7	-23.6	-32.1	-40.6	-29.6	-38.1	-46.6
150	-18.3	-26.8	-35.3	-20.6	-29.1	-37.6	-25.5	-34.0	-42.5
140	-16.2	-24.7	-33.2	-18.0	-26.5	-35.0	-22.0	-30.5	-39.0
130	-14.4	-22.9	-31.4	-15.9	-24.4	-32.9	-19.3	-27.8	-36.3
120	-12.9	-21.4	-29.9	-14.2	-22.7	-31.2	-17.2	-25.7	-34.2
110	-11.6	-20.1	-28.6	-12.8	-21.3	-29.8	-15.6	-24.1	-32.6
100	-10.4	-18.9	-27.4	-11.4	-19.9	-28.4	-14.1	-22.6	-31.1
90	-9.1	-17.6	-26.1	-10.1	-18.6	-27.1	-12.5	-21.0	-29.5

V1(MCG) Limit Weight (1000 LB)

ADJUSTED FIELD LENGTH (FT)	SLUSH/STANDING WATER DEPTH								
	0.12 INCHES (3 mm)			0.25 INCHES (6 mm)			0.50 INCHES (13 mm)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
5800							86.8		
6200				78.7			105.6		
6600	81.1			99.7			125.0	86.8	
7000	103.5			120.8	78.7		145.2	105.6	
7400	125.9	81.1		142.1	99.7		166.1	125.0	86.8
7800	148.3	103.5		163.6	120.8	78.7	188.0	145.2	105.6
8200	170.6	125.9	81.1	185.2	142.1	99.7		166.1	125.0
8600	192.9	148.3	103.5		163.6	120.8		188.0	145.2
9000		170.6	125.9		185.2	142.1			166.1
9400		192.9	148.3			163.6			188.0
9800			170.6			185.2			
10200			192.9						

1. **Enter Weight Adjustment table with slush/standing water depth and dry field/obstacle limit weight to obtain slush/standing water weight adjustment.**
2. **Adjust field length available by -150 ft/+140 ft for every 5°C above/below 4°C.**
3. **Find V1(MCG) limit weight for adjusted field length and pressure altitude.**
4. **Max allowable slush/standing water limited weight is lesser of weights from 1 and 3.**

ADVISORY INFORMATION

Slush/Standing Water Takeoff
No Reverse Thrust
V1 Adjustment (KIAS)

WEIGHT (1000 LB)	SLUSH/STANDING WATER DEPTH								
	0.12 INCHES (3 mm)			0.25 INCHES (6 mm)			0.50 INCHES (13 mm)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
180	-21	-16	-11	-12	-7	-2	0	0	0
170	-22	-17	-12	-14	-9	-4	0	0	0
160	-23	-18	-13	-17	-12	-7	-3	0	0
150	-24	-19	-14	-19	-14	-9	-7	-2	0
140	-25	-20	-15	-21	-16	-11	-10	-5	0
130	-26	-21	-16	-22	-17	-12	-14	-9	-4
120	-27	-22	-17	-24	-19	-14	-17	-12	-7
110	-28	-23	-18	-25	-20	-15	-20	-15	-10
100	-29	-24	-19	-27	-22	-17	-22	-17	-12
90	-29	-24	-19	-28	-23	-18	-25	-20	-15

1. **Obtain V1, VR and V2 for the actual weight using the Dry Runway Takeoff Speeds table.**
2. **If V1(MCG) limited, set V1 = V1(MCG). If not V1(MCG) limited, enter V1 Adjustment table with the actual weight to obtain V1 speed adjustment. If adjusted V1 is less than V1(MCG), set V1 = V1(MCG). V1 not to exceed VR.**

ADVISORY INFORMATION

Slippery Runway Takeoff
Maximum Reverse Thrust
Weight Adjustment (1000 LB)

DRY FIELD/OBSTACLE LIMIT WEIGHT (1000 LB)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
180	-2.5	-2.5	-2.5	-12.5	-12.5	-12.5	-21.5	-21.5	-21.5
170	-2.7	-2.7	-2.7	-12.2	-12.2	-12.2	-20.3	-20.3	-20.3
160	-2.8	-2.8	-2.8	-11.8	-11.8	-11.8	-19.1	-19.1	-19.1
150	-2.8	-2.8	-2.8	-11.2	-11.2	-11.2	-17.8	-17.8	-17.8
140	-2.7	-2.7	-2.7	-10.5	-10.5	-10.5	-16.5	-16.5	-16.5
130	-2.5	-2.5	-2.5	-9.6	-9.6	-9.6	-15.2	-15.2	-15.2
120	-2.2	-2.2	-2.2	-8.6	-8.6	-8.6	-13.9	-13.9	-13.9
110	-1.8	-1.8	-1.8	-7.4	-7.4	-7.4	-12.5	-12.5	-12.5
100	-1.3	-1.3	-1.3	-6.1	-6.1	-6.1	-11.0	-11.0	-11.0
90	-0.7	-0.7	-0.7	-4.6	-4.6	-4.6	-9.5	-9.5	-9.5

V1(MCG) Limit Weight (1000 LB)

ADJUSTED FIELD LENGTH (FT)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
3800	92.1								
4200	120.6	81.6							
4600	150.0	109.8	71.1						
5000	180.2	138.9	99.2	89.7					
5400		168.8	127.9	111.0					
5800		199.5	157.5	133.2	89.7				
6200			187.9	156.3	111.0		77.2		
6600				180.6	133.2	89.7	91.6		
7000					156.3	111.0	106.4		
7400					180.6	133.2	121.7	79.0	
7800						156.3	137.4	93.4	
8200						180.6	153.6	108.3	
8600							170.3	123.6	80.7
9000							187.7	139.4	95.3
9400								155.6	110.2
9800								172.5	125.6
10200								189.9	141.4
10600									157.7
11000									174.6
11400									192.1

1. **Enter Weight Adjustment table with reported braking action and dry field/obstacle limit weight to obtain slippery runway weight adjustment.**
2. **Adjust “Good” field length available by -90 ft/+80 ft for every 5°C above/below 4°C.**
   Adjust “Medium” field length available by -90 ft/+80 ft for every 5°C above/below 4°C.
   Adjust “Poor” field length available by -130 ft/+120 ft for every 5°C above/below 4°C.
3. **Find V1(MCG) limit weight for adjusted field length and pressure altitude.**
4. **Max allowable slippery runway limited weight is lesser of weights from 1 and 3.**

ADVISORY INFORMATION

Slippery Runway Takeoff
Maximum Reverse Thrust
V1 Adjustment (KIAS)

WEIGHT (1000 LB)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
180	-5	-3	0	-14	-12	-9	-25	-23	-20
170	-6	-4	-1	-15	-13	-10	-27	-24	-22
160	-7	-4	-2	-17	-14	-12	-28	-26	-23
150	-8	-5	-3	-18	-15	-13	-30	-27	-25
140	-8	-6	-3	-19	-16	-14	-31	-29	-26
130	-9	-7	-4	-20	-18	-15	-33	-30	-28
120	-10	-8	-5	-21	-19	-16	-34	-32	-29
110	-11	-9	-6	-23	-20	-18	-36	-34	-31
100	-13	-10	-8	-24	-22	-19	-38	-35	-33
90	-14	-12	-9	-26	-24	-21	-40	-37	-35

1. **Obtain V1, VR and V2 for the actual weight using the Dry Runway Takeoff Speeds table.**
2. **If V1(MCG) limited, set V1 = V1(MCG). If not V1(MCG) limited, enter V1 Adjustment table with the actual weight to obtain V1 speed adjustment. If adjusted V1 is less than V1(MCG), set V1 = V1(MCG). V1 not to exceed VR.**

ADVISORY INFORMATION

Slippery Runway Takeoff

No Reverse Thrust

Weight Adjustments (1000 LB)

DRY FIELD/OBSTACLE LIMIT WEIGHT (1000 LB)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
180	-4.4	-4.4	-4.4	-17.0	-17.0	-17.0	-27.2	-27.2	-27.2
170	-4.6	-4.6	-4.6	-16.1	-16.1	-16.1	-25.3	-25.3	-25.3
160	-4.6	-4.6	-4.6	-15.2	-15.2	-15.2	-23.4	-23.4	-23.4
150	-4.6	-4.6	-4.6	-14.3	-14.3	-14.3	-21.7	-21.7	-21.7
140	-4.4	-4.4	-4.4	-13.4	-13.4	-13.4	-20.1	-20.1	-20.1
130	-4.2	-4.2	-4.2	-12.5	-12.5	-12.5	-18.6	-18.6	-18.6
120	-3.8	-3.8	-3.8	-11.5	-11.5	-11.5	-17.2	-17.2	-17.2
110	-3.3	-3.3	-3.3	-10.5	-10.5	-10.5	-15.9	-15.9	-15.9
100	-2.7	-2.7	-2.7	-9.5	-9.5	-9.5	-14.7	-14.7	-14.7
90	-2.0	-2.0	-2.0	-8.5	-8.5	-8.5	-13.5	-13.5	-13.5

V1(MCG) Limit Weight (1000 LB)

ADJUSTED FIELD LENGTH (FT)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
4200	99.2								
4600	130.9	91.4							
5000	163.1	122.9	83.6						
5400	195.8	155.0	115.0						
5800		187.6	146.9	75.4					
6200			179.4	102.1					
6600				129.6	82.0				
7000				157.8	108.9				
7400				186.8	136.5	88.7			
7800					164.9	115.7			
8200					194.2	143.6			
8600						172.2			
9000							85.2		
9400							105.5		
9800							125.9	75.1	
10200							146.4	95.4	
10600							167.0	115.7	
11000							187.7	136.2	85.2
11400								156.7	105.5
11800								177.4	125.9
12200								198.1	146.4
12600									167.0
13000									187.7

1. **Enter Weight Adjustment table with reported braking action and dry field/obstacle limit weight to obtain slippery runway weight adjustment.**
2. **Adjust “Good” field length available by -90 ft/+90 ft for every 5°C above/below 4°C.**
   Adjust “Medium” field length available by -90 ft/+90 ft for every 5°C above/below 4°C.
   Adjust “Poor” field length available by -170 ft/+160 ft for every 5°C above/below 4°C.
3. **Find V1(MCG) limit weight for adjusted field length and pressure altitude.**
4. **Max allowable slippery runway limited weight is lesser of weights from 1 and 3.**

ADVISORY INFORMATION

Slippery Runway Takeoff
No Reverse Thrust
V1 Adjustment (KIAS)

WEIGHT (1000 LB)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
180	-7	-4	-2	-18	-16	-13	-35	-33	-30
170	-8	-5	-3	-20	-17	-15	-37	-35	-32
160	-9	-6	-4	-21	-19	-16	-39	-37	-34
150	-10	-7	-5	-23	-20	-18	-41	-38	-36
140	-10	-8	-5	-24	-22	-19	-43	-40	-38
130	-11	-9	-6	-26	-23	-21	-44	-42	-39
120	-13	-10	-8	-27	-25	-22	-46	-44	-41
110	-14	-11	-9	-29	-26	-24	-48	-45	-43
100	-15	-13	-10	-31	-28	-26	-50	-47	-45
90	-17	-14	-12	-33	-30	-28	-52	-49	-47

1. **Obtain V1, VR and V2 for the actual weight using the Dry Runway Takeoff Speeds table.**
2. **If V1(MCG) limited, set V1 = V1(MCG). If not V1(MCG) limited, enter V1 Adjustment table with the actual weight to obtain V1 speed adjustment. If adjusted V1 is less than V1(MCG), set V1 = V1(MCG). V1 not to exceed VR.**

Takeoff %N1

Based on engine bleeds for packs on, engine and wing anti-ice on or off

OAT (°C)	AIRPORT PRESSURE ALTITUDE (FT)												
	-2000	-1000	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
60	90.3	90.8	91.2	91.2	91.1	91.1	91.0	91.1	91.2	91.0	91.2	91.3	91.4
55	91.0	91.6	92.0	92.0	92.0	91.9	91.9	91.9	92.0	91.9	91.7	91.3	90.8
50	91.8	92.4	92.8	92.8	92.8	92.7	92.7	92.7	92.7	92.6	92.6	92.2	91.8
45	92.6	93.2	93.6	93.6	93.6	93.6	93.5	93.5	93.5	93.4	93.3	93.1	92.8
40	93.4	94.0	94.4	94.4	94.4	94.3	94.3	94.2	94.2	94.1	94.1	94.0	93.8
35	94.2	94.8	95.2	95.2	95.2	95.1	95.1	95.0	95.0	94.9	94.8	94.8	94.7
30	93.8	95.0	96.1	96.0	96.0	96.0	95.9	95.8	95.8	95.7	95.7	95.6	95.6
25	93.1	94.3	95.4	95.9	96.4	96.7	96.7	96.6	96.6	96.5	96.4	96.4	96.3
20	92.3	93.5	94.6	95.1	95.7	96.3	96.9	97.6	97.5	97.5	97.4	97.3	97.2
15	91.6	92.7	93.8	94.3	94.9	95.5	96.1	96.8	97.5	98.2	98.6	98.6	98.5
10	90.8	92.0	93.0	93.6	94.1	94.7	95.3	96.0	96.7	97.5	98.2	99.1	100.0
5	90.0	91.2	92.2	92.8	93.3	93.9	94.5	95.2	95.9	96.7	97.4	98.4	99.3
0	89.2	90.4	91.4	92.0	92.5	93.1	93.7	94.4	95.1	95.9	96.7	97.6	98.5
-5	88.4	89.6	90.6	91.2	91.7	92.3	92.9	93.6	94.3	95.1	95.9	96.8	97.7
-10	87.6	88.8	89.8	90.4	90.9	91.5	92.1	92.8	93.5	94.3	95.1	96.1	97.0
-15	86.8	88.0	89.0	89.5	90.0	90.6	91.3	92.0	92.7	93.5	94.3	95.3	96.2
-20	86.0	87.1	88.2	88.7	89.2	89.8	90.5	91.2	91.9	92.6	93.5	94.5	95.4
-25	85.2	86.3	87.3	87.9	88.4	89.0	89.6	90.3	91.0	91.8	92.6	93.7	94.6
-30	84.4	85.5	86.5	87.0	87.5	88.1	88.8	89.5	90.2	91.0	91.8	92.9	93.8
-35	83.5	84.6	85.6	86.2	86.6	87.3	87.9	88.6	89.3	90.1	91.0	92.1	93.0
-40	82.7	83.8	84.8	85.3	85.8	86.4	87.0	87.8	88.5	89.3	90.1	91.2	92.2
-45	81.8	82.9	83.9	84.4	84.9	85.5	86.2	86.9	87.6	88.4	89.3	90.4	91.4
-50	81.0	82.0	83.0	83.5	84.0	84.6	85.3	86.0	86.7	87.5	88.4	89.5	90.5

%N1 Adjustments for Engine Bleeds

BLEED CONFIGURATION	AIRPORT PRESSURE ALTITUDE (FT)												
	-2000	-1000	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
PACKS OFF	0.7	0.7	0.7	0.7	0.7	0.7	0.8	0.8	0.8	0.8	0.8	0.9	1.0

Assumed Temperature Reduced Thrust

Maximum Assumed Temperature (Table 1 of 3)
Based on 25% Takeoff Thrust Reduction

OAT (°C)	AIRPORT PRESSURE ALTITUDE (FT)											
	-1000	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
55	73	71	69	67								
50	73	71	69	67	65	63						
45	73	71	69	67	65	63	61	59	57			
40	73	71	69	67	65	63	61	59	57	55		
35	67	67	67	67	65	63	61	59	57	55	53	
30	64	61	62	61	61	61	61	59	57	55	53	51
25	64	61	59	57	56	56	57	57	57	55	53	51
20	64	61	59	57	56	54	53	53	53	53	52	51
15	64	61	59	57	56	54	53	52	50	49	48	47
10 & BELOW	64	61	59	57	56	54	53	52	50	48	45	43

Takeoff %N1 (Table 2 of 3)
Based on engine bleed for packs on, engine and wing anti-ice on or off

ASSUMED TEMP (°C)	AIRPORT PRESSURE ALTITUDE (FT)											
	-1000	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
75	88.3	88.6	89.1	89.6	90.2	90.8	91.5	92.2	92.7	93.1	93.3	93.4
70	89.1	89.5	89.4	89.3	89.6	90.1	90.8	91.6	92.0	92.5	92.6	92.7
65	90.0	90.4	90.3	90.2	90.2	90.1	90.2	90.9	91.4	91.8	91.9	92.1
60	90.8	91.2	91.2	91.1	91.1	91.0	91.1	91.2	91.0	91.2	91.3	91.4
55	91.6	92.0	92.0	92.0	91.9	91.9	91.9	92.0	91.9	91.7	91.3	90.8
50	92.4	92.8	92.8	92.8	92.7	92.7	92.7	92.7	92.6	92.6	92.2	91.8
45	93.2	93.6	93.6	93.6	93.6	93.5	93.5	93.5	93.4	93.3	93.1	92.8
40	94.0	94.4	94.4	94.4	94.3	94.3	94.2	94.2	94.1	94.1	94.0	93.8
35	94.8	95.2	95.2	95.2	95.1	95.1	95.0	95.0	94.9	94.8	94.8	94.7
30	95.0	96.1	96.0	96.0	96.0	95.9	95.8	95.8	95.7	95.7	95.6	95.6
25	94.3	95.4	95.9	96.4	96.7	96.7	96.6	96.6	96.5	96.4	96.4	96.3
20	93.5	94.6	95.1	95.7	96.3	96.9	97.6	97.5	97.5	97.4	97.3	97.2
15	92.7	93.8	94.3	94.9	95.5	96.1	96.8	97.5	98.2	98.6	98.6	98.5
10	92.0	93.0	93.6	94.1	94.7	95.3	96.0	96.7	97.5	98.2	99.1	100.0
MINIMUM ASSUMED TEMP (°C)	32	30	28	26	24	22	20	18	16	15	12	10

With engine bleed for packs off, increase %N1 by 1.0

Assumed Temperature Reduced Thrust

%N1 Adjustment for Temperature Difference (Table 3 of 3)

ASSUMED TEMP MINUS OAT (°C)	OUTSIDE AIR TEMPERATURE (°C)													
	-40	-20	0	5	10	15	20	25	30	35	40	45	50	55
110	12.1													
100	11.3	8.5												
90	11.7	8.9												
80	12.5	8.0	5.5											
70	11.3	8.4	5.9	5.6	4.0									
60	9.7	9.2	4.8	4.7	4.4	4.2	2.6							
50	7.8	7.9	5.3	3.5	3.3	3.6	3.0	2.7	1.2					
40		6.4	6.0	5.5	3.7	3.2	3.7	3.0	2.8	3.0	3.7			
30		4.6	4.6	4.6	4.5	4.3	4.2	4.0	4.1	4.0	3.9	3.8	3.7	
20			3.1	3.1	3.1	3.0	2.9	2.9	2.8	2.7	2.7	2.6	2.6	2.5
10			1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.4	1.4	1.4	1.3	1.3
0			0	0	0	0	0	0	0	0	0	0	0	0

1. **Determine Maximum Assumed Temperature allowed from Table 1.**
2. **Find Maximum %N1 from Table 2 using the desired assumed temperature (no greater than temperature from Table 1).**
3. **Use the difference between assumed temperature and OAT to determine the %N1 adjustment from Table 3.**
4. **Subtract %N1 adjustment from Maximum %N1 in Table 2.**

Takeoff Speeds - Dry Runway (22K Derate)
Flaps 1 and 5
V1, VR, V2

WEIGHT (1000 LB)	FLAPS 1			FLAPS 5		
	V1	VR	V2	V1	VR	V2
180	154	155	158	151	151	154
170	150	151	155	147	148	151
160	146	147	151	142	144	148
150	140	141	147	137	138	143
140	135	136	142	131	133	139
130	128	130	137	125	127	134
120	122	123	131	119	121	129
110	115	116	126	112	114	123
100	108	109	120	105	107	117
90	100	102	113	98	100	111

Check V1(MCG).

V1, VR, V2 Adjustments*

TEMP		V1							VR							V2						
		PRESS ALT (1000 FT)							PRESS ALT (1000 FT)							PRESS ALT (1000 FT)						
°C	°F	-2	0	2	4	6	8	10	-2	0	2	4	6	8	10	-2	0	2	4	6	8	10
70	158	6	7						6	6						-1	-1					
60	140	5	6	7	8				4	5	6	7				-1	-1	-1	-1			
50	122	3	4	5	6	8	9	11	3	3	5	6	7	8	10	-1	-1	-1	-1	-1	-1	-1
40	104	1	2	3	5	6	8	9	1	2	3	4	6	7	9	0	0	0	-1	-1	-1	-1
30	86	0	0	1	3	5	6	8	0	0	2	3	4	6	7	0	0	0	0	0	0	0
20	68	0	0	1	2	3	5	7	0	0	1	2	3	5	6	0	0	0	0	1	0	0
-60	-76	0	0	1	2	3	4	5	0	0	1	2	3	4	5	0	0	0	0	1	1	1

Slope and Wind V1 Adjustments*

WEIGHT (1000 LB)	SLOPE (%)					WIND (KTS)							
	-2	-1	0	1	2	-15	-10	-5	0	10	20	30	40
180	-2	-1	0	1	1	-1	-1	0	0	0	1	1	1
160	-2	-1	0	1	1	-1	-1	0	0	0	1	1	1
140	-2	-1	0	1	1	-1	-1	0	0	0	0	1	1
120	-2	-1	0	1	1	-1	-1	0	0	0	1	1	1
100	-1	0	0	1	1	-2	-1	0	0	0	1	1	1

***V1 not to exceed VR.**

V1(MCG)

TEMP		PRESSURE ALTITUDE (FT)						
°C	°F	-2000	0	2000	4000	6000	8000	10000
70	158	98	96					
60	140	98	96	95	93			
50	122	100	98	95	93	91	89	87
40	104	105	103	99	96	92	89	87
30	86	108	108	104	100	97	92	89
20	68	108	108	106	104	101	96	93
-60	-76	110	109	107	105	103	100	98

Takeoff Speeds - Dry Runway (22K Derate)
Flaps 10, 15 and 25
V1, VR, V2

WEIGHT (1000 LB)	FLAPS 10			FLAPS 15			FLAPS 25		
	V1	VR	V2	V1	VR	V2	V1	VR	V2
160	135	136	140	133	133	138			
150	131	132	137	129	129	134	127	127	133
140	126	127	133	124	124	130	122	123	129
130	120	121	128	119	119	126	117	118	125
120	115	116	124	113	114	121	112	112	120
110	109	110	119	108	108	117	106	107	116
100	102	104	114	101	102	112	100	101	111
90	96	98	109	95	96	107	93	95	106

Check V1(MCG).

V1, VR, V2 Adjustments*

TEMP		V1							VR							V2						
		PRESS ALT (1000 FT)							PRESS ALT (1000 FT)							PRESS ALT (1000 FT)						
°C	°F	-2	0	2	4	6	8	10	-2	0	2	4	6	8	10	-2	0	2	4	6	8	10
70	158	5	6						4	5						-2	-2					
60	140	4	5	6	7				3	4	5	5				-2	-2	-2	-3			
50	122	3	3	4	5	6	8	9	2	3	4	4	5	6	7	-1	-1	-2	-2	-3	-3	-3
40	104	1	2	2	4	5	6	7	1	1	2	3	4	5	6	0	-1	-1	-2	-2	-3	-3
30	86	0	0	1	2	3	5	6	0	0	1	2	3	4	5	0	0	-1	-1	-1	-2	-2
20	68	0	0	0	1	2	3	5	0	0	1	1	2	3	4	0	0	0	0	-1	-1	-2
-60	-76	0	0	0	1	2	2	3	0	0	1	1	2	2	3	0	0	0	0	-1	-1	-1

Slope and Wind V1 Adjustments*

WEIGHT (1000 LB)	SLOPE (%)					WIND (KTS)							
	-2	-1	0	1	2	-15	-10	-5	0	10	20	30	40
160	-2	-1	0	1	1	0	1	0	0	1	1	1	1
150	-2	-1	0	1	1	0	0	0	0	0	1	1	1
140	-2	-1	0	1	1	0	0	0	0	0	1	1	1
130	-2	-1	0	1	1	-1	0	-1	0	0	1	1	1
120	-2	-1	0	1	1	-1	-1	-1	0	0	1	1	1
110	-1	-1	0	1	1	-2	-1	-2	0	0	1	1	1
100	-1	-1	0	1	1	-2	-1	-2	0	0	1	1	1
90	-1	-1	0	1	1	-2	-1	-2	0	0	1	1	1

***V1 not to exceed VR.**

V1(MCG)

TEMP		PRESSURE ALTITUDE (FT)						
°C	°F	-2000	0	2000	4000	6000	8000	10000
70	158	98	96					
60	140	98	96	95	93			
50	122	100	98	95	93	91	89	87
40	104	105	103	99	96	92	89	87
30	86	108	108	104	100	97	92	89
20	68	108	108	106	104	101	96	93
-60	-76	110	109	107	105	103	100	98

Takeoff Speeds - Wet Runway (22K Derate)
Flaps 1 and 5
V1, VR, V2

WEIGHT (1000 LB)	FLAPS 1			FLAPS 5		
	V1	VR	V2	V1	VR	V2
180	149	155	159	148	151	154
170	145	151	155	142	148	151
160	140	147	151	136	144	148
150	134	141	147	130	138	143
140	128	136	142	124	133	139
130	121	130	137	118	127	134
120	114	123	131	111	121	129
110	106	116	126	104	114	123
100	99	109	120	96	107	117
90	91	102	113	89	100	111

Check V1(MCG).

V1, VR, V2 Adjustment*

TEMP		V1							VR							V2						
		PRESS ALT (1000 FT)							PRESS ALT (1000 FT)							PRESS ALT (1000 FT)						
°C	°F	-2	0	2	4	6	8	10	-2	0	2	4	6	8	10	-2	0	2	4	6	8	10
70	158	10	11						6	6						-1	-1					
60	140	7	8	10	11				4	5	6	7				-1	-1	-1	-1			
50	122	4	5	7	9	10	13	15	3	3	5	6	7	8	10	-1	-1	-1	-1	-1	-1	-1
40	104	2	3	4	6	8	11	12	1	2	3	4	6	7	9	0	0	0	-1	-1	-1	-1
30	86	0	0	2	4	6	8	10	0	0	2	3	4	6	7	0	0	0	0	0	0	0
20	68	0	0	1	2	3	6	8	0	0	1	2	3	5	6	0	0	0	0	1	0	0
-60	-76	0	0	1	2	3	4	6	0	0	1	2	3	4	5	0	0	0	0	1	1	1

Slope and Wind V1 Adjustment*

WEIGHT (1000 LB)	SLOPE (%)					WIND (KTS)							
	-2	-1	0	1	2	-15	-10	-5	0	10	20	30	40
180	-5	-2	0	3	5	-2	-1	0	0	1	2	2	2
170	-4	-2	0	3	5	-2	-1	0	0	1	1	2	2
160	-4	-2	0	3	5	-3	-1	-1	0	1	1	2	2
150	-4	-2	0	2	4	-3	-2	-1	0	1	1	2	2
140	-4	-2	0	2	4	-3	-2	-1	0	1	1	2	2
130	-4	-2	0	2	4	-3	-2	-1	0	1	1	2	3
120	-3	-2	0	2	3	-3	-2	-1	0	1	2	2	3
110	-3	-1	0	2	3	-4	-2	-1	0	1	2	3	3
100	-2	-1	0	2	3	-4	-2	-1	0	1	2	3	4
90	-1	0	0	2	3	-4	-2	-1	0	1	3	3	4

***V1 not to exceed VR.**

V1(MCG)

TEMP		PRESSURE ALTITUDE (FT)						
°C	°F	-2000	0	2000	4000	6000	8000	10000
70	158	98	96					
60	140	98	96	95	93			
50	122	100	98	95	93	91	89	87
40	104	105	103	99	96	92	89	87
30	86	108	108	104	100	97	92	89
20	68	108	108	106	104	101	96	93
-60	-76	110	109	107	105	103	100	98

Takeoff Speeds - Wet Runway (22K Derate)
Flaps 10, 15 and 25
V1, VR, V2

WEIGHT (1000 LB)	FLAPS 10			FLAPS 15			FLAPS 25		
	V1	VR	V2	V1	VR	V2	V1	VR	V2
160	130	136	140	131	133	138			
150	125	132	137	125	129	134	124	127	133
140	119	127	133	119	124	130	118	123	129
130	113	121	128	113	119	126	112	118	125
120	107	116	124	107	114	121	105	112	120
110	101	110	119	100	108	117	99	107	116
100	94	104	114	94	102	112	92	101	111
90	88	98	109	87	96	107	86	95	106

Check V1(MCG).

V1, VR, V2 Adjustment*

TEMP		V1							VR							V2						
		PRESS ALT (1000 FT)							PRESS ALT (1000 FT)							PRESS ALT (1000 FT)						
°C	°F	-2	0	2	4	6	8	10	-2	0	2	4	6	8	10	-2	0	2	4	6	8	10
70	158	8	9						4	5						-2	-2					
60	140	6	7	8	10				3	4	5	5				-2	-2	-2	-3			
50	122	4	5	6	7	9	11	13	2	3	4	4	5	6	7	-1	-1	-2	-2	-3	-3	-3
40	104	1	2	3	5	6	9	10	1	1	2	3	4	5	6	0	-1	-1	-2	-2	-3	-3
30	86	0	0	1	3	4	6	8	0	0	1	2	3	4	5	0	0	0	-1	-1	-2	-2
20	68	0	0	1	1	2	4	6	0	0	1	1	2	3	4	0	0	0	0	-1	-1	-2
-60	-76	0	0	1	1	2	3	4	0	0	1	1	2	3	3	0	0	0	0	-1	-1	-1

Slope and Wind V1 Adjustment*

WEIGHT (1000 LB)	SLOPE (%)					WIND (KTS)							
	-2	-1	0	1	2	-15	-10	-5	0	10	20	30	40
160	-4	-2	0	2	3	-3	-2	-1	0	0	1	2	2
150	-4	-2	0	1	3	-4	-2	-1	0	1	1	2	2
140	-4	-2	0	1	3	-4	-2	-1	0	1	1	2	2
130	-3	-2	0	1	3	-4	-2	-1	0	1	1	2	3
120	-3	-2	0	1	3	-4	-2	-1	0	1	1	2	3
110	-3	-1	0	1	3	-4	-3	-1	0	1	1	2	3
100	-2	-1	0	1	2	-4	-3	-1	0	1	2	2	3
90	-2	-1	0	1	2	-5	-3	-1	0	1	2	3	3

***V1 not to exceed VR.**

V1(MCG)

TEMP		PRESSURE ALTITUDE (FT)						
°C	°F	-2000	0	2000	4000	6000	8000	10000
70	158	98	96					
60	140	98	96	95	93			
50	122	100	98	95	93	91	89	87
40	104	105	103	99	96	92	89	87
30	86	108	108	104	100	97	92	89
20	68	108	108	106	104	101	96	93
-60	-76	110	109	107	105	103	100	98

Stab Trim Setting (22K Derate)

Flaps 1 and 5

WEIGHT (1000 LB)	C.G. (%MAC)								
	9	11	13	16	20	24	28	31	33
160-180	8 1/2	8 1/2	8 1/2	7 3/4	7	6 1/4	5 1/2	4 3/4	4 1/2
140	8 1/2	8 1/2	8	7 1/4	6 1/2	5 3/4	5	4 1/2	4
120	8 1/2	8	7 1/2	6 3/4	6	5 1/4	4 1/2	4	3 1/2
80-100	7	6 3/4	6 1/2	6	5 1/4	4 1/2	4	3 1/2	3

Flaps 10, 15 and 25

WEIGHT (1000 LB)	C.G. (%MAC)								
	9	11	13	16	20	24	28	31	33
160-180	8 1/2	8 1/2	8 1/2	7 1/2	6 1/2	5 3/4	4 3/4	4 1/4	3 3/4
140	8 1/2	8 1/2	7 3/4	7	6 1/4	5 1/4	4 1/2	3 3/4	3 1/4
120	8 1/2	8	7 1/4	6 1/2	5 1/2	4 3/4	4	3 1/4	2 3/4
80-100	6 3/4	6 1/4	6	5 1/2	4 3/4	4	3 1/4	2 3/4	2 3/4

ADVISORY INFORMATION

Slush/Standing Water Takeoff (22K Derate)

Maximum Reverse Thrust

Weight Adjustments (1000 LB)

22K DERATE DRY FIELD/OBSTACLE LIMIT WEIGHT (1000 LB)	SLUSH/STANDING WATER DEPTH								
	0.12 INCHES (3 mm)			0.25 INCHES (6 mm)			0.50 INCHES (13 mm)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
180	-24.8	-29.3	-33.8	-30.1	-34.6	-39.1	-42.0	-46.5	-51.0
170	-20.9	-25.4	-29.9	-25.0	-29.5	-34.0	-34.5	-39.0	-43.5
160	-17.8	-22.3	-26.8	-20.9	-25.4	-29.9	-28.3	-32.8	-37.3
150	-15.4	-19.9	-24.4	-17.8	-22.3	-26.8	-23.2	-27.7	-32.2
140	-13.4	-17.9	-22.4	-15.5	-20.0	-24.5	-19.9	-24.4	-28.9
130	-11.8	-16.3	-20.8	-13.4	-17.9	-22.4	-17.0	-21.5	-26.0
120	-10.3	-14.8	-19.3	-11.6	-16.1	-20.6	-14.4	-18.9	-23.4
110	-9.1	-13.6	-18.1	-10.1	-14.6	-19.1	-12.1	-16.6	-21.1
100	-8.1	-12.6	-17.1	-8.8	-13.3	-17.8	-10.3	-14.8	-19.3
90	-7.4	-11.9	-16.4	-7.9	-12.4	-16.9	-8.7	-13.2	-17.7

V1(MCG) Limit Weight (1000 LB)

ADJUSTED FIELD LENGTH (FT)	SLUSH/STANDING WATER DEPTH								
	0.12 INCHES (3 mm)			0.25 INCHES (6 mm)			0.50 INCHES (13 mm)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
4600				75.2			86.0		
5000	87.8			93.6			103.4		
5400	106.4			112.3			121.7	77.6	
5800	125.5	78.6		131.4	84.4		140.9	94.6	
6200	145.4	97.0		151.1	102.9		161.2	112.4	
6600	165.9	115.9		171.3	121.8	75.2	182.9	131.1	86.0
7000	187.2	135.4	87.8	192.1	141.2	93.6		150.9	103.4
7400		155.5	106.4		161.1	112.3		171.8	121.7
7800		176.5	125.5		181.6	131.4		194.3	140.9
8200		198.2	145.4			151.1			161.2
8600			165.9			171.3			182.9
9000			187.2			192.1			

1. **Enter Weight Adjustment table with slush/standing water depth and 22K Derate dry field/obstacle limit weight to obtain slush/standing water weight adjustment.**
2. **Adjust field length available by -120 ft/+110 ft for every 5°C above/below 4°C.**
3. **Find V1(MCG) limit weight for adjusted field length and pressure altitude.**
4. **Max allowable slush/standing water limited weight is lesser of weights from 1 and 3.**

ADVISORY INFORMATION

Slush/Standing Water Takeoff (22K Derate)
Maximum Reverse Thrust
V1 Adjustment (KIAS)

WEIGHT (1000 LB)	SLUSH/STANDING WATER DEPTH								
	0.12 INCHES (3 mm)			0.25 INCHES (6 mm)			0.50 INCHES (13 mm)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
180	-13	-10	-8	-4	-2	0	0	0	0
170	-14	-12	-9	-7	-4	-2	0	0	0
160	-15	-13	-10	-9	-7	-4	-1	0	0
150	-16	-14	-11	-11	-9	-6	-3	-1	0
140	-17	-15	-12	-13	-11	-8	-5	-3	0
130	-18	-16	-13	-15	-13	-10	-8	-5	-3
120	-19	-17	-14	-17	-14	-12	-10	-8	-5
110	-20	-18	-15	-18	-15	-13	-13	-10	-8
100	-21	-19	-16	-19	-17	-14	-15	-13	-10
90	-22	-20	-17	-21	-18	-16	-17	-15	-12

1. **Obtain V1, VR and V2 for the actual weight using the 22K Derate Dry Runway Takeoff Speeds table.**
2. **If V1(MCG) limited, set V1 = V1(MCG). If not V1(MCG) limited, enter V1 Adjustment table with the actual weight to obtain V1 speed adjustment. If adjusted V1 is less than V1(MCG), set V1 = V1(MCG). V1 not to exceed VR.**

ADVISORY INFORMATION

Slush/Standing Water Takeoff (22K Derate)

No Reverse Thrust

Weight Adjustments (1000 LB)

22K DERATE DRY FIELD/OBSTACLE LIMIT WEIGHT (1000 LB)	SLUSH/STANDING WATER DEPTH								
	0.12 INCHES (3 mm)			0.25 INCHES (6 mm)			0.50 INCHES (13 mm)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
180	-28.3	-34.8	-41.3	-32.9	-39.4	-45.9	-43.0	-49.5	-56.0
170	-24.8	-31.3	-37.8	-28.6	-35.1	-41.6	-36.9	-43.4	-49.9
160	-21.6	-28.1	-34.6	-24.8	-31.3	-37.8	-31.6	-38.1	-44.6
150	-18.9	-25.4	-31.9	-21.4	-27.9	-34.4	-26.9	-33.4	-39.9
140	-16.5	-23.0	-29.5	-18.6	-25.1	-31.6	-23.0	-29.5	-36.0
130	-14.5	-21.0	-27.5	-16.1	-22.6	-29.1	-19.8	-26.3	-32.8
120	-12.9	-19.4	-25.9	-14.2	-20.7	-27.2	-17.3	-23.8	-30.3
110	-11.6	-18.1	-24.6	-12.6	-19.1	-25.6	-15.3	-21.8	-28.3
100	-10.3	-16.8	-23.3	-11.0	-17.5	-24.0	-13.3	-19.8	-26.3
90	-9.0	-15.5	-22.0	-9.5	-16.0	-22.5	-11.4	-17.9	-24.4

V1(MCG) Limit Weight (1000 LB)

ADJUSTED FIELD LENGTH (FT)	SLUSH/STANDING WATER DEPTH								
	0.12 INCHES (3 mm)			0.25 INCHES (6 mm)			0.50 INCHES (13 mm)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
5400							81.4		
5800				77.2			100.5		
6200	82.6			98.0			120.1	79.1	
6600	104.6			119.2	74.6		140.4	98.1	
7000	127.0	79.9		141.0	95.4		161.3	117.6	76.7
7400	149.9	101.8		163.2	116.6	72.0	182.9	137.8	95.7
7800	173.4	124.1	77.2	186.1	138.2	92.8		158.6	115.2
8200	197.5	147.0	99.0		160.4	113.9		180.1	135.2
8600		170.5	121.3		183.2	135.5			156.0
9000		194.5	144.1			157.6			177.4
9400			167.5			180.3			199.6
9800			191.5						

1. **Enter Weight Adjustment table with slush/standing water depth and 22K Derate dry field/obstacle limit weight to obtain slush/standing water weight adjustment.**
2. **Adjust field length available by -140 ft/+130 ft for every 5°C above/below 4°C.**
3. **Find V1(MCG) limit weight for adjusted field length and pressure altitude.**
4. **Max allowable slush/standing water limited weight is lesser of weights from 1 and 3.**

ADVISORY INFORMATION

Slush/Standing Water Takeoff (22K Derate)
No Reverse Thrust
V1 Adjustment (KIAS)

WEIGHT (1000 LB)	SLUSH/STANDING WATER DEPTH								
	0.12 INCHES (3 mm)			0.25 INCHES (6 mm)			0.50 INCHES (13 mm)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
180	-18	-13	-8	-7	-2	0	0	0	0
170	-20	-15	-10	-10	-5	0	0	0	0
160	-21	-16	-11	-13	-8	-3	0	0	0
150	-22	-17	-12	-16	-11	-6	-2	0	0
140	-23	-18	-13	-18	-13	-8	-7	-2	0
130	-24	-19	-14	-20	-15	-10	-11	-6	-1
120	-25	-20	-15	-22	-17	-12	-14	-9	-4
110	-26	-21	-16	-23	-18	-13	-17	-12	-7
100	-27	-22	-17	-25	-20	-15	-20	-15	-10
90	-28	-23	-18	-26	-21	-16	-22	-17	-12

1. **Obtain V1, VR and V2 for the actual weight using the 22K Derate Dry Runway Takeoff Speeds table.**
2. **If V1(MCG) limited, set V1 = V1(MCG). If not V1(MCG) limited, enter V1 Adjustment table with the actual weight to obtain V1 speed adjustment. If adjusted V1 is less than V1(MCG), set V1 = V1(MCG). V1 not to exceed VR.**

ADVISORY INFORMATION

Slippery Runway Takeoff (22K Derate)

Maximum Reverse Thrust

Weight Adjustment (1000 LB)

22K DERATE DRY FIELD/OBSTACLE LIMIT WEIGHT (1000 LB)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
180	-4.0	-4.0	-4.0	-14.3	-14.3	-14.3	-23.4	-23.4	-23.4
170	-3.4	-3.4	-3.4	-13.0	-13.0	-13.0	-21.2	-21.2	-21.2
160	-2.9	-2.9	-2.9	-11.9	-11.9	-11.9	-19.3	-19.3	-19.3
150	-2.6	-2.6	-2.6	-10.9	-10.9	-10.9	-17.6	-17.6	-17.6
140	-2.4	-2.4	-2.4	-10.1	-10.1	-10.1	-16.2	-16.2	-16.2
130	-2.4	-2.4	-2.4	-9.5	-9.5	-9.5	-15.1	-15.1	-15.1
120	-2.5	-2.5	-2.5	-9.0	-9.0	-9.0	-14.2	-14.2	-14.2
110	-2.7	-2.7	-2.7	-8.7	-8.7	-8.7	-13.6	-13.6	-13.6
100	-3.1	-3.1	-3.1	-8.6	-8.6	-8.6	-13.3	-13.3	-13.3
90	-3.6	-3.6	-3.6	-8.6	-8.6	-8.6	-13.2	-13.2	-13.2

V1(MCG) Limit Weight (1000 LB)

ADJUSTED FIELD LENGTH (FT)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
3400	71.5								
3800	100.8								
4200	130.4	89.8							
4600	160.3	119.2	78.8	78.0					
5000	190.5	149.0	108.2	99.3					
5400		179.1	137.8	121.5	80.6				
5800			167.8	144.6	102.1		71.9		
6200			198.1	168.7	124.3	83.3	86.2		
6600				194.0	147.5	104.8	100.9		
7000					171.8	127.2	116.1	73.7	
7400					197.2	150.5	131.9	88.1	
7800						174.9	148.2	102.8	
8200							165.3	118.0	75.5
8600							183.2	133.9	89.9
9000								150.3	104.7
9400								167.5	120.0
9800								185.5	135.9
10200									152.4
10600									169.7
11000									187.8

1. **Enter Weight Adjustment table with reported braking action and 22K Derate dry field/obstacle limit weight to obtain slippery runway weight adjustment.**
2. **Adjust "Good" field length available by -90 ft/+80 ft for every 5°C above/below 4°C.**
   Adjust "Medium" field length available by -90 ft/+80 ft for every 5°C above/below 4°C.
   Adjust "Poor" field length available by -130 ft/+120 ft for every 5°C above/below 4°C.
3. **Find V1(MCG) limit weight for adjusted field length and pressure altitude.**
4. **Max allowable slippery runway limited weight is lesser of weights from 1 and 3.**

ADVISORY INFORMATION

Slippery Runway Takeoff (22K Derate)
Maximum Reverse Thrust
V1 Adjustment (KIAS)

WEIGHT (1000 LB)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
180	-6	-4	-3	-13	-12	-11	-24	-23	-22
170	-6	-5	-3	-14	-13	-12	-25	-24	-22
160	-6	-5	-4	-15	-14	-13	-26	-25	-24
150	-7	-6	-4	-16	-15	-14	-27	-26	-25
140	-8	-6	-5	-17	-16	-15	-29	-28	-27
130	-9	-7	-6	-19	-17	-16	-31	-30	-28
120	-10	-8	-7	-20	-19	-17	-33	-31	-30
110	-11	-9	-8	-21	-20	-19	-34	-33	-32
100	-12	-10	-9	-23	-22	-20	-36	-35	-33
90	-13	-11	-10	-24	-23	-22	-37	-36	-35

1. **Obtain V1, VR and V2 for the actual weight using the 22K Derate Dry Runway Takeoff Speeds table.**
2. **If V1(MCG) limited, set V1 = V1(MCG). If not V1(MCG) limited, enter V1 Adjustment table with the actual weight to obtain V1 speed adjustment. If adjusted V1 is less than V1(MCG), set V1 = V1(MCG). V1 not to exceed VR.**

ADVISORY INFORMATION

Slippery Runway Takeoff (22K Derate)

No Reverse Thrust

Weight Adjustments (1000 LB)

22K DERATE DRY FIELD/OBSTACLE LIMIT WEIGHT (1000 LB)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
180	-5.8	-5.8	-5.8	-18.2	-18.2	-18.2	-28.9	-28.9	-28.9
170	-5.2	-5.2	-5.2	-16.6	-16.6	-16.6	-26.2	-26.2	-26.2
160	-4.7	-4.7	-4.7	-15.3	-15.3	-15.3	-23.8	-23.8	-23.8
150	-4.3	-4.3	-4.3	-14.1	-14.1	-14.1	-21.8	-21.8	-21.8
140	-4.1	-4.1	-4.1	-13.1	-13.1	-13.1	-20.0	-20.0	-20.0
130	-4.0	-4.0	-4.0	-12.3	-12.3	-12.3	-18.6	-18.6	-18.6
120	-4.0	-4.0	-4.0	-11.7	-11.7	-11.7	-17.4	-17.4	-17.4
110	-4.1	-4.1	-4.1	-11.3	-11.3	-11.3	-16.6	-16.6	-16.6
100	-4.4	-4.4	-4.4	-11.1	-11.1	-11.1	-16.1	-16.1	-16.1
90	-4.7	-4.7	-4.7	-11.2	-11.2	-11.2	-15.9	-15.9	-15.9

V1(MCG) Limit Weight (1000 LB)

ADJUSTED FIELD LENGTH (FT)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
3800	78.4								
4200	111.1	70.2							
4600	143.6	103.0							
5000	175.8	135.5	94.8						
5400		167.8	127.4						
5800		199.8	159.7	92.2					
6200			191.8	119.8	71.9				
6600				148.1	99.0				
7000				177.1	126.8	78.7			
7400					155.3	105.9			
7800					184.5	133.8			
8200						162.5			
8600						192.0	87.9		
9000							106.9		
9400							126.6	76.3	
9800							147.1	95.0	
10200							168.3	114.2	
10600							190.5	134.2	83.2
11000								154.9	102.1
11400								176.6	121.6
11800								199.0	141.9
12200									162.9
12600									184.9

1. Enter Weight Adjustment table with reported braking action and 22K Derate dry field/obstacle limit weight to obtain slippery runway weight adjustment.
2. Adjust “Good” field length available by -90 ft/+90 ft for every 5°C above/below 4°C.
Adjust “Medium” field length available by -90 ft/+90 ft for every 5°C above/below 4°C.
Adjust “Poor” field length available by -160 ft/+150 ft for every 5°C above/below 4°C.
3. Find V1(MCG) limit weight for adjusted field length and pressure altitude.
4. Max allowable slippery runway limited weight is lesser of weights from 1 and 3.

ADVISORY INFORMATION

Slippery Runway Takeoff (22K Derate)
No Reverse Thrust
V1 Adjustment (KIAS)

WEIGHT (1000 LB)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
180	-7	-4	-2	-17	-14	-12	-33	-30	-28
170	-7	-5	-2	-18	-16	-13	-34	-32	-29
160	-8	-5	-3	-19	-17	-14	-36	-34	-31
150	-9	-6	-4	-21	-18	-16	-38	-35	-33
140	-9	-7	-4	-22	-20	-17	-40	-37	-35
130	-10	-8	-5	-24	-21	-19	-42	-39	-37
120	-12	-9	-7	-26	-23	-21	-44	-41	-39
110	-13	-10	-8	-27	-25	-22	-46	-43	-41
100	-14	-12	-9	-29	-27	-24	-48	-45	-43
90	-16	-13	-11	-31	-28	-26	-49	-47	-44

1. **Obtain V1, VR and V2 for the actual weight using the 22K Derate Dry Runway Takeoff Speeds table.**
2. **If V1(MCG) limited, set V1 = V1(MCG). If not V1(MCG) limited, enter V1 Adjustment table with the actual weight to obtain V1 speed adjustment. If adjusted V1 is less than V1(MCG), set V1 = V1(MCG). V1 not to exceed VR.**

Takeoff %N1 (22K Derate)

Based on engine bleeds for packs on, engine and wing anti-ice on or off

OAT (°C)	AIRPORT PRESSURE ALTITUDE (FT)												
	-2000	-1000	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
60	87.7	88.3	88.7	88.8	88.9	89.1	89.2	89.2	89.1	88.6	88.3	88.7	89.2
55	88.5	89.1	89.5	89.7	89.8	89.9	90.0	90.0	90.0	89.5	89.0	88.8	88.6
50	89.3	89.8	90.4	90.5	90.6	90.7	90.9	90.8	90.8	90.4	89.9	89.7	89.6
45	90.2	90.7	91.2	91.3	91.4	91.5	91.7	91.6	91.6	91.2	90.8	90.7	90.5
40	91.1	91.6	92.1	92.2	92.3	92.4	92.5	92.4	92.4	92.1	91.7	91.6	91.5
35	91.9	92.5	93.0	93.1	93.2	93.2	93.3	93.3	93.2	92.9	92.5	92.5	92.4
30	91.5	92.6	93.8	93.9	94.0	94.0	94.1	94.0	93.9	93.7	93.4	93.3	93.2
25	90.8	91.9	93.1	93.7	94.4	94.8	94.9	94.8	94.8	94.4	94.0	94.0	94.0
20	90.0	91.1	92.3	93.0	93.6	94.3	95.0	95.6	95.6	95.3	94.9	94.8	94.7
15	89.3	90.4	91.6	92.2	92.8	93.6	94.3	94.8	95.3	95.9	96.1	95.9	95.5
10	88.5	89.6	90.8	91.4	92.1	92.8	93.5	94.0	94.5	95.1	95.7	96.4	97.1
5	87.8	88.9	90.0	90.7	91.3	92.0	92.7	93.2	93.7	94.3	94.9	95.6	96.3
0	87.0	88.1	89.2	89.9	90.5	91.2	91.9	92.4	92.9	93.5	94.1	94.8	95.5
-5	86.2	87.3	88.4	89.1	89.7	90.4	91.1	91.6	92.1	92.7	93.3	94.0	94.7
-10	85.4	86.5	87.6	88.3	88.9	89.6	90.3	90.8	91.3	91.9	92.5	93.2	93.9
-15	84.6	85.7	86.8	87.5	88.1	88.8	89.4	90.0	90.5	91.1	91.7	92.4	93.1
-20	83.8	84.9	86.0	86.6	87.3	87.9	88.6	89.1	89.7	90.3	90.8	91.6	92.3
-25	83.0	84.1	85.2	85.8	86.4	87.1	87.8	88.3	88.8	89.4	90.0	90.7	91.5
-30	82.2	83.3	84.4	85.0	85.6	86.3	86.9	87.4	88.0	88.6	89.2	89.9	90.6
-35	81.4	82.4	83.5	84.1	84.7	85.4	86.1	86.6	87.1	87.7	88.3	89.0	89.8
-40	80.6	81.6	82.7	83.3	83.9	84.5	85.2	85.7	86.2	86.8	87.4	88.2	88.9
-45	79.7	80.7	81.8	82.4	83.0	83.7	84.3	84.8	85.3	86.0	86.6	87.3	88.0
-50	78.9	79.9	80.9	81.5	82.1	82.8	83.4	83.9	84.5	85.1	85.7	86.4	87.2

%N1 Adjustments for Engine Bleeds

BLEED CONFIGURATION	AIRPORT PRESSURE ALTITUDE (FT)												
	-2000	-1000	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
PACKS OFF	0.7	0.7	0.7	0.7	0.7	0.7	0.8	0.8	0.8	0.8	0.9	0.9	0.9

Assumed Temperature Reduced Thrust (22K Derate)

Maximum Assumed Temperature (Table 1 of 3)

Based on 25% Takeoff Thrust Reduction

OAT (°C)	AIRPORT PRESSURE ALTITUDE (FT)											
	-1000	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
55	73	71	69	67								
50	73	71	69	67	65	63						
45	73	71	69	67	65	63	61	59	57			
40	72	71	69	67	65	63	61	59	57	55		
35	66	66	66	66	65	63	61	59	57	55	53	
30	63	61	61	61	61	61	61	59	57	55	53	51
25	63	61	59	57	56	56	56	56	56	55	53	51
20	63	61	59	57	55	53	51	51	51	50	50	50
15	63	61	59	57	55	53	51	50	47	45	45	45
10 & BELOW	63	61	59	57	55	53	51	50	47	45	43	41

Takeoff %N1 (Table 2 of 3)

Based on engine bleeds for packs on, engine and wing anti-ice on or off

ASSUMED TEMP (°C)	AIRPORT PRESSURE ALTITUDE (FT)											
	-1000	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
75	85.7	86.0	86.7	87.4	88.2	88.9	89.5	90.1	90.2	90.2	90.6	91.1
70	86.6	87.0	87.1	87.1	87.5	88.3	88.9	89.4	89.5	89.6	90.0	90.4
65	87.4	87.8	88.0	88.0	88.2	88.3	88.3	88.8	88.9	88.9	89.4	89.8
60	88.3	88.7	88.8	88.9	89.1	89.2	89.2	89.1	88.6	88.3	88.7	89.2
55	89.1	89.5	89.7	89.8	89.9	90.0	90.0	90.0	89.5	89.0	88.8	88.6
50	89.8	90.4	90.5	90.6	90.7	90.9	90.8	90.8	90.4	89.9	89.7	89.6
45	90.7	91.2	91.3	91.4	91.5	91.7	91.6	91.6	91.2	90.8	90.7	90.5
40	91.6	92.1	92.2	92.3	92.4	92.5	92.4	92.4	92.1	91.7	91.6	91.5
35	92.5	93.0	93.1	93.2	93.2	93.3	93.3	93.2	92.9	92.5	92.5	92.4
30	92.6	93.8	93.9	94.0	94.0	94.1	94.0	93.9	93.7	93.4	93.3	93.2
25	91.9	93.1	93.7	94.4	94.8	94.9	94.8	94.8	94.4	94.0	94.0	94.0
20	91.1	92.3	93.0	93.6	94.3	95.0	95.6	95.6	95.3	94.9	94.8	94.7
15	90.4	91.6	92.2	92.8	93.6	94.3	94.8	95.3	95.9	96.1	95.9	95.5
10	89.6	90.8	91.4	92.1	92.8	93.5	94.0	94.5	95.1	95.7	96.4	97.1
MINIMUM ASSUMED TEMP (°C)	32	30	28	26	24	22	20	18	16	15	12	10

With engine bleed for packs off, increase %N1 by 0.9.

Assumed Temperature Reduced Thrust (22K Derate)
%N1 Adjustment for Temperature Difference (Table 3 of 3)

ASSUMED TEMP MINUS OAT (°C)	OUTSIDE AIR TEMPERATURE (°C)													
	-40	-20	0	5	10	15	20	25	30	35	40	45	50	55
110	11.6													
100	10.3	7.9												
90	10.8	8.4												
80	12.2	7.1	5.0											
70	11.0	7.6	5.4	5.2	3.5									
60	9.6	9.0	4.1	4.0	3.9	3.8	2.1							
50	8.0	7.7	4.5	2.8	2.6	2.7	2.6	2.4	0.8					
40		6.2	5.9	4.7	3.0	2.6	2.7	2.8	2.6	2.5	2.9			
30		4.7	4.6	4.5	4.4	4.2	4.1	4.0	4.0	3.9	3.8	3.7	3.6	
20			3.1	3.0	3.0	3.0	2.9	2.8	2.7	2.7	2.6	2.6	2.5	2.4
10			1.5	1.5	1.5	1.5	1.5	1.5	1.4	1.4	1.4	1.3	1.3	1.3
0			0	0	0	0	0	0	0	0	0	0	0	0

1. **Determine Maximum Assumed Temperature allowed from Table 1.**
2. **Find Maximum %N1 from Table 2 using the desired assumed temperature (no greater than temperature from Table 1).**
3. **Use the difference between assumed temperature and OAT to determine the %N1 adjustment from Table 3.**
4. **Subtract %N1 adjustment from Maximum %N1 in Table 2.**

Takeoff Speeds - Dry Runway (20K Derate)
Flaps 1 and 5
V1, VR, V2

WEIGHT (1000 LB)	FLAPS 1			FLAPS 5		
	V1	VR	V2	V1	VR	V2
160	148	148	151	144	144	147
150	143	143	147	140	140	143
140	137	137	142	134	135	139
130	131	131	137	128	129	134
120	124	125	131	121	122	128
110	117	118	125	115	116	123
100	110	111	119	108	109	117
90	103	104	113	100	102	111

Check V1(MCG).

V1, VR, V2 Adjustments*

TEMP		V1							VR							V2						
		PRESS ALT (1000 FT)							PRESS ALT (1000 FT)							PRESS ALT (1000 FT)						
°C	°F	-2	0	2	4	6	8	10	-2	0	2	4	6	8	10	-2	0	2	4	6	8	10
70	158	6	7						6	7						-1	-1					
60	140	4	5	5	6				4	5	5	6				-1	-1	-1	-1			
50	122	3	4	4	4	6	7	9	3	4	4	4	5	7	9	-1	0	0	0	0	-1	-1
40	104	1	2	2	2	4	6	8	1	2	2	2	4	6	8	0	0	0	0	0	0	-1
30	86	0	0	1	1	2	4	7	0	0	1	1	3	5	7	0	0	0	0	0	0	0
20	68	0	0	0	0	2	3	5	0	0	0	1	2	4	5	0	0	0	0	1	1	0
-60	-76	0	0	0	0	2	3	4	0	0	0	1	2	3	4	0	0	0	0	1	1	1

Slope and Wind V1 Adjustments*

WEIGHT (1000 LB)	SLOPE (%)					WIND (KTS)							
	-2	-1	0	1	2	-15	-10	-5	0	10	20	30	40
160	-2	-1	0	0	0	-1	0	0	0	0	0	0	0
150	-2	-1	0	0	0	-1	0	0	0	0	0	0	0
140	-2	-1	0	0	0	-1	-1	0	0	0	0	0	0
130	-2	-1	0	0	0	-1	-1	0	0	0	0	0	0
120	-2	-1	0	0	0	-1	-1	0	0	0	0	0	0
110	-1	-1	0	1	1	-1	-1	0	0	0	1	1	1
100	-1	0	0	1	1	-1	-1	0	0	0	1	1	1
90	0	0	0	1	1	-1	-1	0	0	0	1	1	1

***V1 not to exceed VR.**

V1(MCG)

TEMP		PRESSURE ALTITUDE (FT)						
°C	°F	-2000	0	2000	4000	6000	8000	10000
70	158	93	91					
60	140	93	91	92	93			
50	122	95	93	92	93	91	88	84
40	104	100	98	97	96	92	88	84
30	86	103	103	102	101	97	92	86
20	68	103	103	102	101	99	96	90
-60	-76	105	104	104	102	100	97	95

Takeoff Speeds - Dry Runway (20K Derate)
Flaps 10, 15 and 25
V1, VR, V2

WEIGHT (1000 LB)	FLAPS 10			FLAPS 15			FLAPS 25		
	V1	VR	V2	V1	VR	V2	V1	VR	V2
150	133	133	136						
140	128	128	132	125	126	130	124	124	128
130	122	123	128	120	120	125	119	119	124
120	117	117	123	115	115	121	113	114	120
110	111	111	118	109	109	116	108	108	115
100	104	105	113	103	104	111	102	102	110
90	98	99	108	97	97	106	95	96	105

Check V1(MCG).

V1, VR, V2 Adjustments*

TEMP		V1							VR							V2						
		PRESS ALT (1000 FT)							PRESS ALT (1000 FT)							PRESS ALT (1000 FT)						
°C	°F	-2	0	2	4	6	8	10	-2	0	2	4	6	8	10	-2	0	2	4	6	8	10
70	158	5	6						4	5						-2	-2					
60	140	4	4	4	5				3	4	4	4				-2	-2	-2	-2			
50	122	2	3	3	3	4	6	8	2	3	3	3	4	5	7	-1	-1	-1	-1	-2	-2	-2
40	104	1	1	1	1	2	4	7	1	1	2	2	3	4	6	0	-1	-1	-1	-1	-2	-2
30	86	0	0	0	0	1	3	5	0	0	1	1	2	3	5	0	0	0	0	-1	-1	-2
20	68	0	0	0	0	1	2	4	0	0	0	1	1	2	4	0	0	0	0	0	-1	-1
-60	-76	0	0	0	0	1	2	3	0	0	0	1	1	2	3	0	0	0	0	0	0	-1

Slope and Wind V1 Adjustments*

WEIGHT (1000 LB)	SLOPE (%)					WIND (KTS)							
	-2	-1	0	1	2	-15	-10	-5	0	10	20	30	40
150	-2	-1	0	0	0	-1	-1	0	0	0	0	0	0
140	-2	-1	0	0	0	-1	-1	0	0	0	0	0	0
130	-2	-1	0	0	0	-1	-1	0	0	0	0	0	0
120	-2	-1	0	0	0	-1	-1	0	0	0	0	0	0
110	-1	-1	0	0	0	-1	-1	0	0	0	0	0	0
100	-1	0	0	1	1	-2	-1	0	0	0	1	1	1
90	-1	0	0	1	1	-2	-1	0	0	0	1	1	1

***V1 not to exceed VR.**

V1(MCG)

TEMP		PRESSURE ALTITUDE (FT)						
°C	°F	-2000	0	2000	4000	6000	8000	10000
70	158	93	91					
60	140	93	91	92	93			
50	122	95	93	92	93	91	88	84
40	104	100	98	97	96	92	88	84
30	86	103	103	102	101	97	92	86
20	68	103	103	102	101	99	96	90
-60	-76	105	104	104	102	100	97	95

Takeoff Speeds - Wet Runway (20K Derate)
Flaps 1 and 5
V1, VR, V2

WEIGHT (1000 LB)	FLAPS 1			FLAPS 5		
	V1	VR	V2	V1	VR	V2
160	143	148	151	140	144	147
150	137	143	147	134	140	143
140	131	137	142	128	135	139
130	124	131	137	121	129	134
120	117	125	131	114	122	128
110	110	118	125	107	116	123
100	102	111	119	100	109	117
90	94	104	113	92	102	111

Check V1(MCG).

V1, VR, V2 Adjustments*

TEMP		V1							VR							V2						
		PRESS ALT (1000 FT)							PRESS ALT (1000 FT)							PRESS ALT (1000 FT)						
°C	°F	-2	0	2	4	6	8	10	-2	0	2	4	6	8	10	-2	0	2	4	6	8	10
70	158	10	11						6	7						-1	-1					
60	140	7	8	8	9				4	5	5	6				-1	-1	-1	-1			
50	122	4	5	5	5	7	10	14	3	4	4	4	5	7	9	-1	0	0	0	0	-1	-1
40	104	2	3	2	2	4	8	11	1	2	2	2	4	6	8	0	0	0	0	0	0	-1
30	86	0	0	1	1	2	5	9	0	0	1	1	3	5	7	0	0	0	0	0	0	0
20	68	0	0	0	0	2	4	7	0	0	0	1	2	4	5	0	0	0	0	1	1	0
-60	-76	0	0	0	0	2	3	5	0	0	0	1	2	3	4	0	0	0	0	1	1	1

Slope and Wind V1 Adjustments*

WEIGHT (1000 LB)	SLOPE (%)					WIND (KTS)							
	-2	-1	0	1	2	-15	-10	-5	0	10	20	30	40
160	-4	-2	0	2	5	-3	-2	-1	0	1	1	2	2
150	-4	-2	0	2	4	-3	-2	-1	0	1	1	2	2
140	-4	-2	0	2	4	-3	-2	-1	0	1	1	2	2
130	-4	-2	0	2	4	-3	-2	-1	0	1	1	2	2
120	-3	-1	0	2	4	-3	-2	-1	0	1	1	2	3
110	-3	-1	0	2	3	-3	-2	-1	0	1	2	2	3
100	-2	-1	0	2	3	-4	-2	-1	0	1	2	3	3
90	-2	-1	0	2	3	-4	-2	-1	0	1	2	3	4

***V1 not to exceed VR.**

V1(MCG)

TEMP		PRESSURE ALTITUDE (FT)						
°C	°F	-2000	0	2000	4000	6000	8000	10000
70	158	93	91					
60	140	93	91	92	93			
50	122	95	93	92	93	91	88	84
40	104	100	98	97	96	92	88	84
30	86	103	103	102	101	97	92	86
20	68	103	103	102	101	99	96	90
-60	-76	105	104	104	102	100	97	95

Takeoff Speeds - Wet Runway (20K Derate)
Flaps 10, 15 and 25
V1, VR, V2

WEIGHT (1000 LB)	FLAPS 10			FLAPS 15			FLAPS 25		
	V1	VR	V2	V1	VR	V2	V1	VR	V2
150	130	133	136						
140	123	128	132	122	126	130	122	124	128
130	116	123	128	116	120	125	115	119	124
120	110	117	123	110	115	121	108	114	120
110	104	111	118	103	109	116	102	108	115
100	97	105	113	96	104	111	95	102	110
90	90	99	108	89	97	106	88	96	105

Check V1(MCG).

V1, VR, V2 Adjustments*

TEMP		V1							VR							V2						
		PRESS ALT (1000 FT)							PRESS ALT (1000 FT)							PRESS ALT (1000 FT)						
°C	°F	-2	0	2	4	6	8	10	-2	0	2	4	6	8	10	-2	0	2	4	6	8	10
70	158	8	10						4	5						-2	-2					
60	140	6	7	7	8				3	4	4	4				-2	-2	-2	-2			
50	122	4	5	4	4	6	9	13	2	3	3	3	4	5	7	-1	-1	-1	-1	-2	-2	-2
40	104	1	2	2	2	3	6	10	1	1	2	2	3	4	6	0	-1	-1	-1	-1	-2	-2
30	86	0	0	0	0	2	4	7	0	0	1	1	2	3	5	0	0	0	0	-1	-1	-2
20	68	0	0	0	0	1	2	5	0	0	0	1	1	2	4	0	0	0	0	0	-1	-1
-60	-76	0	0	0	0	1	2	3	0	0	0	1	1	2	3	0	0	0	0	0	0	-1

Slope and Wind V1 Adjustments*

WEIGHT (1000 LB)	SLOPE (%)					WIND (KTS)							
	-2	-1	0	1	2	-15	-10	-5	0	10	20	30	40
150	-4	-2	0	2	3	-3	-2	-1	0	1	1	2	2
140	-3	-2	0	2	3	-3	-2	-1	0	1	1	2	2
130	-3	-2	0	2	3	-3	-2	-1	0	1	1	2	3
120	-3	-1	0	2	3	-3	-2	-1	0	1	1	2	3
110	-3	-1	0	1	3	-3	-2	-1	0	1	2	2	3
100	-2	-1	0	1	3	-4	-2	-1	0	1	2	2	3
90	-2	-1	0	1	2	-4	-3	-1	0	1	2	3	3

***V1 not to exceed VR.**

V1(MCG)

TEMP		PRESSURE ALTITUDE (FT)						
°C	°F	-2000	0	2000	4000	6000	8000	10000
70	158	93	91					
60	140	93	91	92	93			
50	122	95	93	92	93	91	88	84
40	104	100	98	97	96	92	88	84
30	86	103	103	102	101	97	92	86
20	68	103	103	102	101	99	96	90
-60	-76	105	104	104	102	100	97	95

Stab Trim Setting (20K Derate)

Flaps 1 and 5

WEIGHT (1000 LB)	C.G. (%MAC)								
	9	11	13	16	20	24	28	31	33
160 - 180	8 1/2	8 1/2	8 1/2	8	7	6 1/4	5 1/2	4 3/4	4 1/4
140	8 1/2	8 1/2	8	7 1/2	6 3/4	5 3/4	5	4 1/2	4
120	8 1/2	8	7 3/4	7	6 1/4	5 1/4	4 1/2	4	3 1/2
80 - 100	7 3/4	7 1/4	6 3/4	6 1/4	5 1/2	4 3/4	4	3 1/4	3

Flaps 10, 15 and 25

WEIGHT (1000 LB)	C.G. (%MAC)								
	9	11	13	16	20	24	28	31	33
160 - 180	8 1/2	8 1/2	8 1/2	7 3/4	6 3/4	6	5	4 1/2	4
140	8 1/2	8 1/2	8	7 1/4	6 1/4	5 1/2	4 3/4	4	3 1/2
120	8 1/2	8	7 1/2	6 3/4	6	5	4 1/4	3 1/2	3 1/4
80 - 100	7 1/4	7	6 1/2	6	5 1/4	4 1/2	3 1/2	3	2 3/4

ADVISORY INFORMATION

Slush/Standing Water Takeoff (20K Derate)

Maximum Reverse Thrust

Weight Adjustments (1000 LB)

20K DERATE DRY FIELD/OBSTACLE LIMIT WEIGHT (1000 LB)	SLUSH/STANDING WATER DEPTH								
	0.12 INCHES (3 mm)			0.25 INCHES (6 mm)			0.50 INCHES (13 mm)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
180	-25.5	-29.0	-32.5	-31.3	-34.8	-38.3	-48.1	-51.6	-55.1
170	-22.0	-25.5	-29.0	-26.8	-30.3	-33.8	-39.9	-43.4	-46.9
160	-18.9	-22.4	-25.9	-22.8	-26.3	-29.8	-32.6	-36.1	-39.6
150	-16.2	-19.7	-23.2	-19.3	-22.8	-26.3	-26.4	-29.9	-33.4
140	-13.7	-17.2	-20.7	-16.1	-19.6	-23.1	-21.6	-25.1	-28.6
130	-11.6	-15.1	-18.6	-13.5	-17.0	-20.5	-17.7	-21.2	-24.7
120	-10.0	-13.5	-17.0	-11.5	-15.0	-18.5	-14.7	-18.2	-21.7
110	-8.6	-12.1	-15.6	-9.9	-13.4	-16.9	-12.5	-16.0	-19.5
100	-8.0	-11.5	-15.0	-8.9	-12.4	-15.9	-10.9	-14.4	-17.9
90	-7.6	-11.1	-14.6	-8.3	-11.8	-15.3	-10.1	-13.6	-17.1

V1(MCG) Limit Weight (1000 LB)

ADJUSTED FIELD LENGTH (FT)	SLUSH/STANDING WATER DEPTH								
	0.12 INCHES (3 mm)			0.25 INCHES (6 mm)			0.50 INCHES (13 mm)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
4200				74.0			82.1		
4600	88.5			93.2			100.5		
5000	108.0			112.6			119.5	72.9	
5400	128.2	78.8		132.6	83.6		139.0	91.3	
5800	149.0	98.2		153.3	102.8		159.2	109.9	
6200	170.6	118.0		174.7	122.5	74.0	180.2	129.2	82.1
6600	193.0	138.5	88.5	196.8	142.9	93.2		149.0	100.5
7000		159.7	108.0		163.9	112.6		169.6	119.5
7400		181.7	128.2		185.6	132.6		191.0	139.0
7800			149.0			153.3			159.2
8200			170.6			174.7			180.2
8600			193.0			196.8			

1. **Enter Weight Adjustment table with slush/standing water depth and 20K Derate dry field/obstacle limit weight to obtain slush/standing water weight adjustment.**
2. **Adjust field length available by -100 ft/+90 ft for every 5°C above/below 4°C.**
3. **Find V1(MCG) limit weight for adjusted field length and pressure altitude.**
4. **Max allowable slush/standing water limited weight is lesser of weights from 1 and 3.**

ADVISORY INFORMATION

Slush/Standing Water Takeoff (20K Derate)
Maximum Reverse Thrust
V1 Adjustment (KIAS)

WEIGHT (1000 LB)	SLUSH/STANDING WATER DEPTH								
	0.12 INCHES (3 mm)			0.25 INCHES (6 mm)			0.50 INCHES (13 mm)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
180	-7	-2	0	0	0	0	0	0	0
170	-9	-4	0	0	0	0	0	0	0
160	-11	-6	-1	-4	0	0	0	0	0
150	-13	-8	-3	-7	-2	0	0	0	0
140	-14	-9	-4	-10	-5	0	0	0	0
130	-16	-11	-6	-12	-7	-2	-4	0	0
120	-17	-12	-7	-14	-9	-4	-7	-2	0
110	-18	-13	-8	-15	-10	-5	-10	-5	0
100	-19	-14	-9	-17	-12	-7	-13	-8	-3
90	-19	-14	-9	-18	-13	-8	-15	-10	-5

1. **Obtain V1, VR and V2 for the actual weight using the 20K Derate Dry Runway Takeoff Speeds table.**
2. **If V1(MCG) limited, set V1 = V1(MCG). If not V1(MCG) limited, enter V1 Adjustment table with the actual weight to obtain V1 speed adjustment. If adjusted V1 is less than V1(MCG), set V1 = V1(MCG). V1 not to exceed VR.**

ADVISORY INFORMATION

Slush/Standing Water Takeoff (20K Derate)

No Reverse Thrust

Weight Adjustments (1000 LB)

20K DERATE DRY FIELD/OBSTACLE LIMIT WEIGHT (1000 LB)	SLUSH/STANDING WATER DEPTH								
	0.12 INCHES (3 mm)			0.25 INCHES (6 mm)			0.50 INCHES (13 mm)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
180	-31.6	-37.6	-43.6	-37.7	-43.7	-49.7	-51.4	-57.4	-63.4
170	-27.2	-33.2	-39.2	-32.1	-38.1	-44.1	-43.1	-49.1	-55.1
160	-23.3	-29.3	-35.3	-27.3	-33.3	-39.3	-36.0	-42.0	-48.0
150	-19.9	-25.9	-31.9	-23.1	-29.1	-35.1	-29.9	-35.9	-41.9
140	-17.1	-23.1	-29.1	-19.6	-25.6	-31.6	-24.8	-30.8	-36.8
130	-14.9	-20.9	-26.9	-16.8	-22.8	-28.8	-20.9	-26.9	-32.9
120	-13.1	-19.1	-25.1	-14.6	-20.6	-26.6	-18.1	-24.1	-30.1
110	-11.8	-17.8	-23.8	-13.0	-19.0	-25.0	-16.0	-22.0	-28.0
100	-10.5	-16.5	-22.5	-11.4	-17.4	-23.4	-14.0	-20.0	-26.0
90	-9.2	-15.2	-21.2	-9.8	-15.8	-21.8	-12.1	-18.1	-24.1

V1(MCG) Limit Weight (1000 LB)

ADJUSTED FIELD LENGTH (FT)	SLUSH/STANDING WATER DEPTH								
	0.12 INCHES (3 mm)			0.25 INCHES (6 mm)			0.50 INCHES (13 mm)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
5000							80.2		
5400				79.3			99.5		
5800	88.2			101.6			120.8	73.3	
6200	112.2			124.4	71.1		145.1	92.1	
6600	136.6	79.2		148.0	93.2		174.0	112.5	
7000	161.2	103.2		172.3	115.8			135.5	84.9
7400	186.2	127.4	70.3	197.5	139.1	84.8		162.4	104.6
7800		152.0	94.2		163.1	107.2		196.0	126.5
8200		176.8	118.3		188.0	130.3			151.8
8600			142.7			154.0			182.4
9000			167.4			178.6			
9400			192.5						

1. **Enter Weight Adjustment table with slush/standing water depth and 20K Derate dry field/obstacle limit weight to obtain slush/standing water weight adjustment.**
2. **Adjust field length available by -120 ft/+110 ft for every 5°C above/below 4°C.**
3. **Find V1(MCG) limit weight for adjusted field length and pressure altitude.**
4. **Max allowable slush/standing water limited weight is lesser of weights from 1 and 3.**

ADVISORY INFORMATION

Slush/Standing Water Takeoff (20K Derate)
No Reverse Thrust
V1 Adjustment (KIAS)

WEIGHT (1000 LB)	SLUSH/STANDING WATER DEPTH								
	0.12 INCHES (3 mm)			0.25 INCHES (6 mm)			0.50 INCHES (13 mm)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
180	-13	-11	-8	0	0	0	0	0	0
170	-15	-13	-10	-3	0	0	0	0	0
160	-17	-14	-12	-7	-4	-2	0	0	0
150	-18	-16	-13	-11	-8	-6	0	0	0
140	-20	-17	-15	-14	-11	-9	0	0	0
130	-21	-19	-16	-17	-14	-12	-5	-3	0
120	-22	-20	-17	-19	-16	-14	-10	-7	-5
110	-23	-21	-18	-21	-18	-16	-14	-11	-9
100	-24	-22	-19	-22	-20	-17	-17	-14	-12
90	-25	-23	-20	-23	-21	-18	-19	-17	-14

1. **Obtain V1, VR and V2 for the actual weight using the 20K Derate Dry Runway Takeoff Speeds table.**
2. **If V1(MCG) limited, set V1 = V1(MCG). If not V1(MCG) limited, enter V1 Adjustment table with the actual weight to obtain V1 speed adjustment. If adjusted V1 is less than V1(MCG), set V1 = V1(MCG). V1 not to exceed VR.**

ADVISORY INFORMATION

Slippery Runway Takeoff (20K Derate)

Maximum Reverse Thrust

Weight Adjustment (1000 LB)

20K DERATE DRY FIELD/OBSTACLE LIMIT WEIGHT (1000 LB)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
180	-4.4	-4.4	-4.4	-14.2	-14.2	-14.2	-23.2	-23.2	-23.2
170	-3.5	-3.5	-3.5	-12.9	-12.9	-12.9	-21.1	-21.1	-21.1
160	-3.1	-3.1	-3.1	-11.7	-11.7	-11.7	-19.2	-19.2	-19.2
150	-2.5	-2.5	-2.5	-10.6	-10.6	-10.6	-17.5	-17.5	-17.5
140	-2.1	-2.1	-2.1	-9.6	-9.6	-9.6	-15.9	-15.9	-15.9
130	-1.8	-1.8	-1.8	-8.8	-8.8	-8.8	-14.6	-14.6	-14.6
120	-1.7	-1.7	-1.7	-8.2	-8.2	-8.2	-13.5	-13.5	-13.5
110	-1.7	-1.7	-1.7	-7.8	-7.8	-7.8	-12.7	-12.7	-12.7
100	-1.9	-1.9	-1.9	-7.5	-7.5	-7.5	-12.1	-12.1	-12.1
90	-2.2	-2.2	-2.2	-7.3	-7.3	-7.3	-11.7	-11.7	-11.7

V1(MCG) Limit Weight (1000 LB)

ADJUSTED FIELD LENGTH (FT)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
3400	84.7								
3800	114.6								
4200	144.5	95.9							
4600	174.5	125.8	77.3	91.3					
5000		155.8	107.1	113.9					
5400		185.7	137.1	137.4	88.5				
5800			167.0	161.8	111.1		82.9		
6200			197.0	187.1	134.4	85.7	98.2		
6600					158.7	108.2	114.0		
7000					183.9	131.5	130.4	82.9	
7400						155.6	147.4	98.2	
7800						180.7	165.2	114.0	
8200							183.8	130.4	82.9
8600								147.4	98.2
9000								165.2	114.0
9400								183.8	130.4
9800									147.4
10200									165.2
10600									183.8

1. **Enter Weight Adjustment table with reported braking action and 20K Derate dry field/obstacle limit weight to obtain slippery runway weight adjustment.**
2. **Adjust "Good" field length available by -80 ft/+70 ft for every 5°C above/below 4°C.**
   Adjust "Medium" field length available by -80 ft/+70 ft for every 5°C above/below 4°C.
   Adjust "Poor" field length available by -120 ft/+110 ft for every 5°C above/below 4°C.
3. **Find V1(MCG) limit weight for adjusted field length and pressure altitude.**
4. **Max allowable slippery runway limited weight is lesser of weights from 1 and 3.**

ADVISORY INFORMATION

Slippery Runway Takeoff (20K Derate)
Maximum Reverse Thrust
V1 Adjustment (KIAS)

WEIGHT (1000 LB)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
180	-4	-3	-2	-12	-10	-9	-21	-20	-19
170	-5	-3	-2	-12	-11	-10	-21	-20	-19
160	-5	-4	-3	-13	-11	-10	-22	-21	-20
150	-6	-4	-3	-14	-12	-11	-24	-22	-21
140	-6	-5	-4	-15	-14	-12	-25	-24	-23
130	-7	-6	-5	-16	-15	-14	-27	-26	-25
120	-8	-7	-6	-18	-16	-15	-29	-28	-27
110	-9	-8	-7	-19	-18	-17	-31	-30	-29
100	-10	-9	-8	-21	-19	-18	-33	-32	-30
90	-11	-10	-9	-22	-21	-20	-35	-33	-32

1. **Obtain V1, VR and V2 for the actual weight using the 20K Derate Dry Runway Takeoff Speeds table.**
2. **If V1(MCG) limited, set V1 = V1(MCG). If not V1(MCG) limited, enter V1 Adjustment table with the actual weight to obtain V1 speed adjustment. If adjusted V1 is less than V1(MCG), set V1 = V1(MCG). V1 not to exceed VR.**

ADVISORY INFORMATION

Slippery Runway Takeoff (20K Derate)

No Reverse Thrust

Weight Adjustments (1000 LB)

20K DERATE DRY FIELD/OBSTACLE LIMIT WEIGHT (1000 LB)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
180	-6.9	-6.9	-6.9	-19.0	-19.0	-19.0	-30.0	-30.0	-30.0
170	-5.8	-5.8	-5.8	-17.0	-17.0	-17.0	-27.0	-27.0	-27.0
160	-4.9	-4.9	-4.9	-15.4	-15.4	-15.4	-24.4	-24.4	-24.4
150	-4.2	-4.2	-4.2	-13.9	-13.9	-13.9	-22.1	-22.1	-22.1
140	-3.7	-3.7	-3.7	-12.8	-12.8	-12.8	-20.1	-20.1	-20.1
130	-3.5	-3.5	-3.5	-11.9	-11.9	-11.9	-18.5	-18.5	-18.5
120	-3.5	-3.5	-3.5	-11.3	-11.3	-11.3	-17.1	-17.1	-17.1
110	-3.7	-3.7	-3.7	-10.9	-10.9	-10.9	-16.1	-16.1	-16.1
100	-4.2	-4.2	-4.2	-10.8	-10.8	-10.8	-15.4	-15.4	-15.4
90	-4.8	-4.8	-4.8	-10.9	-10.9	-10.9	-15.0	-15.0	-15.0

V1(MCG) Limit Weight (1000 LB)

ADJUSTED FIELD LENGTH (FT)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
3800	96.4								
4200	129.1	83.9							
4600	161.2	116.9	71.4						
5000	192.6	149.2	104.6						
5400		180.9	137.2	88.4					
5800			169.1	116.9					
6200				145.8	92.0				
6600				175.0	120.5				
7000					149.4	95.5			
7400					178.7	124.1			
7800						153.1	73.5		
8200						182.4	93.6		
8600							114.3		
9000							135.4	76.0	
9400							157.2	96.2	
9800							179.6	116.9	
10200								138.1	78.5
10600								160.0	98.7
11000								182.5	119.5
11400									140.8
11800									162.7
12200									185.3

1. **Enter Weight Adjustment table with reported braking action and 20K Derate dry field/obstacle limit weight to obtain slippery runway weight adjustment.**
2. **Adjust "Good" field length available by -90 ft/+80 ft for every 5°C above/below 4°C.**
   Adjust "Medium" field length available by -90 ft/+80 ft for every 5°C above/below 4°C.
   Adjust "Poor" field length available by -140 ft/+130 ft for every 5°C above/below 4°C.
3. **Find V1(MCG) limit weight for adjusted field length and pressure altitude.**
4. **Max allowable slippery runway limited weight is lesser of weights from 1 and 3.**

ADVISORY INFORMATION

Slippery Runway Takeoff (20K Derate)
No Reverse Thrust
V1 Adjustment (KIAS)

WEIGHT (1000 LB)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
180	-9	-7	-4	-19	-17	-14	-34	-31	-29
170	-8	-5	-3	-18	-15	-13	-32	-30	-27
160	-7	-5	-2	-17	-15	-12	-32	-30	-27
150	-7	-5	-2	-18	-15	-13	-33	-31	-28
140	-8	-5	-3	-19	-16	-14	-35	-33	-30
130	-9	-6	-4	-21	-18	-16	-37	-35	-32
120	-10	-8	-5	-23	-20	-18	-40	-37	-35
110	-11	-9	-6	-25	-22	-20	-42	-40	-37
100	-13	-10	-8	-27	-24	-22	-44	-42	-39
90	-14	-11	-9	-28	-25	-23	-45	-43	-40

1. **Obtain V1, VR and V2 for the actual weight using the 20K Derate Dry Runway Takeoff Speeds table.**
2. **If V1(MCG) limited, set V1 = V1(MCG). If not V1(MCG) limited, enter V1 Adjustment table with the actual weight to obtain V1 speed adjustment. If adjusted V1 is less than V1(MCG), set V1 = V1(MCG). V1 not to exceed VR.**

Takeoff %N1 (20K Derate)

Based on engine bleeds for packs on, engine and wing anti-ice on or off

OAT (°C)	AIRPORT PRESSURE ALTITUDE (FT)												
	-2000	-1000	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
60	84.0	84.4	84.7	86.1	87.3	88.1	89.1	89.3	89.5	88.8	88.2	87.9	87.5
55	84.8	85.3	85.8	87.0	88.1	89.0	90.0	90.1	90.3	89.6	88.8	87.9	86.9
50	85.8	86.3	86.8	87.9	88.9	89.8	90.8	90.9	91.0	90.3	89.6	88.7	87.7
45	86.8	87.2	87.7	88.7	89.7	90.7	91.7	91.7	91.7	91.1	90.4	89.5	88.6
40	87.7	88.2	88.6	89.7	90.6	91.6	92.5	92.4	92.4	91.8	91.2	90.3	89.4
35	88.6	89.0	89.5	90.6	91.5	92.4	93.4	93.3	93.2	92.5	91.9	91.0	90.1
30	88.2	89.3	90.5	91.4	92.5	93.3	94.3	94.1	94.0	93.4	92.7	91.8	90.9
25	87.5	88.6	89.7	90.7	91.8	92.7	93.8	94.2	94.7	94.2	93.5	92.6	91.7
20	86.8	87.9	89.0	90.0	91.1	91.9	93.0	93.4	93.9	94.5	94.3	93.4	92.5
15	86.0	87.2	88.3	89.3	90.3	91.2	92.2	92.6	93.1	93.7	94.2	94.2	93.4
10	85.3	86.4	87.5	88.5	89.6	90.4	91.5	91.9	92.3	92.9	93.4	93.7	94.3
5	84.6	85.7	86.8	87.7	88.8	89.6	90.7	91.1	91.6	92.1	92.6	92.9	93.5
0	83.8	84.9	86.0	87.0	88.0	88.9	89.9	90.3	90.8	91.4	91.8	92.1	92.7
-5	83.1	84.2	85.2	86.2	87.2	88.1	89.1	89.5	90.0	90.5	91.0	91.3	91.9
-10	82.3	83.4	84.5	85.4	86.4	87.3	88.3	88.7	89.2	89.7	90.2	90.5	91.0
-15	81.6	82.6	83.7	84.6	85.6	86.5	87.5	87.9	88.3	88.9	89.3	89.7	90.2
-20	80.8	81.8	82.9	83.8	84.8	85.7	86.7	87.0	87.5	88.1	88.5	88.8	89.4
-25	80.0	81.1	82.1	83.0	84.0	84.8	85.8	86.2	86.7	87.3	87.7	88.0	88.5
-30	79.2	80.3	81.3	82.2	83.2	84.0	85.0	85.4	85.8	86.4	86.8	87.2	87.7
-35	78.4	79.5	80.5	81.4	82.4	83.2	84.1	84.5	85.0	85.6	86.0	86.3	86.8
-40	77.6	78.6	79.6	80.6	81.5	82.3	83.3	83.7	84.1	84.7	85.1	85.4	86.0
-45	76.8	77.8	78.8	79.7	80.7	81.5	82.4	82.8	83.3	83.8	84.2	84.5	85.1
-50	76.0	77.0	78.0	78.9	79.8	80.6	81.6	81.9	82.4	82.9	83.3	83.7	84.2

%N1 Adjustments for Engine Bleeds

BLEED CONFIGURATION	AIRPORT PRESSURE ALTITUDE (FT)												
	-2000	-1000	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
PACKS OFF	0.7	0.7	0.7	0.7	0.7	0.7	0.8	0.8	0.8	0.8	0.9	0.9	0.9

Assumed Temperature Reduced Thrust (20K Derate)

Maximum Assumed Temperature (Table 1 of 3)

Based on 25% Takeoff Thrust Reduction

OAT (°C)	AIRPORT PRESSURE ALTITUDE (FT)											
	-1000	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
55	73	71	69	67								
50	73	71	69	67	65	63						
45	73	71	69	67	65	63	61	59	57			
40	69	68	69	67	65	63	61	59	57	55		
35	64	63	65	66	65	63	61	59	57	55	53	
30	61	59	60	61	61	61	61	59	57	55	53	51
25	61	59	60	60	60	60	59	58	57	55	53	51
20	61	59	60	60	60	60	59	58	53	51	52	51
15	61	59	60	60	60	60	59	58	53	49	46	46
10 & BELOW	61	59	60	60	60	60	59	58	53	49	45	40

Takeoff %N1 (Table 2 of 3)

Based on engine bleeds for packs on, engine and wing anti-ice on or off

ASSUMED TEMP (°C)	AIRPORT PRESSURE ALTITUDE (FT)											
	-1000	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
75	81.4	81.5	84.0	85.8	87.2	88.8	89.7	90.6	90.4	90.1	89.8	89.4
70	82.5	82.6	84.3	85.5	86.6	88.2	89.1	89.9	89.7	89.5	89.2	88.8
65	83.4	83.7	85.2	86.4	87.2	88.2	88.5	89.3	89.1	88.9	88.6	88.1
60	84.4	84.7	86.1	87.3	88.1	89.1	89.3	89.5	88.8	88.2	87.9	87.5
55	85.3	85.8	87.0	88.1	89.0	90.0	90.1	90.3	89.6	88.8	87.9	86.9
50	86.3	86.8	87.9	88.9	89.8	90.8	90.9	91.0	90.3	89.6	88.7	87.7
45	87.2	87.7	88.7	89.7	90.7	91.7	91.7	91.7	91.1	90.4	89.5	88.6
40	88.2	88.6	89.7	90.6	91.6	92.5	92.4	92.4	91.8	91.2	90.3	89.4
35	89.0	89.5	90.6	91.5	92.4	93.4	93.3	93.2	92.5	91.9	91.0	90.1
30	89.3	90.5	91.4	92.5	93.3	94.3	94.1	94.0	93.4	92.7	91.8	90.9
25	88.6	89.7	90.7	91.8	92.7	93.8	94.2	94.7	94.2	93.5	92.6	91.7
20	87.9	89.0	90.0	91.1	91.9	93.0	93.4	93.9	94.5	94.3	93.4	92.5
15	87.2	88.3	89.3	90.3	91.2	92.2	92.6	93.1	93.7	94.2	94.2	93.4
10	86.4	87.5	88.5	89.6	90.4	91.5	91.9	92.3	92.9	93.4	93.7	94.3
MINIMUM ASSUMED TEMP (°C)	32	30	30	30	29	29	27	25	21	18	14	10

With engine bleed for packs off, increase %N1 by 0.9.

Assumed Temperature Reduced Thrust (20K Derate)
%N1 Adjustment for Temperature Difference (Table 3 of 3)

ASSUMED TEMP MINUS OAT (°C)	OUTSIDE AIR TEMPERATURE (°C)													
	-40	-20	0	5	10	15	20	25	30	35	40	45	50	55
110	11.2													
100	10.3	6.0												
90	10.5	8.2												
80	11.8	7.1	3.2											
70	10.7	7.4	5.3	3.6	1.8									
60	9.2	8.7	4.1	4.0	3.9	2.2	0.5							
50	7.8	7.5	4.3	2.7	2.6	3.7	2.7	0.9	0.5					
40		6.0	5.7	4.4	2.8	2.9	3.3	3.1	1.4	1.1	0.8			
30		4.6	4.4	4.3	4.2	4.1	4.0	3.9	3.5	3.3	3.0	2.8	3.4	
20			3.0	2.9	2.9	2.9	2.8	2.7	2.6	2.6	2.5	2.5	2.4	2.3
10			1.5	1.5	1.5	1.5	1.4	1.4	1.4	1.3	1.3	1.3	1.2	1.2
0			0	0	0	0	0	0	0	0	0	0	0	0

1. **Determine Maximum Assumed Temperature allowed from Table 1.**
2. **Find Maximum %N1 from Table 2 using the desired assumed temperature (no greater than temperature from Table 1).**
3. **Use the difference between assumed temperature and OAT to determine the %N1 adjustment from Table 3.**
4. **Subtract %N1 adjustment from Maximum %N1 in Table 2.**

Max Climb %N1

Based on engine bleed for packs on or off and anti-ice off

TAT (°C)	PRESSURE ALTITUDE (FT)/SPEED (KIAS/MACH)									
	0	5000	10000	15000	20000	25000	30000	35000	37000	41000
	280	280	280	280	280	280	280	.78	.78	.78
60	89.4	89.7	89.7	89.8	89.6	91.4	93.0	94.4	94.5	92.8
55	90.2	90.5	90.5	90.7	90.0	90.8	92.4	93.7	93.8	92.1
50	90.9	91.2	91.3	91.5	91.0	90.8	91.7	93.0	93.1	91.4
45	91.6	91.9	92.1	92.3	91.9	91.7	91.7	92.3	92.4	90.7
40	92.4	92.6	92.9	93.1	92.7	92.5	92.5	91.6	91.7	90.0
35	92.9	93.3	93.6	93.8	93.6	93.3	93.3	92.4	91.7	90.1
30	92.2	94.1	94.3	94.6	94.4	94.1	94.0	93.2	92.6	91.1
25	91.5	94.1	95.0	95.2	95.2	94.8	94.7	94.0	93.4	92.1
20	90.7	93.3	95.8	96.0	95.9	95.6	95.4	94.7	94.2	93.0
15	90.0	92.5	95.2	96.8	96.7	96.3	96.1	95.5	95.0	94.0
10	89.2	91.8	94.4	97.1	97.6	97.0	96.7	96.2	95.8	94.9
5	88.4	91.0	93.6	96.3	98.5	97.9	97.4	97.0	96.6	95.8
0	87.7	90.2	92.8	95.5	97.9	99.0	98.4	97.8	97.5	96.7
-5	86.9	89.4	92.0	94.7	97.2	98.9	99.4	98.6	98.3	97.7
-10	86.1	88.6	91.2	93.9	96.4	98.1	99.7	99.5	99.2	98.7
-15	85.3	87.8	90.3	93.1	95.6	97.4	98.9	100.5	100.1	99.7
-20	84.5	87.0	89.5	92.3	94.8	96.6	98.1	100.2	100.7	100.3
-25	83.7	86.1	88.7	91.4	94.1	95.8	97.3	99.3	99.9	99.5
-30	82.9	85.3	87.8	90.6	93.3	95.0	96.5	98.5	99.0	98.7
-35	82.0	84.5	87.0	89.8	92.4	94.1	95.6	97.6	98.2	97.8
-40	81.2	83.6	86.1	88.9	91.6	93.3	94.8	96.8	97.3	96.9

%N1 Adjustments for Engine Bleeds

BLEED CONFIGURATION	PRESSURE ALTITUDE (1000 FT)					
	0	10	20	30	35	41
ENGINE ANTI-ICE	-0.6	-0.8	-0.9	-0.9	-0.8	-0.8
ENGINE & WING ANTI-ICE*	-1.8	-2.1	-2.5	-2.7	-3.0	-3.0

***Dual bleed sources**

Go-around %N1

Based on engine bleed for packs on, engine and wing anti-ice on or off

AIRPORT OAT		TAT (°C)	AIRPORT PRESSURE ALTITUDE (FT)											
°C	°F		-2000	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
57	134	60	91.0	91.8	91.8									
52	125	55	91.7	92.6	92.6	92.5	92.5							
47	116	50	92.5	93.3	93.3	93.3	93.3	93.3	93.2	93.2				
42	108	45	93.3	94.1	94.1	94.1	94.0	94.0	94.0	93.9	93.9	93.8		
37	99	40	94.1	94.9	94.9	94.8	94.8	94.7	94.7	94.6	94.6	94.6	94.5	94.4
32	90	35	94.3	95.8	95.8	95.7	95.7	95.6	95.5	95.5	95.4	95.3	95.3	95.2
27	81	30	93.5	95.7	96.3	96.5	96.5	96.4	96.4	96.3	96.2	96.2	96.1	96.0
22	72	25	92.8	94.9	95.5	96.1	96.7	97.3	97.3	97.2	97.1	97.0	97.0	96.9
17	63	20	92.0	94.2	94.7	95.3	95.9	96.5	97.2	97.9	98.3	98.2	98.1	98.0
12	54	15	91.3	93.4	94.0	94.5	95.1	95.8	96.5	97.2	97.9	98.7	99.4	99.4
7	45	10	90.5	92.6	93.2	93.8	94.4	95.0	95.7	96.4	97.1	97.9	98.7	99.5
2	36	5	89.7	91.8	92.4	93.0	93.6	94.2	94.9	95.6	96.4	97.1	98.0	98.8
-3	27	0	89.0	91.0	91.6	92.2	92.8	93.4	94.1	94.8	95.6	96.4	97.2	98.1
-8	18	-5	88.2	90.2	90.8	91.4	92.0	92.6	93.3	94.0	94.8	95.6	96.4	97.3
-13	9	-10	87.4	89.4	90.0	90.6	91.1	91.8	92.5	93.2	94.0	94.8	95.7	96.5
-17	1	-15	86.6	88.6	89.2	89.7	90.3	90.9	91.7	92.4	93.2	94.0	94.9	95.8
-22	-8	-20	85.8	87.8	88.3	88.9	89.5	90.1	90.8	91.6	92.3	93.2	94.1	95.0
-27	-17	-25	84.9	86.9	87.5	88.1	88.6	89.3	90.0	90.7	91.5	92.3	93.3	94.2
-32	-26	-30	84.1	86.1	86.7	87.2	87.8	88.4	89.2	89.9	90.7	91.5	92.5	93.4
-37	-35	-35	83.3	85.2	85.8	86.3	86.9	87.6	88.3	89.0	89.8	90.7	91.6	92.6
-42	-44	-40	82.4	84.4	84.9	85.5	86.1	86.7	87.4	88.2	89.0	89.8	90.8	91.8
-47	-53	-45	81.6	83.5	84.1	84.6	85.2	85.8	86.6	87.3	88.1	89.0	90.0	90.9
-52	-62	-50	80.7	82.6	83.2	83.7	84.3	84.9	85.7	86.4	87.2	88.1	89.1	90.1

%N1 Adjustments for Engine Bleeds

BLEED CONFIGURATION	PRESSURE ALTITUDE (FT)											
	-2000	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
PACKS OFF	0.6	0.8	0.8	0.8	0.8	0.8	0.8	0.9	0.9	0.9	1.0	0.9
A/C HIGH	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1

Flight With Unreliable Airspeed / Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

CLIMB (280/.76)

Flaps Up, Set Max Climb Thrust

PRESSURE ALTITUDE (FT)		WEIGHT (1000 LB)				
		90	110	130	150	170
40000	**PITCH ATT**	**4.0**	**4.0**	**4.0**		
	V/S (FT/MIN)	1700	1100	500		
30000	**PITCH ATT**	**4.0**	**4.0**	**4.0**	**4.0**	**4.0**
	V/S (FT/MIN)	2500	2000	1500	1200	900
20000	**PITCH ATT**	**7.5**	**6.5**	**6.0**	**6.0**	**6.0**
	V/S (FT/MIN)	4100	3300	2700	2200	1800
10000	**PITCH ATT**	**11.0**	**9.5**	**9.0**	**8.5**	**8.0**
	V/S (FT/MIN)	5600	4500	3700	3100	2600
SEA LEVEL	**PITCH ATT**	**15.0**	**12.5**	**11.5**	**10.5**	**10.0**
	V/S (FT/MIN)	6700	5400	4500	3800	3300

CRUISE (.76/280)

Flaps Up, %N1 for Level Flight

PRESSURE ALTITUDE (FT)		WEIGHT (1000 LB)				
		90	110	130	150	170
40000	**PITCH ATT**	**2.0**	**2.5**	**3.5**		
	%N1	**83.0**	**85.7**	**90.3**		
35000	**PITCH ATT**	**1.5**	**2.0**	**2.5**	**3.0**	**3.5**
	%N1	**81.0**	**82.5**	**84.5**	**87.1**	**91.4**
30000	**PITCH ATT**	**1.0**	**1.5**	**2.0**	**2.5**	**3.0**
	%N1	**80.3**	**81.2**	**82.5**	**84.1**	**86.0**
25000	**PITCH ATT**	**1.0**	**1.5**	**2.0**	**2.5**	**3.0**
	%N1	**76.7**	**77.6**	**78.8**	**80.3**	**82.1**
20000	**PITCH ATT**	**1.0**	**1.5**	**2.0**	**2.5**	**3.5**
	%N1	**73.1**	**73.9**	**75.0**	**76.4**	**78.1**
15000	**PITCH ATT**	**1.0**	**1.5**	**2.0**	**3.0**	**3.5**
	%N1	**69.2**	**70.2**	**71.3**	**72.6**	**74.2**

Flight With Unreliable Airspeed / Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

DESCENT (.76/280)

Flaps Up, Set Idle Thrust

PRESSURE ALTITUDE (FT)		WEIGHT (1000 LB)				
		90	110	130	150	170
40000	**PITCH ATT**	**-1.5**	**-0.5**	**0.0**	**0.5**	**1.0**
	V/S (FT/MIN)	-2800	-2600	-2600	-2800	-3000
30000	**PITCH ATT**	**-3.0**	**-2.0**	**-1.0**	**-0.5**	**0.0**
	V/S (FT/MIN)	-3000	-2500	-2300	-2100	-2000
20000	**PITCH ATT**	**-3.0**	**-2.0**	**-1.0**	**0.0**	**0.5**
	V/S (FT/MIN)	-2700	-2300	-2000	-1900	-1800
10000	**PITCH ATT**	**-3.0**	**-2.0**	**-1.0**	**0.0**	**0.5**
	V/S (FT/MIN)	-2400	-2000	-1800	-1700	-1600
SEA LEVEL	**PITCH ATT**	**-3.0**	**-2.0**	**-1.0**	**0.0**	**0.5**
	V/S (FT/MIN)	-2200	-1800	-1600	-1500	-1400

HOLDING (VREF40 + 70)

Flaps Up, %N1 for Level Flight

PRESSURE ALTITUDE (FT)		WEIGHT (1000 LB)				
		90	110	130	150	170
15000	**PITCH ATT**	**5.0**	**5.0**	**5.0**	**5.0**	**5.0**
	%N1	**56.9**	**62.2**	**66.1**	**69.8**	**73.1**
	KIAS	178	196	213	229	245
10000	**PITCH ATT**	**5.0**	**5.0**	**5.0**	**5.0**	**5.0**
	%N1	**53.2**	**57.8**	**62.3**	**65.8**	**68.9**
	KIAS	178	195	213	228	243
5000	**PITCH ATT**	**5.5**	**5.5**	**5.0**	**5.0**	**5.0**
	%N1	**49.6**	**54.2**	**58.1**	**61.8**	**65.3**
	KIAS	178	194	212	228	243

Flight With Unreliable Airspeed / Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

TERMINAL AREA (5000 FT)

%N1 for Level Flight

Airport Altitude = -2000 FT

FLAP POSITION (VREF + INCREMENT)		WEIGHT (1000 LB) 90	110	130	150	170
FLAPS UP (GEAR UP)	**PITCH ATT**	**5.0**	**5.5**	**6.0**	**6.0**	**6.5**
	%N1	**48.2**	**52.5**	**56.4**	**59.8**	**63.2**
VREF40+70	KIAS	178	190	200	210	219
FLAPS 1 (GEAR UP)	**PITCH ATT**	**5.0**	**5.5**	**6.0**	**6.0**	**6.5**
	%N1	**50.1**	**54.6**	**58.5**	**62.2**	**65.6**
VREF40+50	KIAS	158	170	180	190	199
FLAPS 5 (GEAR UP)	**PITCH ATT**	**5.5**	**6.0**	**6.5**	**6.5**	**7.0**
	%N1	**50.4**	**55.2**	**59.5**	**63.5**	**67.0**
VREF40+30	KIAS	138	150	160	170	179
FLAPS 10 (GEAR UP)	**PITCH ATT**	**5.0**	**5.5**	**6.0**	**6.0**	**6.5**
	%N1	**53.4**	**58.2**	**62.6**	**66.5**	**69.9**
VREF40+30	KIAS	138	150	160	170	179
FLAPS 15 (GEAR UP)	**PITCH ATT**	**5.5**	**6.0**	**6.5**	**6.5**	**6.5**
	%N1	**53.7**	**58.7**	**63.2**	**67.2**	**70.7**
VREF40+20	KIAS	128	140	150	160	169
FLAPS 25 (GEAR UP)	**PITCH ATT**	**7.0**	**7.0**	**7.5**	**7.5**	**7.5**
	%N1	**54.6**	**59.9**	**64.5**	**68.4**	**72.1**
VREF40+10	KIAS	118	130	140	150	159
FLAPS 15 (GEAR DOWN)	**PITCH ATT**	**6.0**	**6.0**	**6.5**	**6.5**	**7.0**
	%N1	**58.0**	**63.2**	**67.7**	**71.7**	**75.3**
VREF40+20	KIAS	128	140	150	160	169

Flight With Unreliable Airspeed / Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

TERMINAL AREA (5000 FT)
%N1 for Level Flight
Airport Altitude = -1000 FT

FLAP POSITION (VREF + INCREMENT)		WEIGHT (1000 LB) 90	110	130	150	170
FLAPS UP (GEAR UP) VREF40+70	**PITCH ATT**	**5.0**	**5.5**	**6.0**	**6.0**	**6.5**
	%N1	**48.9**	**53.2**	**57.0**	**60.5**	**64.0**
	KIAS	178	190	200	211	219
FLAPS 1 (GEAR UP) VREF40+50	**PITCH ATT**	**5.0**	**5.5**	**6.0**	**6.0**	**6.5**
	%N1	**50.8**	**55.3**	**59.2**	**63.0**	**66.3**
	KIAS	158	170	180	191	199
FLAPS 5 (GEAR UP) VREF40+30	**PITCH ATT**	**5.5**	**6.0**	**6.5**	**6.5**	**7.0**
	%N1	**51.1**	**56.0**	**60.3**	**64.3**	**67.8**
	KIAS	138	150	160	171	179
FLAPS 10 (GEAR UP) VREF40+30	**PITCH ATT**	**5.0**	**5.5**	**6.0**	**6.0**	**6.5**
	%N1	**54.1**	**59.0**	**63.4**	**67.3**	**70.8**
	KIAS	138	150	160	171	179
FLAPS 15 (GEAR UP) VREF40+20	**PITCH ATT**	**5.5**	**6.0**	**6.5**	**6.5**	**6.5**
	%N1	**54.4**	**59.5**	**64.0**	**68.0**	**71.6**
	KIAS	128	140	150	161	169
FLAPS 25 (GEAR UP) VREF40+10	**PITCH ATT**	**7.0**	**7.0**	**7.5**	**7.5**	**7.5**
	%N1	**55.4**	**60.7**	**65.3**	**69.2**	**72.9**
	KIAS	118	130	140	151	159
FLAPS 15 (GEAR DOWN) VREF40+20	**PITCH ATT**	**6.0**	**6.0**	**6.5**	**6.5**	**7.0**
	%N1	**58.7**	**64.0**	**68.5**	**72.6**	**76.1**
	KIAS	128	140	150	161	169

Flight With Unreliable Airspeed / Turbulent Air Penetration
Altitude and/or vertical speed indications may also be unreliable.

TERMINAL AREA (5000 FT)
%N1 for Level Flight
Airport Altitude = SEA LEVEL

FLAP POSITION (VREF + INCREMENT)		WEIGHT (1000 LB) 90	110	130	150	170
FLAPS UP (GEAR UP) VREF40+70	**PITCH ATT**	**5.0**	**5.5**	**6.0**	**6.0**	**6.5**
	%N1	**49.7**	**53.9**	**57.8**	**61.4**	**64.8**
	KIAS	178	190	201	211	219
FLAPS 1 (GEAR UP) VREF40+50	**PITCH ATT**	**5.0**	**5.5**	**6.0**	**6.0**	**6.5**
	%N1	**51.5**	**56.0**	**60.0**	**63.8**	**67.1**
	KIAS	158	170	181	191	199
FLAPS 5 (GEAR UP) VREF40+30	**PITCH ATT**	**5.5**	**6.0**	**6.5**	**6.5**	**7.0**
	%N1	**51.9**	**56.7**	**61.1**	**65.1**	**68.6**
	KIAS	138	150	161	171	179
FLAPS 10 (GEAR UP) VREF40+30	**PITCH ATT**	**5.0**	**5.5**	**6.0**	**6.0**	**6.5**
	%N1	**54.8**	**59.8**	**64.2**	**68.1**	**71.6**
	KIAS	138	150	161	171	179
FLAPS 15 (GEAR UP) VREF40+20	**PITCH ATT**	**5.5**	**6.0**	**6.5**	**6.5**	**6.5**
	%N1	**55.1**	**60.3**	**64.9**	**68.8**	**72.5**
	KIAS	128	140	151	161	169
FLAPS 25 (GEAR UP) VREF40+10	**PITCH ATT**	**7.0**	**7.0**	**7.0**	**7.5**	**7.5**
	%N1	**56.1**	**61.5**	**66.1**	**70.0**	**73.8**
	KIAS	118	130	141	151	159
FLAPS 15 (GEAR DOWN) VREF40+20	**PITCH ATT**	**6.0**	**6.0**	**6.5**	**6.5**	**7.0**
	%N1	**59.5**	**64.9**	**69.3**	**73.4**	**77.0**
	KIAS	128	140	151	161	169

Flight With Unreliable Airspeed / Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

TERMINAL AREA (5000 FT)
%N1 for Level Flight
Airport Altitude = 1000 FT

FLAP POSITION (VREF + INCREMENT)		WEIGHT (1000 LB)				
		90	110	130	150	170
FLAPS UP (GEAR UP) VREF40+70	**PITCH ATT**	**5.0**	**5.5**	**6.0**	**6.0**	**6.5**
	%N1	**50.4**	**54.6**	**58.5**	**62.2**	**65.6**
	KIAS	178	190	201	211	220
FLAPS 1 (GEAR UP) VREF40+50	**PITCH ATT**	**5.0**	**5.5**	**6.0**	**6.0**	**6.5**
	%N1	**52.2**	**56.8**	**60.8**	**64.6**	**67.8**
	KIAS	158	170	181	191	200
FLAPS 5 (GEAR UP) VREF40+30	**PITCH ATT**	**5.5**	**6.0**	**6.5**	**6.5**	**7.0**
	%N1	**52.6**	**57.4**	**62.0**	**65.9**	**69.4**
	KIAS	138	150	161	171	180
FLAPS 10 (GEAR UP) VREF40+30	**PITCH ATT**	**5.0**	**5.5**	**6.0**	**6.0**	**6.5**
	%N1	**55.5**	**60.6**	**65.0**	**68.9**	**72.5**
	KIAS	138	150	161	171	180
FLAPS 15 (GEAR UP) VREF40+20	**PITCH ATT**	**5.5**	**6.0**	**6.0**	**6.5**	**6.5**
	%N1	**55.8**	**61.1**	**65.7**	**69.6**	**73.3**
	KIAS	128	140	151	161	170
FLAPS 25 (GEAR UP) VREF40+10	**PITCH ATT**	**7.0**	**7.0**	**7.0**	**7.5**	**7.5**
	%N1	**56.9**	**62.3**	**66.8**	**70.9**	**74.6**
	KIAS	118	130	141	151	160
FLAPS 15 (GEAR DOWN) VREF40+20	**PITCH ATT**	**6.0**	**6.0**	**6.5**	**6.5**	**7.0**
	%N1	**60.3**	**65.7**	**70.1**	**74.3**	**77.8**
	KIAS	128	140	151	161	170

Flight With Unreliable Airspeed / Turbulent Air Penetration
Altitude and/or vertical speed indications may also be unreliable.

TERMINAL AREA (5000 FT)
%N1 for Level Flight
Airport Altitude = 2000 FT

FLAP POSITION (VREF + INCREMENT)		WEIGHT (1000 LB) 90	110	130	150	170
FLAPS UP (GEAR UP)	**PITCH ATT**	**5.0**	**5.5**	**6.0**	**6.0**	**6.5**
	%N1	**51.0**	**55.3**	**59.3**	**63.1**	**66.3**
VREF40+70	KIAS	178	190	201	211	220
FLAPS 1 (GEAR UP)	**PITCH ATT**	**5.0**	**5.5**	**6.0**	**6.0**	**6.5**
	%N1	**52.9**	**57.5**	**61.7**	**65.3**	**68.6**
VREF40+50	KIAS	158	170	181	191	200
FLAPS 5 (GEAR UP)	**PITCH ATT**	**5.5**	**6.0**	**6.5**	**6.5**	**7.0**
	%N1	**53.3**	**58.2**	**62.8**	**66.7**	**70.2**
VREF40+30	KIAS	138	150	161	171	180
FLAPS 10 (GEAR UP)	**PITCH ATT**	**5.0**	**5.5**	**6.0**	**6.0**	**6.5**
	%N1	**56.3**	**61.4**	**65.9**	**69.8**	**73.4**
VREF40+30	KIAS	138	150	161	171	180
FLAPS 15 (GEAR UP)	**PITCH ATT**	**5.5**	**6.0**	**6.0**	**6.5**	**6.5**
	%N1	**56.6**	**61.9**	**66.5**	**70.5**	**74.1**
VREF40+20	KIAS	128	140	151	161	170
FLAPS 25 (GEAR UP)	**PITCH ATT**	**7.0**	**7.0**	**7.0**	**7.0**	**7.5**
	%N1	**57.7**	**63.1**	**67.6**	**71.8**	**75.4**
VREF40+10	KIAS	118	130	141	151	160
FLAPS 15 (GEAR DOWN)	**PITCH ATT**	**6.0**	**6.0**	**6.5**	**6.5**	**6.5**
	%N1	**61.2**	**66.4**	**71.0**	**75.2**	**78.7**
VREF40+20	KIAS	128	140	151	161	170

Flight With Unreliable Airspeed / Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

TERMINAL AREA (5000 FT)
%N1 for Level Flight
Airport Altitude = 3000 FT

FLAP POSITION (VREF + INCREMENT)		WEIGHT (1000 LB) 90	110	130	150	170
FLAPS UP (GEAR UP) VREF40+70	**PITCH ATT**	**5.0**	**5.5**	**6.0**	**6.0**	**6.5**
	%N1	**51.7**	**56.1**	**60.0**	**63.9**	**67.0**
	KIAS	178	190	201	212	220
FLAPS 1 (GEAR UP) VREF40+50	**PITCH ATT**	**5.0**	**5.5**	**6.0**	**6.0**	**6.5**
	%N1	**53.7**	**58.3**	**62.5**	**66.1**	**69.4**
	KIAS	158	170	181	192	200
FLAPS 5 (GEAR UP) VREF40+30	**PITCH ATT**	**5.5**	**6.0**	**6.5**	**6.5**	**7.0**
	%N1	**54.0**	**59.0**	**63.6**	**67.5**	**71.0**
	KIAS	138	150	161	172	180
FLAPS 10 (GEAR UP) VREF40+30	**PITCH ATT**	**5.0**	**5.5**	**6.0**	**6.0**	**6.5**
	%N1	**57.1**	**62.3**	**66.7**	**70.6**	**74.2**
	KIAS	138	150	161	172	180
FLAPS 15 (GEAR UP) VREF40+20	**PITCH ATT**	**5.5**	**6.0**	**6.0**	**6.5**	**6.5**
	%N1	**57.4**	**62.7**	**67.2**	**71.3**	**75.0**
	KIAS	128	140	151	162	170
FLAPS 25 (GEAR UP) VREF40+10	**PITCH ATT**	**7.0**	**7.0**	**7.0**	**7.0**	**7.5**
	%N1	**58.5**	**64.0**	**68.4**	**72.6**	**76.2**
	KIAS	118	130	141	152	160
FLAPS 15 (GEAR DOWN) VREF40+20	**PITCH ATT**	**6.0**	**6.0**	**6.5**	**6.5**	**6.5**
	%N1	**62.0**	**67.2**	**71.9**	**76.0**	**79.6**
	KIAS	128	140	151	162	170

Flight With Unreliable Airspeed / Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

TERMINAL AREA (5000 FT)
%N1 for Level Flight
Airport Altitude = 4000 FT

FLAP POSITION (VREF + INCREMENT)		WEIGHT (1000 LB) 90	110	130	150	170
FLAPS UP (GEAR UP) VREF40+70	**PITCH ATT**	**5.0**	**5.5**	**6.0**	**6.0**	**6.5**
	%N1	**52.3**	**56.8**	**60.9**	**64.7**	**67.8**
	KIAS	178	190	202	212	221
FLAPS 1 (GEAR UP) VREF40+50	**PITCH ATT**	**5.0**	**5.5**	**5.5**	**6.0**	**6.5**
	%N1	**54.5**	**59.0**	**63.4**	**66.9**	**70.3**
	KIAS	158	170	182	192	201
FLAPS 5 (GEAR UP) VREF40+30	**PITCH ATT**	**5.5**	**6.0**	**6.5**	**6.5**	**7.0**
	%N1	**54.8**	**59.9**	**64.4**	**68.2**	**71.9**
	KIAS	138	150	162	172	181
FLAPS 10 (GEAR UP) VREF40+30	**PITCH ATT**	**5.0**	**5.5**	**6.0**	**6.0**	**6.0**
	%N1	**57.8**	**63.0**	**67.4**	**71.5**	**75.0**
	KIAS	138	150	162	172	181
FLAPS 15 (GEAR UP) VREF40+20	**PITCH ATT**	**5.5**	**6.0**	**6.0**	**6.5**	**6.5**
	%N1	**58.2**	**63.5**	**68.1**	**72.3**	**75.8**
	KIAS	128	140	152	162	171
FLAPS 25 (GEAR UP) VREF40+10	**PITCH ATT**	**7.0**	**7.0**	**7.0**	**7.0**	**7.5**
	%N1	**59.3**	**64.8**	**69.3**	**73.5**	**77.0**
	KIAS	118	130	142	152	161
FLAPS 15 (GEAR DOWN) VREF40+20	**PITCH ATT**	**6.0**	**6.0**	**6.5**	**6.5**	**6.5**
	%N1	**62.8**	**68.0**	**72.8**	**76.8**	**80.5**
	KIAS	128	140	152	162	171

Flight With Unreliable Airspeed / Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

TERMINAL AREA (5000 FT)
%N1 for Level Flight
Airport Altitude = 5000 FT

FLAP POSITION (VREF + INCREMENT)		WEIGHT (1000 LB)				
		90	110	130	150	170
FLAPS UP (GEAR UP) VREF40+70	**PITCH ATT**	**5.0**	**5.5**	**6.0**	**6.0**	**6.5**
	%N1	**53.0**	**57.5**	**61.7**	**65.4**	**68.6**
	KIAS	178	190	202	212	221
FLAPS 1 (GEAR UP) VREF40+50	**PITCH ATT**	**5.0**	**5.5**	**5.5**	**6.0**	**6.5**
	%N1	**55.2**	**59.9**	**64.1**	**67.7**	**71.1**
	KIAS	158	170	182	192	201
FLAPS 5 (GEAR UP) VREF40+30	**PITCH ATT**	**5.5**	**6.0**	**6.5**	**6.5**	**7.0**
	%N1	**55.5**	**60.7**	**65.2**	**69.1**	**72.7**
	KIAS	138	150	162	172	181
FLAPS 10 (GEAR UP) VREF40+30	**PITCH ATT**	**5.0**	**5.5**	**5.5**	**6.0**	**6.0**
	%N1	**58.7**	**63.9**	**68.3**	**72.4**	**75.8**
	KIAS	138	150	162	172	181
FLAPS 15 (GEAR UP) VREF40+20	**PITCH ATT**	**5.5**	**6.0**	**6.0**	**6.5**	**6.5**
	%N1	**59.0**	**64.4**	**68.9**	**73.1**	**76.6**
	KIAS	128	140	152	162	171
FLAPS 25 (GEAR UP) VREF40+10	**PITCH ATT**	**7.0**	**7.0**	**7.0**	**7.0**	**7.5**
	%N1	**60.1**	**65.5**	**70.2**	**74.3**	**77.9**
	KIAS	118	130	142	152	161
FLAPS 15 (GEAR DOWN) VREF40+20	**PITCH ATT**	**6.0**	**6.0**	**6.5**	**6.5**	**6.5**
	%N1	**63.6**	**68.9**	**73.7**	**77.7**	**81.4**
	KIAS	128	140	152	162	171

Flight With Unreliable Airspeed / Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

TERMINAL AREA (5000 FT)
%N1 for Level Flight
Airport Altitude = 6000 FT

FLAP POSITION (VREF + INCREMENT)		WEIGHT (1000 LB)				
		90	110	130	150	170
FLAPS UP (GEAR UP) VREF40+70	**PITCH ATT**	**5.0**	**5.5**	**5.5**	**6.0**	**6.5**
	%N1	**53.8**	**58.3**	**62.6**	**66.2**	**69.4**
	KIAS	178	190	202	213	221
FLAPS 1 (GEAR UP) VREF40+50	**PITCH ATT**	**5.0**	**5.5**	**5.5**	**6.0**	**6.5**
	%N1	**55.9**	**60.7**	**64.9**	**68.5**	**72.0**
	KIAS	158	170	182	193	201
FLAPS 5 (GEAR UP) VREF40+30	**PITCH ATT**	**5.5**	**6.0**	**6.5**	**6.5**	**6.5**
	%N1	**56.3**	**61.6**	**66.0**	**69.9**	**73.5**
	KIAS	138	150	162	173	181
FLAPS 10 (GEAR UP) VREF40+30	**PITCH ATT**	**5.0**	**5.5**	**5.5**	**6.0**	**6.0**
	%N1	**59.5**	**64.7**	**69.2**	**73.2**	**76.6**
	KIAS	138	150	162	173	181
FLAPS 15 (GEAR UP) VREF40+20	**PITCH ATT**	**5.5**	**6.0**	**6.0**	**6.0**	**6.5**
	%N1	**59.8**	**65.2**	**69.8**	**74.0**	**77.4**
	KIAS	128	140	152	163	171
FLAPS 25 (GEAR UP) VREF40+10	**PITCH ATT**	**7.0**	**7.0**	**7.0**	**7.0**	**7.0**
	%N1	**60.9**	**66.3**	**71.0**	**75.1**	**78.8**
	KIAS	118	130	142	153	161
FLAPS 15 (GEAR DOWN) VREF40+20	**PITCH ATT**	**6.0**	**6.0**	**6.0**	**6.5**	**6.5**
	%N1	**64.4**	**69.8**	**74.5**	**78.6**	**82.2**
	KIAS	128	140	152	163	171

Flight With Unreliable Airspeed / Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

TERMINAL AREA (5000 FT)
%N1 for Level Flight
Airport Altitude = 7000 FT

FLAP POSITION (VREF + INCREMENT)		WEIGHT (1000 LB) 90	110	130	150	170
FLAPS UP (GEAR UP) VREF40+70	**PITCH ATT**	**5.0**	**5.5**	**5.5**	**6.0**	**6.5**
	%N1	**54.5**	**59.1**	**63.4**	**66.9**	**70.2**
	KIAS	178	191	202	213	222
FLAPS 1 (GEAR UP) VREF40+50	**PITCH ATT**	**5.0**	**5.5**	**5.5**	**6.0**	**6.5**
	%N1	**56.7**	**61.6**	**65.7**	**69.3**	**72.9**
	KIAS	158	171	182	193	202
FLAPS 5 (GEAR UP) VREF40+30	**PITCH ATT**	**5.5**	**6.0**	**6.0**	**6.5**	**6.5**
	%N1	**57.1**	**62.4**	**66.8**	**70.7**	**74.3**
	KIAS	138	151	162	173	182
FLAPS 10 (GEAR UP) VREF40+30	**PITCH ATT**	**5.0**	**5.5**	**5.5**	**6.0**	**6.0**
	%N1	**60.3**	**65.5**	**70.0**	**74.0**	**77.4**
	KIAS	138	151	162	173	182
FLAPS 15 (GEAR UP) VREF40+20	**PITCH ATT**	**5.5**	**6.0**	**6.0**	**6.0**	**6.5**
	%N1	**60.7**	**66.0**	**70.7**	**74.7**	**78.3**
	KIAS	128	141	152	163	172
FLAPS 25 (GEAR UP) VREF40+10	**PITCH ATT**	**7.0**	**7.0**	**7.0**	**7.0**	**7.0**
	%N1	**61.8**	**67.1**	**71.9**	**75.9**	**79.7**
	KIAS	118	131	142	153	162
FLAPS 15 (GEAR DOWN) VREF40+20	**PITCH ATT**	**6.0**	**6.0**	**6.0**	**6.5**	**6.5**
	%N1	**65.2**	**70.7**	**75.4**	**79.5**	**83.1**
	KIAS	128	141	152	163	172

Flight With Unreliable Airspeed / Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

TERMINAL AREA (5000 FT)
%N1 for Level Flight
Airport Altitude = 8000 FT

FLAP POSITION (VREF + INCREMENT)		WEIGHT (1000 LB) 90	110	130	150	170
FLAPS UP (GEAR UP) VREF40+70	**PITCH ATT**	**5.0**	**5.5**	**5.5**	**6.0**	**6.5**
	%N1	**55.3**	**59.9**	**64.2**	**67.7**	**71.0**
	KIAS	178	191	203	213	222
FLAPS 1 (GEAR UP) VREF40+50	**PITCH ATT**	**5.0**	**5.5**	**5.5**	**6.0**	**6.5**
	%N1	**57.4**	**62.4**	**66.5**	**70.2**	**73.7**
	KIAS	158	171	183	193	202
FLAPS 5 (GEAR UP) VREF40+30	**PITCH ATT**	**5.5**	**6.0**	**6.0**	**6.5**	**6.5**
	%N1	**57.9**	**63.2**	**67.6**	**71.6**	**75.1**
	KIAS	138	151	163	173	182
FLAPS 10 (GEAR UP) VREF40+30	**PITCH ATT**	**5.0**	**5.5**	**5.5**	**6.0**	**6.0**
	%N1	**61.2**	**66.3**	**70.9**	**74.8**	**78.3**
	KIAS	138	151	163	173	182
FLAPS 15 (GEAR UP) VREF40+20	**PITCH ATT**	**5.5**	**6.0**	**6.0**	**6.0**	**6.5**
	%N1	**61.5**	**66.8**	**71.6**	**75.5**	**79.2**
	KIAS	128	141	153	163	172
FLAPS 25 (GEAR UP) VREF40+10	**PITCH ATT**	**7.0**	**7.0**	**7.0**	**7.0**	**7.0**
	%N1	**62.6**	**68.0**	**72.8**	**76.8**	**80.6**
	KIAS	118	131	143	153	162
FLAPS 15 (GEAR DOWN) VREF40+20	**PITCH ATT**	**6.0**	**6.0**	**6.0**	**6.5**	**6.5**
	%N1	**66.0**	**71.6**	**76.2**	**80.4**	**84.1**
	KIAS	128	141	153	163	172

Flight With Unreliable Airspeed / Turbulent Air Penetration
Altitude and/or vertical speed indications may also be unreliable.

TERMINAL AREA (5000 FT)
%N1 for Level Flight
Airport Altitude = 9000 FT

FLAP POSITION (VREF + INCREMENT)		WEIGHT (1000 LB) 90	110	130	150	170
FLAPS UP (GEAR UP)	**PITCH ATT**	**5.0**	**5.5**	**5.5**	**6.0**	**6.5**
	%N1	**56.0**	**60.8**	**65.0**	**68.4**	**71.9**
VREF40+70	KIAS	179	191	203	214	223
FLAPS 1 (GEAR UP)	**PITCH ATT**	**5.0**	**5.5**	**5.5**	**6.0**	**6.0**
	%N1	**58.2**	**63.2**	**67.3**	**71.1**	**74.5**
VREF40+50	KIAS	159	171	183	194	203
FLAPS 5 (GEAR UP)	**PITCH ATT**	**5.5**	**6.0**	**6.0**	**6.5**	**6.5**
	%N1	**58.7**	**64.0**	**68.4**	**72.5**	**75.9**
VREF40+30	KIAS	139	151	163	174	183
FLAPS 10 (GEAR UP)	**PITCH ATT**	**5.0**	**5.5**	**5.5**	**6.0**	**6.0**
	%N1	**62.0**	**67.2**	**71.8**	**75.6**	**79.2**
VREF40+30	KIAS	139	151	163	174	183
FLAPS 15 (GEAR UP)	**PITCH ATT**	**5.5**	**6.0**	**6.0**	**6.0**	**6.5**
	%N1	**62.3**	**67.7**	**72.5**	**76.4**	**80.0**
VREF40+20	KIAS	129	141	153	164	173
FLAPS 25 (GEAR UP)	**PITCH ATT**	**7.0**	**7.0**	**7.0**	**7.0**	**7.0**
	%N1	**63.5**	**68.8**	**73.6**	**77.7**	**81.4**
VREF40+10	KIAS	119	131	143	154	163
FLAPS 15 (GEAR DOWN)	**PITCH ATT**	**6.0**	**6.0**	**6.0**	**6.0**	**6.5**
	%N1	**66.9**	**72.5**	**77.1**	**81.3**	**85.0**
VREF40+20	KIAS	129	141	153	164	173

Flight With Unreliable Airspeed / Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

TERMINAL AREA (5000 FT)
%N1 for Level Flight
Airport Altitude = 10000 FT

FLAP POSITION (VREF + INCREMENT)		WEIGHT (1000 LB)				
		90	110	130	150	170
FLAPS UP (GEAR UP) VREF40+70	**PITCH ATT**	**5.0**	**5.5**	**5.5**	**6.0**	**6.5**
	%N1	**56.8**	**61.7**	**65.7**	**69.3**	**72.7**
	KIAS	179	191	203	214	223
FLAPS 1 (GEAR UP) VREF40+50	**PITCH ATT**	**5.0**	**5.5**	**5.5**	**6.0**	**6.0**
	%N1	**59.1**	**64.0**	**68.1**	**72.0**	**75.3**
	KIAS	159	171	183	194	203
FLAPS 5 (GEAR UP) VREF40+30	**PITCH ATT**	**5.5**	**6.0**	**6.0**	**6.5**	**6.5**
	%N1	**59.6**	**64.9**	**69.3**	**73.3**	**76.8**
	KIAS	139	151	163	174	183
FLAPS 10 (GEAR UP) VREF40+30	**PITCH ATT**	**5.0**	**5.5**	**5.5**	**6.0**	**6.0**
	%N1	**62.8**	**68.1**	**72.6**	**76.5**	**80.1**
	KIAS	139	151	163	174	183
FLAPS 15 (GEAR UP) VREF40+20	**PITCH ATT**	**5.5**	**6.0**	**6.0**	**6.0**	**6.5**
	%N1	**63.1**	**68.5**	**73.3**	**77.2**	**81.0**
	KIAS	129	141	153	164	173
FLAPS 25 (GEAR UP) VREF40+10	**PITCH ATT**	**7.0**	**7.0**	**7.0**	**7.0**	**7.0**
	%N1	**64.2**	**69.8**	**74.4**	**78.6**	**82.3**
	KIAS	119	131	143	154	163
FLAPS 15 (GEAR DOWN) VREF40+20	**PITCH ATT**	**6.0**	**6.0**	**6.0**	**6.0**	**6.5**
	%N1	**67.7**	**73.3**	**78.1**	**82.2**	**85.9**
	KIAS	129	141	153	164	173

Flight With Unreliable Airspeed / Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

TERMINAL AREA (5000 FT)
%N1 for Level Flight
Airport Altitude = 11000 FT

FLAP POSITION (VREF + INCREMENT)		WEIGHT (1000 LB) 90	110	130	150	170
FLAPS UP (GEAR UP) VREF40+70	**PITCH ATT**	**5.0**	**5.5**	**5.5**	**6.0**	**6.5**
	%N1	**57.6**	**62.6**	**66.4**	**70.1**	**73.5**
	KIAS	179	192	204	214	224
FLAPS 1 (GEAR UP) VREF40+50	**PITCH ATT**	**5.0**	**5.5**	**5.5**	**6.0**	**6.0**
	%N1	**60.1**	**64.8**	**69.1**	**72.9**	**76.1**
	KIAS	159	172	184	194	204
FLAPS 5 (GEAR UP) VREF40+30	**PITCH ATT**	**5.5**	**6.0**	**6.0**	**6.5**	**6.5**
	%N1	**60.7**	**65.8**	**70.3**	**74.2**	**77.7**
	KIAS	139	152	164	174	184
FLAPS 10 (GEAR UP) VREF40+30	**PITCH ATT**	**5.0**	**5.5**	**5.5**	**5.5**	**6.0**
	%N1	**63.8**	**69.1**	**73.6**	**77.4**	**81.1**
	KIAS	139	152	164	174	184
FLAPS 15 (GEAR UP) VREF40+20	**PITCH ATT**	**5.5**	**6.0**	**6.0**	**6.0**	**6.0**
	%N1	**64.2**	**69.7**	**74.2**	**78.3**	**81.9**
	KIAS	129	142	154	164	174
FLAPS 25 (GEAR UP) VREF40+10	**PITCH ATT**	**7.0**	**7.0**	**7.0**	**7.0**	**7.0**
	%N1	**65.3**	**70.9**	**75.4**	**79.6**	**83.3**
	KIAS	119	132	144	154	164
FLAPS 15 (GEAR DOWN) VREF40+20	**PITCH ATT**	**6.0**	**6.0**	**6.0**	**6.0**	**6.5**
	%N1	**68.9**	**74.3**	**79.1**	**83.2**	**87.0**
	KIAS	129	142	154	164	174

Flight With Unreliable Airspeed / Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

TERMINAL AREA (5000 FT)
%N1 for Level Flight
Airport Altitude = 12000 FT

FLAP POSITION (VREF + INCREMENT)		WEIGHT (1000 LB) 90	110	130	150	170
FLAPS UP (GEAR UP) VREF40+70	**PITCH ATT**	**5.0**	**5.5**	**5.5**	**6.0**	**6.5**
	%N1	**58.4**	**63.4**	**67.2**	**71.0**	**74.3**
	KIAS	179	192	204	215	224
FLAPS 1 (GEAR UP) VREF40+50	**PITCH ATT**	**5.0**	**5.5**	**5.5**	**6.0**	**6.0**
	%N1	**61.1**	**65.7**	**70.0**	**73.7**	**77.0**
	KIAS	159	172	184	195	204
FLAPS 5 (GEAR UP) VREF40+30	**PITCH ATT**	**5.5**	**6.0**	**6.0**	**6.5**	**6.5**
	%N1	**61.7**	**66.7**	**71.3**	**75.0**	**78.7**
	KIAS	139	152	164	175	184
FLAPS 10 (GEAR UP) VREF40+30	**PITCH ATT**	**5.0**	**5.5**	**5.5**	**5.5**	**6.0**
	%N1	**64.8**	**70.1**	**74.5**	**78.4**	**82.0**
	KIAS	139	152	164	175	184
FLAPS 15 (GEAR UP) VREF40+20	**PITCH ATT**	**5.5**	**6.0**	**6.0**	**6.0**	**6.0**
	%N1	**65.2**	**70.8**	**75.1**	**79.2**	**82.9**
	KIAS	129	142	154	165	174
FLAPS 25 (GEAR UP) VREF40+10	**PITCH ATT**	**7.0**	**7.0**	**7.0**	**7.0**	**7.0**
	%N1	**66.5**	**71.9**	**76.5**	**80.6**	**84.3**
	KIAS	119	132	144	155	164
FLAPS 15 (GEAR DOWN) VREF40+20	**PITCH ATT**	**6.0**	**6.0**	**6.0**	**6.0**	**6.5**
	%N1	**70.1**	**75.4**	**80.1**	**84.3**	**88.1**
	KIAS	129	142	154	165	174

Flight With Unreliable Airspeed / Turbulent Air Penetration
Altitude and/or vertical speed indications may also be unreliable.

TERMINAL AREA (5000 FT)
%N1 for Level Flight
Airport Altitude = 13000 FT

FLAP POSITION (VREF + INCREMENT)		WEIGHT (1000 LB) 90	110	130	150	170
FLAPS UP (GEAR UP) VREF40+70	**PITCH ATT**	**5.0**	**5.5**	**5.5**	**6.0**	**6.5**
	%N1	**59.3**	**64.1**	**68.0**	**71.8**	**75.0**
	KIAS	179	192	204	215	224
FLAPS 1 (GEAR UP) VREF40+50	**PITCH ATT**	**5.0**	**5.5**	**5.5**	**6.0**	**6.0**
	%N1	**62.0**	**66.6**	**70.9**	**74.5**	**77.8**
	KIAS	159	172	184	195	204
FLAPS 5 (GEAR UP) VREF40+30	**PITCH ATT**	**5.5**	**6.0**	**6.0**	**6.0**	**6.5**
	%N1	**62.6**	**67.7**	**72.2**	**75.9**	**79.6**
	KIAS	139	152	164	175	184
FLAPS 10 (GEAR UP) VREF40+30	**PITCH ATT**	**5.0**	**5.5**	**5.5**	**5.5**	**6.0**
	%N1	**65.8**	**71.1**	**75.4**	**79.4**	**83.0**
	KIAS	139	152	164	175	184
FLAPS 15 (GEAR UP) VREF40+20	**PITCH ATT**	**5.5**	**6.0**	**6.0**	**6.0**	**6.0**
	%N1	**66.3**	**71.7**	**76.1**	**80.2**	**83.8**
	KIAS	129	142	154	165	174
FLAPS 25 (GEAR UP) VREF40+10	**PITCH ATT**	**7.0**	**7.0**	**6.5**	**6.5**	**7.0**
	%N1	**67.6**	**72.9**	**77.6**	**81.6**	**85.3**
	KIAS	119	132	144	155	164
FLAPS 15 (GEAR DOWN) VREF40+20	**PITCH ATT**	**5.5**	**6.0**	**6.0**	**6.0**	**6.5**
	%N1	**71.1**	**76.4**	**81.2**	**85.3**	**89.1**
	KIAS	129	142	154	165	174

Flight With Unreliable Airspeed / Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

TERMINAL AREA (5000 FT)
%N1 for Level Flight
Airport Altitude = 14000 FT

FLAP POSITION (VREF + INCREMENT)		WEIGHT (1000 LB)				
		90	110	130	150	170
FLAPS UP (GEAR UP) VREF40+70	**PITCH ATT**	**5.0**	**5.5**	**5.5**	**6.0**	**6.5**
	%N1	**60.2**	**64.8**	**68.9**	**72.6**	**75.9**
	KIAS	179	192	204	215	224
FLAPS 1 (GEAR UP) VREF40+50	**PITCH ATT**	**5.0**	**5.5**	**5.5**	**6.0**	**6.0**
	%N1	**62.8**	**67.4**	**71.8**	**75.3**	**78.7**
	KIAS	159	172	184	195	204
FLAPS 5 (GEAR UP) VREF40+30	**PITCH ATT**	**5.5**	**6.0**	**6.0**	**6.5**	**6.5**
	%N1	**63.5**	**68.7**	**73.0**	**76.8**	**80.5**
	KIAS	139	152	164	175	184
FLAPS 10 (GEAR UP) VREF40+30	**PITCH ATT**	**5.0**	**5.5**	**5.5**	**5.5**	**6.0**
	%N1	**66.8**	**72.0**	**76.3**	**80.3**	**83.9**
	KIAS	139	152	164	175	184
FLAPS 15 (GEAR UP) VREF40+20	**PITCH ATT**	**5.5**	**6.0**	**6.0**	**6.0**	**6.0**
	%N1	**67.4**	**72.6**	**77.1**	**81.2**	**84.8**
	KIAS	129	142	154	165	174
FLAPS 25 (GEAR UP) VREF40+10	**PITCH ATT**	**7.0**	**7.0**	**7.0**	**6.5**	**7.0**
	%N1	**68.8**	**73.9**	**78.6**	**82.6**	**86.3**
	KIAS	119	132	144	155	164
FLAPS 15 (GEAR DOWN) VREF40+20	**PITCH ATT**	**5.5**	**6.0**	**6.0**	**6.0**	**6.5**
	%N1	**72.1**	**77.5**	**82.1**	**86.3**	**90.2**
	KIAS	129	142	154	165	174

Flight With Unreliable Airspeed / Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

TERMINAL AREA (5000 FT)
%N1 for Level Flight
Airport Altitude = 14500 FT

FLAP POSITION (VREF + INCREMENT)		WEIGHT (1000 LB)				
		90	110	130	150	170
FLAPS UP (GEAR UP)	**PITCH ATT**	**5.0**	**5.5**	**5.5**	**6.0**	**6.5**
	%N1	**60.7**	**65.2**	**69.3**	**73.0**	**76.3**
VREF40+70	KIAS	179	192	204	215	225
FLAPS 1 (GEAR UP)	**PITCH ATT**	**5.0**	**5.5**	**5.5**	**6.0**	**6.0**
	%N1	**63.2**	**67.9**	**72.2**	**75.7**	**79.2**
VREF40+50	KIAS	159	172	184	195	205
FLAPS 5 (GEAR UP)	**PITCH ATT**	**5.5**	**6.0**	**6.0**	**6.5**	**6.5**
	%N1	**63.9**	**69.1**	**73.4**	**77.3**	**80.9**
VREF40+30	KIAS	139	152	164	175	185
FLAPS 10 (GEAR UP)	**PITCH ATT**	**5.0**	**5.5**	**5.5**	**5.5**	**6.0**
	%N1	**67.3**	**72.4**	**76.8**	**80.8**	**84.3**
VREF40+30	KIAS	139	152	164	175	185
FLAPS 15 (GEAR UP)	**PITCH ATT**	**5.5**	**6.0**	**6.0**	**6.0**	**6.0**
	%N1	**67.9**	**73.0**	**77.6**	**81.6**	**85.2**
VREF40+20	KIAS	129	142	154	165	175
FLAPS 25 (GEAR UP)	**PITCH ATT**	**7.0**	**7.0**	**6.5**	**6.5**	**7.0**
	%N1	**69.3**	**74.3**	**79.1**	**83.1**	**86.8**
VREF40+10	KIAS	119	132	144	155	165
FLAPS 15 (GEAR DOWN)	**PITCH ATT**	**5.5**	**6.0**	**6.0**	**6.0**	**6.5**
	%N1	**72.6**	**78.0**	**82.6**	**86.8**	**90.9**
VREF40+20	KIAS	129	142	154	165	175

Flight With Unreliable Airspeed / Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

FINAL APPROACH (1500 FT)

Gear Down, %N1 for 3° Glideslope

Airport Altitude = -2000 FT

FLAP POSITION (VREF + INCREMENT)		WEIGHT (1000 LB) 90	110	130	150	170
FLAPS 15 VREF15+10	**PITCH ATT**	**3.5**	**4.0**	**4.0**	**4.0**	**4.5**
	%N1	**41.7**	**45.7**	**49.3**	**52.5**	**55.5**
	KIAS	125	137	148	158	166
FLAPS 30 VREF30+10	**PITCH ATT**	**2.0**	**2.0**	**2.0**	**2.5**	**2.5**
	%N1	**45.8**	**50.1**	**54.0**	**57.4**	**60.5**
	KIAS	121	132	143	153	161
FLAPS 40 VREF40+10	**PITCH ATT**	**0.0**	**0.0**	**0.5**	**0.5**	**1.0**
	%N1	**51.7**	**56.4**	**60.6**	**64.3**	**67.5**
	KIAS	118	130	140	150	158

Flap placard speed exceeded in shaded area.

Airport Altitude = -1000 FT

FLAP POSITION (VREF + INCREMENT)		WEIGHT (1000 LB) 90	110	130	150	170
FLAPS 15 VREF15+10	**PITCH ATT**	**3.5**	**4.0**	**4.0**	**4.0**	**4.5**
	%N1	**42.3**	**46.4**	**49.9**	**53.2**	**56.2**
	KIAS	125	137	148	158	166
FLAPS 30 VREF30+10	**PITCH ATT**	**2.0**	**2.0**	**2.0**	**2.5**	**2.5**
	%N1	**46.5**	**50.8**	**54.7**	**58.1**	**61.3**
	KIAS	121	132	143	153	161
FLAPS 40 VREF40+10	**PITCH ATT**	**0.0**	**0.0**	**0.5**	**0.5**	**1.0**
	%N1	**52.4**	**57.1**	**61.4**	**65.1**	**68.2**
	KIAS	118	130	140	150	158

Flap placard speed exceeded in shaded area.

Flight With Unreliable Airspeed / Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

FINAL APPROACH (1500 FT)

Gear Down, %N1 for 3° Glideslope

Airport Altitude = SEA LEVEL

FLAP POSITION (VREF + INCREMENT)		WEIGHT (1000 LB) 90	110	130	150	170
FLAPS 15 VREF15+10	**PITCH ATT**	**3.5**	**4.0**	**4.0**	**4.0**	**4.5**
	%N1	**42.8**	**47.0**	**50.6**	**54.0**	**56.9**
	KIAS	125	137	148	158	167
FLAPS 30 VREF30+10	**PITCH ATT**	**2.0**	**2.0**	**2.0**	**2.5**	**2.5**
	%N1	**47.1**	**51.5**	**55.4**	**58.8**	**62.1**
	KIAS	121	132	143	153	161
FLAPS 40 VREF40+10	**PITCH ATT**	**0.0**	**0.0**	**0.5**	**0.5**	**1.0**
	%N1	**53.1**	**57.9**	**62.2**	**66.0**	**69.1**
	KIAS	118	130	140	150	158

Flap placard speed exceeded in shaded area.

Airport Altitude = 1000 FT

FLAP POSITION (VREF + INCREMENT)		WEIGHT (1000 LB) 90	110	130	150	170
FLAPS 15 VREF15+10	**PITCH ATT**	**3.5**	**4.0**	**4.0**	**4.0**	**4.5**
	%N1	**43.4**	**47.7**	**51.2**	**54.6**	**57.6**
	KIAS	125	137	148	158	167
FLAPS 30 VREF30+10	**PITCH ATT**	**2.0**	**2.0**	**2.0**	**2.5**	**2.5**
	%N1	**47.7**	**52.2**	**56.1**	**59.6**	**62.9**
	KIAS	121	132	143	153	161
FLAPS 40 VREF40+10	**PITCH ATT**	**0.0**	**0.0**	**0.5**	**0.5**	**1.0**
	%N1	**53.8**	**58.6**	**62.9**	**66.7**	**69.9**
	KIAS	118	130	140	150	158

Flap placard speed exceeded in shaded area.

Flight With Unreliable Airspeed / Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

FINAL APPROACH (1500 FT)

Gear Down, %N1 for 3° Glideslope

Airport Altitude = 2000 FT

FLAP POSITION (VREF + INCREMENT)		WEIGHT (1000 LB) 90	110	130	150	170
FLAPS 15 VREF15+10	**PITCH ATT**	**3.5**	**4.0**	**4.0**	**4.0**	**4.5**
	%N1	**44.0**	**48.3**	**51.9**	**55.3**	**58.3**
	KIAS	125	137	148	158	167
FLAPS 30 VREF30+10	**PITCH ATT**	**2.0**	**2.0**	**2.0**	**2.5**	**2.5**
	%N1	**48.3**	**52.9**	**56.8**	**60.4**	**63.7**
	KIAS	121	132	143	153	161
FLAPS 40 VREF40+10	**PITCH ATT**	**0.0**	**0.0**	**0.5**	**0.5**	**0.5**
	%N1	**54.5**	**59.4**	**63.7**	**67.5**	**70.7**
	KIAS	118	130	140	150	159

Flap placard speed exceeded in shaded area.

Airport Altitude = 3000 FT

FLAP POSITION (VREF + INCREMENT)		WEIGHT (1000 LB) 90	110	130	150	170
FLAPS 15 VREF15+10	**PITCH ATT**	**3.5**	**4.0**	**4.0**	**4.0**	**4.5**
	%N1	**44.7**	**48.9**	**52.7**	**56.0**	**59.1**
	KIAS	125	137	148	158	167
FLAPS 30 VREF30+10	**PITCH ATT**	**2.0**	**2.0**	**2.0**	**2.5**	**2.5**
	%N1	**49.0**	**53.6**	**57.5**	**61.2**	**64.4**
	KIAS	121	133	143	153	162
FLAPS 40 VREF40+10	**PITCH ATT**	**0.0**	**0.0**	**0.5**	**0.5**	**0.5**
	%N1	**55.2**	**60.2**	**64.6**	**68.3**	**71.6**
	KIAS	118	130	140	150	159

Flap placard speed exceeded in shaded area.

Flight With Unreliable Airspeed / Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

FINAL APPROACH (1500 FT)

Gear Down, %N1 for 3° Glideslope

Airport Altitude = 4000 FT

FLAP POSITION (VREF + INCREMENT)		WEIGHT (1000 LB) 90	110	130	150	170
FLAPS 15 VREF15+10	**PITCH ATT**	**3.5**	**4.0**	**4.0**	**4.0**	**4.5**
	%N1	**45.3**	**49.5**	**53.4**	**56.7**	**59.8**
	KIAS	125	137	148	159	167
FLAPS 30 VREF30+10	**PITCH ATT**	**2.0**	**2.0**	**2.0**	**2.5**	**2.5**
	%N1	**49.7**	**54.3**	**58.3**	**62.1**	**65.2**
	KIAS	121	133	143	153	162
FLAPS 40 VREF40+10	**PITCH ATT**	**0.0**	**0.0**	**0.5**	**0.5**	**0.5**
	%N1	**56.0**	**61.0**	**65.4**	**69.1**	**72.5**
	KIAS	118	130	140	151	159

Flap placard speed exceeded in shaded area.

Airport Altitude = 5000 FT

FLAP POSITION (VREF + INCREMENT)		WEIGHT (1000 LB) 90	110	130	150	170
FLAPS 15 VREF15+10	**PITCH ATT**	**3.5**	**4.0**	**4.0**	**4.0**	**4.5**
	%N1	**46.0**	**50.2**	**54.1**	**57.5**	**60.6**
	KIAS	125	137	148	159	168
FLAPS 30 VREF30+10	**PITCH ATT**	**2.0**	**2.0**	**2.0**	**2.5**	**2.5**
	%N1	**50.4**	**55.0**	**59.1**	**62.8**	**66.0**
	KIAS	121	133	143	154	162
FLAPS 40 VREF40+10	**PITCH ATT**	**0.0**	**0.0**	**0.5**	**0.5**	**0.5**
	%N1	**56.7**	**61.8**	**66.1**	**70.0**	**73.4**
	KIAS	118	130	141	151	159

Flap placard speed exceeded in shaded area.

Flight With Unreliable Airspeed / Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

FINAL APPROACH (1500 FT)

Gear Down, %N1 for 3° Glideslope

Airport Altitude = 6000 FT

FLAP POSITION (VREF + INCREMENT)		WEIGHT (1000 LB)				
		90	110	130	150	170
FLAPS 15 VREF15+10	**PITCH ATT**	**3.5**	**4.0**	**4.0**	**4.0**	**4.5**
	%N1	**46.7**	**50.9**	**54.8**	**58.2**	**61.5**
	KIAS	125	137	148	159	168
FLAPS 30 VREF30+10	**PITCH ATT**	**2.0**	**2.0**	**2.0**	**2.5**	**2.5**
	%N1	**51.1**	**55.7**	**59.9**	**63.6**	**66.8**
	KIAS	121	133	144	154	162
FLAPS 40 VREF40+10	**PITCH ATT**	**0.0**	**0.0**	**0.5**	**0.5**	**0.5**
	%N1	**57.5**	**62.6**	**66.9**	**70.9**	**74.3**
	KIAS	118	130	141	151	160

Flap placard speed exceeded in shaded area.

Airport Altitude = 7000 FT

FLAP POSITION (VREF + INCREMENT)		WEIGHT (1000 LB)				
		90	110	130	150	170
FLAPS 15 VREF15+10	**PITCH ATT**	**3.5**	**4.0**	**4.0**	**4.0**	**4.5**
	%N1	**47.3**	**51.6**	**55.5**	**59.0**	**62.3**
	KIAS	125	137	149	159	168
FLAPS 30 VREF30+10	**PITCH ATT**	**2.0**	**2.0**	**2.0**	**2.5**	**2.5**
	%N1	**51.8**	**56.4**	**60.7**	**64.4**	**67.6**
	KIAS	121	133	144	154	162
FLAPS 40 VREF40+10	**PITCH ATT**	**0.0**	**0.0**	**0.5**	**0.5**	**0.5**
	%N1	**58.3**	**63.4**	**67.8**	**71.8**	**75.1**
	KIAS	118	130	141	151	160

Flap placard speed exceeded in shaded area.

Flight With Unreliable Airspeed / Turbulent Air Penetration
Altitude and/or vertical speed indications may also be unreliable.

FINAL APPROACH (1500 FT)
Gear Down, %N1 for 3° Glideslope

Airport Altitude = 8000 FT

FLAP POSITION (VREF + INCREMENT)		WEIGHT (1000 LB) 90	110	130	150	170
FLAPS 15 VREF15+10	**PITCH ATT**	**3.5**	**4.0**	**4.0**	**4.0**	**4.0**
	%N1	**47.9**	**52.3**	**56.2**	**59.8**	**63.1**
	KIAS	125	137	149	159	168
FLAPS 30 VREF30+10	**PITCH ATT**	**2.0**	**2.0**	**2.0**	**2.0**	**2.5**
	%N1	**52.5**	**57.2**	**61.5**	**65.2**	**68.4**
	KIAS	121	133	144	154	163
FLAPS 40 VREF40+10	**PITCH ATT**	**0.0**	**0.0**	**0.5**	**0.5**	**0.5**
	%N1	**59.1**	**64.2**	**68.6**	**72.6**	**75.9**
	KIAS	118	130	141	152	160

Flap placard speed exceeded in shaded area.

Airport Altitude = 9000 FT

FLAP POSITION (VREF + INCREMENT)		WEIGHT (1000 LB) 90	110	130	150	170
FLAPS 15 VREF15+10	**PITCH ATT**	**3.5**	**4.0**	**4.0**	**4.0**	**4.0**
	%N1	**48.5**	**53.0**	**57.0**	**60.6**	**63.8**
	KIAS	125	137	149	160	169
FLAPS 30 VREF30+10	**PITCH ATT**	**2.0**	**2.0**	**2.0**	**2.0**	**2.5**
	%N1	**53.2**	**58.0**	**62.3**	**66.0**	**69.2**
	KIAS	121	133	144	154	163
FLAPS 40 VREF40+10	**PITCH ATT**	**0.0**	**0.0**	**0.0**	**0.5**	**0.5**
	%N1	**59.9**	**65.0**	**69.5**	**73.5**	**76.8**
	KIAS	118	130	142	152	161

Flap placard speed exceeded in shaded area.

Flight With Unreliable Airspeed / Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

FINAL APPROACH (1500 FT)

Gear Down, %N1 for 3° Glideslope

Airport Altitude = 10000 FT

FLAP POSITION (VREF + INCREMENT)		WEIGHT (1000 LB)				
		90	110	130	150	170
FLAPS 15 VREF15+10	**PITCH ATT**	**3.5**	**4.0**	**4.0**	**4.0**	**4.0**
	%N1	**49.2**	**53.8**	**57.7**	**61.4**	**64.5**
	KIAS	125	137	149	160	169
FLAPS 30 VREF30+10	**PITCH ATT**	**2.0**	**2.0**	**2.0**	**2.0**	**2.5**
	%N1	**53.9**	**58.8**	**63.1**	**66.8**	**70.0**
	KIAS	121	133	144	154	163
FLAPS 40 VREF40+10	**PITCH ATT**	**0.0**	**0.0**	**0.0**	**0.0**	**0.5**
	%N1	**60.7**	**65.8**	**70.4**	**74.4**	**77.7**
	KIAS	118	130	142	152	161

Flap placard speed exceeded in shaded area.

Airport Altitude = 11000 FT

FLAP POSITION (VREF + INCREMENT)		WEIGHT (1000 LB)				
		90	110	130	150	170
FLAPS 15 VREF15+10	**PITCH ATT**	**3.5**	**4.0**	**4.0**	**4.0**	**4.0**
	%N1	**49.9**	**54.5**	**58.5**	**62.3**	**65.2**
	KIAS	125	138	149	160	169
FLAPS 30 VREF30+10	**PITCH ATT**	**2.0**	**2.0**	**2.0**	**2.0**	**2.5**
	%N1	**54.7**	**59.6**	**63.9**	**67.6**	**70.9**
	KIAS	121	133	144	155	163
FLAPS 40 VREF40+10	**PITCH ATT**	**0.0**	**0.0**	**0.0**	**0.0**	**0.5**
	%N1	**61.5**	**66.6**	**71.3**	**75.2**	**78.6**
	KIAS	118	130	142	153	161

Flap placard speed exceeded in shaded area.

Flight With Unreliable Airspeed / Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

FINAL APPROACH (1500 FT)

Gear Down, %N1 for 3° Glideslope

Airport Altitude = 12000 FT

FLAP POSITION (VREF + INCREMENT)		WEIGHT (1000 LB)				
		90	110	130	150	170
FLAPS 15 VREF15+10	**PITCH ATT**	**3.5**	**4.0**	**4.0**	**4.0**	**4.0**
	%N1	**50.6**	**55.2**	**59.3**	**63.0**	**66.0**
	KIAS	125	138	150	160	169
FLAPS 30 VREF30+10	**PITCH ATT**	**2.0**	**2.0**	**2.0**	**2.0**	**2.5**
	%N1	**55.4**	**60.5**	**64.8**	**68.4**	**71.8**
	KIAS	121	133	145	155	163
FLAPS 40 VREF40+10	**PITCH ATT**	**0.0**	**0.0**	**0.0**	**0.0**	**0.5**
	%N1	**62.3**	**67.5**	**72.2**	**76.1**	**79.5**
	KIAS	118	131	142	153	162

Flap placard speed exceeded in shaded area.

Airport Altitude = 13000 FT

FLAP POSITION (VREF + INCREMENT)		WEIGHT (1000 LB)				
		90	110	130	150	170
FLAPS 15 VREF15+10	**PITCH ATT**	**3.5**	**4.0**	**4.0**	**4.0**	**4.0**
	%N1	**51.4**	**56.0**	**60.2**	**63.7**	**66.7**
	KIAS	125	138	150	161	170
FLAPS 30 VREF30+10	**PITCH ATT**	**2.0**	**2.0**	**2.0**	**2.0**	**2.5**
	%N1	**56.2**	**61.3**	**65.5**	**69.3**	**72.5**
	KIAS	121	133	145	155	164
FLAPS 40 VREF40+10	**PITCH ATT**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**
	%N1	**63.2**	**68.4**	**73.1**	**77.0**	**80.4**
	KIAS	118	131	143	153	162

Flap placard speed exceeded in shaded area.

Flight With Unreliable Airspeed / Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

FINAL APPROACH (1500 FT)

Gear Down, %N1 for 3° Glideslope

Airport Altitude = 14000 FT

FLAP POSITION (VREF + INCREMENT)		WEIGHT (1000 LB) 90	110	130	150	170
FLAPS 15 VREF15+10	**PITCH ATT**	**3.5**	**3.5**	**4.0**	**4.0**	**4.0**
	%N1	**52.2**	**56.8**	**61.1**	**64.5**	**67.5**
	KIAS	125	138	150	161	170
FLAPS 30 VREF30+10	**PITCH ATT**	**2.0**	**2.0**	**2.0**	**2.0**	**2.5**
	%N1	**57.1**	**62.2**	**66.4**	**70.2**	**73.4**
	KIAS	121	133	145	155	164
FLAPS 40 VREF40+10	**PITCH ATT**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**
	%N1	**64.1**	**69.5**	**74.0**	**78.0**	**81.4**
	KIAS	119	131	143	154	163

Flap placard speed exceeded in shaded area.

Airport Altitude = 14500 FT

FLAP POSITION (VREF + INCREMENT)		WEIGHT (1000 LB) 90	110	130	150	170
FLAPS 15 VREF15+10	**PITCH ATT**	**3.5**	**3.5**	**4.0**	**4.0**	**4.0**
	%N1	**52.6**	**57.3**	**61.6**	**64.9**	**68.0**
	KIAS	125	138	150	161	170
FLAPS 30 VREF30+10	**PITCH ATT**	**2.0**	**2.0**	**2.0**	**2.0**	**2.5**
	%N1	**57.7**	**62.7**	**66.9**	**70.7**	**73.8**
	KIAS	121	134	145	155	164
FLAPS 40 VREF40+10	**PITCH ATT**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**
	%N1	**64.6**	**70.1**	**74.5**	**78.5**	**81.9**
	KIAS	119	131	143	154	163

Flap placard speed exceeded in shaded area.

Flight With Unreliable Airspeed / Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

GO-AROUND

Flaps 1, Gear Up, Set Go-Around Thrust

PRESSURE ALTITUDE (FT)		WEIGHT (1000 LB)				
		90	110	130	150	170
14000	**PITCH ATT**	**16.5**	**14.0**	**12.5**	**11.0**	**10.0**
	V/S (FT/MIN)	4100	3300	2600	2200	1800
	KIAS	159	171	183	194	203
10000	**PITCH ATT**	**19.0**	**16.0**	**14.0**	**12.5**	**11.5**
	V/S (FT/MIN)	4700	3800	3100	2600	2100
	KIAS	158	170	182	192	201
5000	**PITCH ATT**	**22.0**	**18.0**	**16.0**	**14.0**	**13.0**
	V/S (FT/MIN)	5100	4200	3500	2900	2500
	KIAS	158	170	181	191	199
SEA LEVEL	**PITCH ATT**	**24.5**	**20.0**	**17.5**	**15.5**	**14.0**
	V/S (FT/MIN)	5400	4500	3800	3200	2700
	KIAS	158	170	180	190	198
-2000	**PITCH ATT**	**24.5**	**20.5**	**17.5**	**16.0**	**14.5**
	V/S (FT/MIN)	5400	4400	3700	3200	2700
	KIAS	158	170	180	190	198

Flaps 5, Gear Up, Set Go-Around Thrust

PRESSURE ALTITUDE (FT)		WEIGHT (1000 LB)				
		90	110	130	150	170
14000	**PITCH ATT**	**17.5**	**15.0**	**13.0**	**11.5**	**10.5**
	V/S (FT/MIN)	3700	2900	2400	1900	1500
	KIAS	139	151	163	174	183
10000	**PITCH ATT**	**20.0**	**17.0**	**14.5**	**13.0**	**12.0**
	V/S (FT/MIN)	4200	3400	2800	2300	1900
	KIAS	138	150	162	172	181
5000	**PITCH ATT**	**23.0**	**19.0**	**16.5**	**14.5**	**13.5**
	V/S (FT/MIN)	4600	3700	3100	2600	2200
	KIAS	138	150	161	171	179
SEA LEVEL	**PITCH ATT**	**25.5**	**21.0**	**18.0**	**16.0**	**14.5**
	V/S (FT/MIN)	4900	4000	3400	2900	2400
	KIAS	138	150	160	170	178
-2000	**PITCH ATT**	**26.0**	**21.5**	**18.5**	**16.5**	**15.0**
	V/S (FT/MIN)	4800	4000	3300	2800	2400
	KIAS	138	150	160	170	178

Only authorized operators may use Flaps 5 for a Go-Around in conjunction with the Alternate Go-Around and Missed Approach Procedure.

Flight With Unreliable Airspeed / Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

GO-AROUND

Flaps 15, Gear Up, Set Go-Around Thrust

PRESSURE ALTITUDE (FT)		WEIGHT (1000 LB)				
		90	110	130	150	170
14000	**PITCH ATT**	**17.0**	**14.0**	**12.0**	**10.5**	**9.5**
	V/S (FT/MIN)	3200	2500	2000	1600	1200
	KIAS	129	141	153	164	173
10000	**PITCH ATT**	**19.5**	**16.0**	**14.0**	**12.0**	**11.0**
	V/S (FT/MIN)	3700	3000	2400	2000	1600
	KIAS	128	140	152	162	171
5000	**PITCH ATT**	**22.5**	**18.5**	**15.5**	**14.0**	**12.5**
	V/S (FT/MIN)	4100	3300	2700	2300	1900
	KIAS	128	140	151	161	169
SEA LEVEL	**PITCH ATT**	**25.0**	**20.5**	**17.5**	**15.5**	**14.0**
	V/S (FT/MIN)	4400	3600	3000	2500	2100
	KIAS	128	140	150	160	168
-2000	**PITCH ATT**	**25.5**	**20.5**	**17.5**	**15.5**	**14.0**
	V/S (FT/MIN)	4400	3600	3000	2500	2100
	KIAS	128	140	150	160	168

Intentionally
Blank

Performance Inflight — Chapter PI
All Engine — Section 21

Long Range Cruise Maximum Operating Altitude
Max Cruise Thrust

ISA + 10°C and Below

WEIGHT (1000 LB)	OPTIMUM ALT (FT)	TAT (°C)	MARGIN TO INITIAL BUFFET 'G' (BANK ANGLE)				
			1.20 (33°)	1.25 (36°)	1.30 (39°)	1.40 (44°)	1.50 (48°)
170	31800	-9	35300*	35300*	35300*	34300	32900
160	33100	-12	36600*	36600*	36600*	35500	34200
150	34500	-15	37900*	37900*	37900*	36900	35500
140	36000	-19	39200*	39200*	39200*	38300	37000
130	37500	-19	40600*	40600*	40600*	39900	38500
120	39200	-19	41000	41000	41000	41000	40200
110	41000	-19	41000	41000	41000	41000	41000
100	41000	-19	41000	41000	41000	41000	41000
90	41000	-19	41000	41000	41000	41000	41000
80	41000	-19	41000	41000	41000	41000	41000

ISA + 15°C

WEIGHT (1000 LB)	OPTIMUM ALT (FT)	TAT (°C)	MARGIN TO INITIAL BUFFET 'G' (BANK ANGLE)				
			1.20 (33°)	1.25 (36°)	1.30 (39°)	1.40 (44°)	1.50 (48°)
170	31800	-4	34100*	34100*	34100*	34100*	32900
160	33100	-7	35700*	35700*	35700*	35500	34200
150	34500	-10	37000*	37000*	37000*	36900	35500
140	36000	-13	38300*	38300*	38300*	38300	37000
130	37500	-13	39700*	39700*	39700*	39700*	38500
120	39200	-13	41000	41000	41000	41000	40200
110	41000	-13	41000	41000	41000	41000	41000
100	41000	-13	41000	41000	41000	41000	41000
90	41000	-13	41000	41000	41000	41000	41000
80	41000	-13	41000	41000	41000	41000	41000

ISA + 20°C

WEIGHT (1000 LB)	OPTIMUM ALT (FT)	TAT (°C)	MARGIN TO INITIAL BUFFET 'G' (BANK ANGLE)				
			1.20 (33°)	1.25 (36°)	1.30 (39°)	1.40 (44°)	1.50 (48°)
170	31800	2	32300*	32300*	32300*	32300*	32300*
160	33100	-1	34200*	34200*	34200*	34200*	34200
150	34500	-4	35800*	35800*	35800*	35800*	35500
140	36000	-7	37200*	37200*	37200*	37200*	37000
130	37500	-8	38600*	38600*	38600*	38600*	38500
120	39200	-8	40000*	40000*	40000*	40000*	40000*
110	41000	-8	41000	41000	41000	41000	41000
100	41000	-8	41000	41000	41000	41000	41000
90	41000	-8	41000	41000	41000	41000	41000
80	41000	-8	41000	41000	41000	41000	41000

***Denotes altitude thrust limited in level flight, 100 fpm residual rate of climb.**

Long Range Cruise Control

WEIGHT (1000 LB)		PRESSURE ALTITUDE (1000 FT)									
		23	25	27	29	31	33	35	37	39	41
170	%N1	82.3	83.7	85.0	86.1	87.5	89.1	92.1			
	MACH	.701	.726	.748	.761	.775	.787	.790			
	KIAS	305	304	301	294	287	279	268			
	FF/ENG	3219	3203	3185	3142	3119	3139	3235			
160	%N1	80.8	82.4	83.7	84.9	86.2	87.6	89.6	94.1		
	MACH	.681	.709	.734	.752	.766	.779	.790	.787		
	KIAS	296	296	295	290	283	276	268	255		
	FF/ENG	3022	3021	3015	2987	2948	2932	2978	3139		
150	%N1	79.4	80.8	82.4	83.7	84.9	86.2	87.7	90.6		
	MACH	.664	.688	.716	.740	.756	.770	.783	.791		
	KIAS	288	287	287	285	280	273	266	256		
	FF/ENG	2842	2826	2838	2828	2790	2755	2753	2838		
140	%N1	78.0	79.3	80.8	82.3	83.6	84.8	86.1	88.2	92.2	
	MACH	.647	.669	.694	.722	.745	.760	.774	.786	.790	
	KIAS	280	278	278	278	275	269	262	255	244	
	FF/ENG	2665	2643	2648	2653	2638	2593	2565	2603	2715	
130	%N1	76.5	77.8	79.1	80.6	82.1	83.4	84.6	86.4	89.1	93.7
	MACH	.629	.650	.672	.699	.727	.748	.763	.777	.788	.789
	KIAS	272	270	269	268	268	264	258	251	244	233
	FF/ENG	2497	2466	2459	2467	2466	2443	2401	2403	2461	2593
120	%N1	74.9	76.2	77.5	78.8	80.3	81.8	83.1	84.7	86.9	90.0
	MACH	.610	.630	.652	.675	.703	.730	.751	.765	.779	.790
	KIAS	263	262	260	258	258	257	253	247	241	233
	FF/ENG	2337	2297	2281	2277	2282	2275	2250	2230	2248	2312
110	%N1	72.9	74.4	75.7	77.0	78.3	79.9	81.4	83.0	85.1	87.4
	MACH	.586	.610	.630	.652	.676	.705	.732	.752	.767	.780
	KIAS	253	253	251	249	248	248	247	242	236	230
	FF/ENG	2165	2137	2111	2099	2092	2095	2086	2073	2070	2090
100	%N1	70.7	72.3	73.8	75.1	76.4	77.8	79.4	81.2	83.3	85.3
	MACH	.559	.583	.608	.629	.651	.675	.704	.732	.752	.767
	KIAS	241	241	241	240	238	236	236	235	231	226
	FF/ENG	1986	1966	1951	1930	1917	1907	1908	1910	1911	1928
90	%N1	68.1	69.9	71.4	72.9	74.3	75.6	77.0	79.0	81.2	83.3
	MACH	.531	.554	.579	.603	.626	.648	.672	.701	.730	.751
	KIAS	228	229	229	229	228	226	225	225	224	220
	FF/ENG	1805	1789	1781	1770	1776	1757	1744	1750	1764	1767
80	%N1	65.2	66.9	68.7	70.3	71.9	73.3	74.6	76.4	78.7	80.9
	MACH	.500	.522	.546	.571	.596	.620	.642	.666	.694	.724
	KIAS	214	215	216	216	216	216	214	213	212	212
	FF/ENG	1653	1642	1636	1628	1615	1594	1575	1569	1580	1596

Shaded area approximates optimum altitude.

Long Range Cruise Enroute Fuel and Time - Low Altitudes

Ground to Air Miles Conversions

AIR DISTANCE (NM)					GROUND DISTANCE (NM)	AIR DISTANCE (NM)				
HEADWIND COMPONENT (KTS)						TAILWIND COMPONENT (KTS)				
100	80	60	40	20		20	40	60	80	100
298	272	249	230	214	200	190	181	173	166	159
449	410	375	346	322	300	285	272	260	248	239
601	548	501	462	429	400	380	362	346	331	318
753	686	627	578	537	500	475	453	433	414	398
905	824	753	694	644	600	571	544	519	497	477
1058	963	879	810	752	700	666	634	606	580	557
1212	1102	1006	927	860	800	761	725	692	662	636
1366	1242	1133	1043	967	900	856	815	778	745	715
1521	1382	1260	1160	1075	1000	951	906	865	828	794
1676	1523	1388	1277	1183	1100	1046	997	951	910	874
1832	1663	1516	1394	1291	1200	1141	1087	1038	993	953
1988	1804	1644	1511	1399	1300	1237	1178	1124	1076	1032
2145	1946	1772	1628	1507	1400	1332	1269	1211	1158	1111
2303	2088	1900	1746	1615	1500	1426	1359	1297	1241	1190
2462	2231	2029	1863	1723	1600	1521	1449	1383	1323	1269
2621	2374	2158	1981	1832	1700	1616	1539	1469	1405	1348
2780	2517	2287	2099	1940	1800	1711	1629	1554	1487	1426
2941	2661	2417	2217	2048	1900	1806	1719	1640	1569	1505
3102	2805	2546	2334	2157	2000	1901	1810	1726	1651	1583

Reference Fuel And Time Required at Check Point

AIR DIST (NM)	PRESSURE ALTITUDE (1000 FT)									
	10		14		20		24		28	
	FUEL (1000 LB)	TIME (HR:MIN)	FUEL (1000 LB)	TIME (HR:MIN)	FUEL (1000 LB)	TIME (HR:MIN)	FUEL (1000 LB)	TIME (HR:MIN)	FUEL (1000 LB)	TIME (HR:MIN)
200	3.0	0:43	2.7	0:41	2.3	0:38	2.0	0:37	1.8	0:36
300	4.7	1:03	4.2	1:00	3.6	0:55	3.2	0:53	2.9	0:51
400	6.3	1:24	5.7	1:19	5.0	1:12	4.5	1:09	4.1	1:06
500	7.9	1:44	7.2	1:38	6.3	1:30	5.7	1:25	5.2	1:22
600	9.5	2:05	8.7	1:58	7.6	1:47	6.9	1:41	6.4	1:37
700	11.0	2:26	10.1	2:17	8.9	2:05	8.1	1:58	7.5	1:53
800	12.6	2:46	11.6	2:37	10.2	2:23	9.3	2:14	8.6	2:08
900	14.2	3:08	13.1	2:57	11.5	2:40	10.5	2:31	9.7	2:24
1000	15.7	3:29	14.5	3:16	12.8	2:58	11.7	2:48	10.8	2:40
1100	17.3	3:50	16.0	3:37	14.1	3:16	12.9	3:04	11.9	2:55
1200	18.8	4:12	17.4	3:57	15.4	3:34	14.0	3:21	13.0	3:11
1300	20.4	4:33	18.8	4:17	16.7	3:52	15.2	3:38	14.1	3:27
1400	21.9	4:55	20.2	4:37	18.0	4:11	16.4	3:55	15.2	3:43
1500	23.4	5:17	21.6	4:58	19.2	4:29	17.5	4:12	16.3	3:59
1600	24.9	5:39	23.1	5:19	20.5	4:48	18.7	4:29	17.4	4:15
1700	26.4	6:02	24.4	5:40	21.7	5:06	19.9	4:47	18.4	4:31
1800	27.9	6:24	25.8	6:00	23.0	5:25	21.0	5:04	19.5	4:48
1900	29.4	6:47	27.2	6:22	24.2	5:44	22.1	5:21	20.6	5:04
2000	30.8	7:10	28.6	6:43	25.4	6:03	23.3	5:39	21.6	5:20

Long Range Cruise Enroute Fuel and Time - Low Altitudes
Fuel Required Adjustments (1000 LB)

REFERENCE FUEL REQUIRED (1000 LB)	WEIGHT AT CHECK POINT (1000 LB)				
	80	100	120	140	160
5	-0.6	-0.3	0.0	0.4	0.7
10	-1.2	-0.7	0.0	0.8	1.6
15	-1.8	-1.0	0.0	1.3	2.5
20	-2.4	-1.3	0.0	1.7	3.4
25	-3.0	-1.7	0.0	2.1	4.3
30	-3.7	-1.9	0.0	2.6	5.2
35	-4.3	-2.1	0.0	3.0	6.1

Based on .78/280/250 descent.

Long Range Cruise Enroute Fuel and Time - High Altitudes
Ground to Air Miles Conversions

AIR DISTANCE (NM)					GROUND DISTANCE (NM)	AIR DISTANCE (NM)				
HEADWIND COMPONENT (KTS)						TAILWIND COMPONENT (KTS)				
100	80	60	40	20		20	40	60	80	100
540	505	474	447	422	400	381	365	349	336	324
808	756	710	669	633	600	573	548	526	506	488
1076	1008	946	892	844	800	765	732	702	675	651
1346	1260	1183	1115	1055	1000	956	916	879	845	814
1616	1513	1420	1338	1266	1200	1148	1100	1055	1014	977
1887	1766	1657	1562	1477	1400	1339	1283	1231	1183	1140
2159	2020	1895	1785	1688	1600	1531	1466	1407	1352	1303
2432	2275	2133	2009	1900	1800	1722	1650	1583	1521	1465
2705	2530	2372	2234	2111	2000	1913	1833	1759	1690	1628
2978	2785	2611	2458	2323	2200	2105	2016	1934	1859	1791
3253	3041	2850	2683	2535	2400	2296	2199	2109	2028	1953
3528	3298	3090	2908	2747	2600	2487	2382	2285	2196	2115
3805	3555	3330	3133	2959	2800	2678	2565	2460	2364	2277
4083	3814	3571	3359	3171	3000	2869	2747	2635	2532	2439
4361	4072	3811	3584	3383	3200	3060	2930	2810	2700	2601
4641	4332	4053	3810	3595	3400	3251	3113	2985	2868	2762
4923	4592	4295	4036	3807	3600	3442	3295	3160	3036	2923
5205	4854	4537	4263	4020	3800	3633	3478	3335	3203	3084
5489	5116	4781	4490	4233	4000	3824	3660	3509	3371	3245
5774	5379	5025	4717	4446	4200	4014	3842	3683	3538	3405
6061	5644	5269	4945	4659	4400	4205	4024	3857	3705	3566
6349	5909	5515	5173	4872	4600	4396	4206	4031	3871	3726
6638	6176	5761	5402	5086	4800	4586	4388	4205	4038	3885
6929	6443	6007	5631	5300	5000	4777	4570	4379	4204	4045

Long Range Cruise Enroute Fuel and Time - High Altitudes

Reference Fuel And Time Required at Check Point

AIR DIST (NM)	PRESSURE ALTITUDE (1000 FT)									
	29		31		33		35		37	
	FUEL (1000 LB)	TIME (HR:MIN)	FUEL (1000 LB)	TIME (HR:MIN)	FUEL (1000 LB)	TIME (HR:MIN)	FUEL (1000 LB)	TIME (HR:MIN)	FUEL (1000 LB)	TIME (HR:MIN)
400	4.3	1:03	4.1	1:01	3.9	1:00	3.8	0:59	3.7	1:00
600	6.4	1:34	6.2	1:32	5.9	1:29	5.7	1:28	5.6	1:28
800	8.5	2:06	8.2	2:03	8.0	1:59	7.7	1:57	7.5	1:56
1000	10.7	2:38	10.3	2:34	10.0	2:29	9.6	2:26	9.4	2:24
1200	12.8	3:09	12.4	3:04	12.0	2:59	11.6	2:55	11.3	2:52
1400	14.9	3:41	14.4	3:35	14.0	3:29	13.5	3:24	13.1	3:20
1600	17.0	4:13	16.5	4:06	16.0	3:59	15.5	3:52	15.0	3:48
1800	19.1	4:44	18.6	4:37	18.0	4:29	17.4	4:21	16.9	4:16
2000	21.3	5:16	20.6	5:08	20.0	4:58	19.4	4:50	18.8	4:44
2200	23.3	5:49	22.6	5:40	21.9	5:29	21.2	5:20	20.6	5:13
2400	25.3	6:22	24.6	6:12	23.8	6:01	23.1	5:50	22.4	5:42
2600	27.3	6:55	26.5	6:44	25.7	6:32	24.9	6:20	24.2	6:11
2800	29.4	7:28	28.5	7:16	27.6	7:03	26.8	6:50	26.0	6:39
3000	31.4	8:01	30.4	7:48	29.5	7:34	28.6	7:20	27.8	7:08
3200	33.4	8:36	32.3	8:21	31.4	8:06	30.4	7:52	29.6	7:38
3400	35.3	9:11	34.2	8:55	33.2	8:38	32.2	8:23	31.3	8:09
3600	37.3	9:45	36.1	9:28	35.0	9:11	34.0	8:54	33.0	8:39
3800	39.3	10:20	38.0	10:01	36.9	9:43	35.7	9:26	34.7	9:09
4000	41.2	10:55	39.9	10:35	38.7	10:16	37.5	9:57	36.5	9:39
4200	43.1	11:32	41.7	11:10	40.5	10:49	39.2	10:30	38.1	10:10
4400	45.0	12:08	43.6	11:45	42.2	11:23	40.9	11:02	39.8	10:42
4600	46.9	12:45	45.4	12:20	44.0	11:57	42.6	11:35	41.4	11:13
4800	48.8	13:22	47.2	12:56	45.7	12:31	44.3	12:08	43.1	11:45
5000	50.6	13:59	49.0	13:31	47.5	13:04	46.0	12:40	44.7	12:16

Fuel Required Adjustments (1000 LB)

REFERENCE FUEL REQUIRED (1000 LB)	WEIGHT AT CHECK POINT (1000 LB)				
	80	100	120	140	160
5	-0.7	-0.5	0.0	0.8	2.6
10	-1.4	-0.8	0.0	1.5	4.3
15	-2.1	-1.1	0.0	2.1	5.8
20	-2.9	-1.4	0.0	2.7	7.2
25	-3.7	-1.8	0.0	3.3	8.5
30	-4.5	-2.2	0.0	3.8	9.6
35	-5.3	-2.6	0.0	4.3	10.6
40	-6.2	-3.0	0.0	4.7	11.5
45	-7.2	-3.4	0.0	5.1	12.2
50	-8.2	-3.9	0.0	5.4	12.7
55	-9.2	-4.4	0.0	5.8	13.2

Based on .78/280/250 descent.

Long Range Cruise Wind-Altitude Trade

PRESSURE ALTITUDE (1000 FT)	CRUISE WEIGHT (1000 LB)									
	170	160	150	140	130	120	110	100	90	80
41				41	19	6	0	3	12	29
39			32	14	4	0	3	11	25	45
37	42	23	10	2	0	3	11	24	41	62
35	15	5	1	1	4	12	24	39	58	79
33	2	0	1	6	14	25	39	56	75	97
31	0	3	8	16	27	40	55	73	92	114
29	5	11	19	30	42	56	72	90	109	129
27	15	23	33	45	58	72	88	106	125	144
25	27	37	48	60	74	89	105	122	140	158

The above wind factor table is for calculation of wind required to maintain present range capability at new pressure altitude, i.e., break-even wind.

Method:

1. **Read wind factors for present and new altitudes from table.**
2. **Determine difference (new altitude wind factor minus present altitude wind factor); This difference may be negative or positive.**
3. **Break-even wind at new altitude is present altitude wind plus difference from step 2.**

Descent
.78/280/250

PRESSURE ALTITUDE (FT)	TIME (MIN)	FUEL (LB)	DISTANCE (NM)			
			LANDING WEIGHT (1000 LB)			
			80	100	120	140
41000	25	710	97	113	126	135
39000	25	700	92	108	121	130
37000	24	690	88	103	115	124
35000	23	680	84	98	110	119
33000	23	670	80	94	106	114
31000	22	660	76	89	100	108
29000	21	650	72	84	94	101
27000	20	630	68	79	88	95
25000	19	610	63	74	82	88
23000	18	600	59	68	76	82
21000	17	580	55	63	70	75
19000	16	550	51	58	64	69
17000	15	530	46	53	59	63
15000	14	510	42	48	53	56
10000	10	420	30	33	36	38
5000	7	320	17	19	20	21
1500	4	240	9	9	9	9

Allowances for a straight-in approach are included.

Holding

Flaps Up

WEIGHT (1000 LB)		PRESSURE ALTITUDE (FT)								
		1500	5000	10000	15000	20000	25000	30000	35000	41000
170	%N1	62.2	65.3	68.9	73.1	77.2	81.6	85.7	92.1	
	KIAS	242	243	243	245	246	248	251	246	
	FF/ENG	3080	3030	3010	2990	2940	2940	3010	3230	
160	%N1	60.6	63.6	67.4	71.5	75.6	80.0	84.1	89.1	
	KIAS	235	235	236	237	239	241	243	246	
	FF/ENG	2910	2870	2840	2820	2760	2750	2810	2950	
150	%N1	58.9	61.8	65.8	69.8	74.0	78.4	82.5	87.0	
	KIAS	227	228	228	229	231	233	235	238	
	FF/ENG	2750	2700	2670	2640	2600	2570	2620	2700	
140	%N1	57.3	59.9	64.2	67.9	72.3	76.6	80.8	85.2	
	KIAS	220	220	221	222	223	224	226	229	
	FF/ENG	2590	2540	2500	2470	2440	2380	2440	2480	
130	%N1	55.5	58.1	62.3	66.1	70.4	74.6	79.0	83.3	94.0
	KIAS	211	212	213	213	214	216	218	220	214
	FF/ENG	2420	2370	2340	2300	2270	2210	2250	2290	2600
120	%N1	53.6	56.2	60.1	64.3	68.3	72.6	77.0	81.3	89.3
	KIAS	202	204	204	205	206	207	209	211	214
	FF/ENG	2260	2210	2170	2140	2100	2050	2070	2100	2280
110	%N1	51.6	54.2	57.8	62.2	66.1	70.5	74.8	79.2	86.6
	KIAS	194	194	195	196	197	198	199	201	204
	FF/ENG	2110	2050	2010	1980	1940	1890	1890	1930	2050
100	%N1	49.5	51.9	55.6	59.6	63.8	68.1	72.3	76.9	84.0
	KIAS	185	185	186	187	187	188	190	191	194
	FF/ENG	1950	1890	1850	1840	1800	1770	1750	1750	1840
90	%N1	47.2	49.6	53.2	56.9	61.4	65.3	69.8	74.3	81.4
	KIAS	178	178	178	178	178	178	180	181	183
	FF/ENG	1840	1770	1720	1680	1640	1610	1590	1580	1640
80	%N1	44.8	47.1	50.6	54.3	58.4	62.6	67.0	71.3	78.5
	KIAS	172	172	172	172	172	172	172	172	172
	FF/ENG	1680	1620	1560	1520	1490	1460	1440	1410	1460

This table includes 5% additional fuel for holding in a racetrack pattern.

Intentionally
Blank

ADVISORY INFORMATION

Normal Configuration Landing Distance

Flaps 15

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	130000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 130000 LB	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF15	ONE REV	NO REV
Dry Runway									
MAX MANUAL	2860	160/-150	60/80	-110/360	30/-30	60/-60	100	50	120
AUTOBRAKE MAX	3640	170/-180	80/110	-140/460	0/0	80/-80	180	0	10
AUTOBRAKE 3	5090	280/-300	140/190	-220/760	0/0	140/-140	290	0	0
AUTOBRAKE 2	6530	410/-440	200/280	-310/1060	40/-90	190/-190	330	90	90
AUTOBRAKE 1	7280	500/-530	240/340	-370/1260	170/-210	210/-210	310	610	670
Good Reported Braking Action									
MAX MANUAL	3950	210/-220	100/150	-180/630	90/-80	90/-90	150	210	480
AUTOBRAKE MAX	4180	220/-230	110/150	-180/650	80/-70	100/-100	180	230	520
AUTOBRAKE 3	5100	280/-300	140/190	-230/770	10/-10	140/-140	290	10	50
AUTOBRAKE 2	6530	410/-440	200/280	-310/1060	40/-90	190/-190	330	90	90
AUTOBRAKE 1	7280	500/-530	240/340	-370/1260	170/-210	210/-210	310	610	670
Medium Reported Braking Action									
MAX MANUAL	5430	340/-340	160/240	-290/1040	240/-190	140/-140	200	600	1490
AUTOBRAKE MAX	5460	340/-350	170/240	-290/1050	230/-180	140/-150	230	600	1470
AUTOBRAKE 3	5660	340/-350	170/240	-300/1070	190/-120	150/-150	290	490	1390
AUTOBRAKE 2	6690	420/-450	200/280	-340/1200	150/-140	190/-190	330	220	640
AUTOBRAKE 1	7320	500/-530	250/340	-380/1310	230/-230	210/-210	310	660	870
Poor Reported Braking Action									
MAX MANUAL	7130	500/-490	240/350	-440/1660	600/-390	180/-200	250	1330	3670
AUTOBRAKE MAX	7130	500/-490	240/350	-440/1660	610/-400	190/-200	250	1330	3670
AUTOBRAKE 3	7130	500/-490	240/350	-440/1660	610/-380	190/-200	270	1330	3670
AUTOBRAKE 2	7560	510/-520	250/360	-450/1710	540/-350	200/-220	310	1010	3290
AUTOBRAKE 1	7940	550/-570	260/380	-470/1760	560/-400	210/-230	310	1200	3020

Reference distance is based on sea level, standard day, no wind or slope, VREF15, two-engine detent No. 2 reverse thrust, and auto speedbrakes.
For max manual braking and manual speedbrakes, increase reference landing distance by 180 ft.
For autobrake and manual speedbrakes, increase reference landing distance by 150 ft.
Reference Distance includes an air distance allowance of 1000 ft from threshold to touchdown.
Actual (unfactored) distances are shown.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Normal Configuration Landing Distance

Flaps 30

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	130000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 130000 LB	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF30	ONE REV	NO REV

Dry Runway

MAX MANUAL	2770	150/-130	60/80	-100/350	30/-30	60/-60	100	50	110
AUTOBRAKE MAX	3480	160/-170	80/110	-130/440	0/0	80/-80	170	0	0
AUTOBRAKE 3	4820	260/-280	130/180	-220/740	0/0	130/-130	280	0	0
AUTOBRAKE 2	6150	370/-410	180/250	-300/1030	40/-100	170/-170	300	90	90
AUTOBRAKE 1	6820	460/-480	220/310	-350/1220	160/-190	200/-200	290	540	640

Good Reported Braking Action

MAX MANUAL	3830	200/-210	100/140	-170/620	90/-80	90/-90	150	200	440
AUTOBRAKE MAX	4050	210/-220	100/150	-180/640	80/-70	90/-100	180	210	480
AUTOBRAKE 3	4830	260/-280	130/180	-220/750	20/-10	130/-130	280	10	50
AUTOBRAKE 2	6150	370/-410	180/250	-300/1030	40/-100	170/-170	300	90	90
AUTOBRAKE 1	6820	460/-480	220/310	-350/1220	160/-190	200/-200	290	540	640

Medium Reported Braking Action

MAX MANUAL	5200	320/-320	150/220	-280/1020	240/-190	130/-140	200	540	1320
AUTOBRAKE MAX	5240	320/-330	160/220	-280/1030	220/-170	130/-140	230	540	1310
AUTOBRAKE 3	5400	320/-330	160/230	-290/1040	190/-120	140/-150	280	460	1260
AUTOBRAKE 2	6320	380/-420	190/260	-330/1170	150/-150	170/-180	300	220	600
AUTOBRAKE 1	6860	460/-480	220/310	-360/1270	230/-210	200/-200	290	590	830

Poor Reported Braking Action

MAX MANUAL	6750	460/-460	220/320	-420/1620	570/-370	170/-190	240	1170	3140
AUTOBRAKE MAX	6760	460/-460	220/320	-420/1620	580/-380	170/-190	240	1170	3140
AUTOBRAKE 3	6770	470/-460	220/320	-420/1620	580/-360	170/-190	260	1170	3140
AUTOBRAKE 2	7150	470/-480	230/330	-440/1670	520/-340	190/-200	290	910	2830
AUTOBRAKE 1	7460	510/-530	240/350	-450/1710	540/-380	200/-220	280	1080	2650

Reference distance is based on sea level, standard day, no wind or slope, VREF30, two-engine detent No. 2 reverse thrust, and auto speedbrakes.
For max manual braking and manual speedbrakes, increase reference landing distance by 170 ft.
For autobrake and manual speedbrakes, increase reference landing distance by 150 ft.
Reference Distance includes an air distance allowance of 1000 ft from threshold to touchdown.
Actual (unfactored) distances are shown.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Normal Configuration Landing Distance

Flaps 40

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	130000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 130000 LB	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF40	ONE REV	NO REV
Dry Runway									
MAX MANUAL	2730	150/-120	60/80	-100/350	30/-30	50/-50	110	50	100
AUTOBRAKE MAX	3380	150/-170	80/110	-130/430	0/0	70/-70	170	0	0
AUTOBRAKE 3	4660	250/-270	130/180	-210/720	0/0	120/-120	280	0	0
AUTOBRAKE 2	5940	360/-390	180/250	-290/1010	40/-90	170/-170	290	70	70
AUTOBRAKE 1	6600	440/-460	220/300	-350/1200	150/-190	190/-190	280	470	580
Good Reported Braking Action									
MAX MANUAL	3780	200/-200	100/140	-170/620	90/-80	90/-90	150	190	420
AUTOBRAKE MAX	4000	210/-220	100/150	-180/640	80/-70	90/-90	180	200	460
AUTOBRAKE 3	4680	250/-270	130/180	-210/740	30/-10	120/-120	280	10	50
AUTOBRAKE 2	5940	360/-390	180/250	-290/1010	40/-90	170/-170	290	70	70
AUTOBRAKE 1	6600	440/-460	220/300	-350/1200	150/-190	190/-190	280	470	580
Medium Reported Braking Action									
MAX MANUAL	5100	310/-310	150/220	-280/1020	240/-190	130/-130	200	510	1230
AUTOBRAKE MAX	5150	320/-320	160/230	-280/1020	230/-170	130/-140	230	500	1220
AUTOBRAKE 3	5270	320/-320	160/230	-280/1040	200/-130	140/-140	280	470	1210
AUTOBRAKE 2	6120	370/-400	180/260	-320/1150	150/-150	170/-170	290	200	570
AUTOBRAKE 1	6640	440/-460	220/300	-350/1250	230/-210	190/-190	280	520	770
Poor Reported Braking Action									
MAX MANUAL	6590	450/-440	210/320	-420/1610	570/-370	170/-190	230	1090	2870
AUTOBRAKE MAX	6610	450/-440	220/320	-420/1610	580/-380	170/-190	240	1090	2880
AUTOBRAKE 3	6620	460/-440	220/320	-420/1610	570/-350	170/-190	260	1090	2880
AUTOBRAKE 2	6940	460/-460	220/330	-430/1650	510/-340	180/-200	280	860	2600
AUTOBRAKE 1	7240	490/-500	230/350	-450/1690	530/-370	190/-210	270	1000	2450

Reference distance is based on sea level, standard day, no wind or slope, VREF40, two-engine detent No. 2 reverse thrust, and auto speedbrakes.
For max manual braking and manual speedbrakes, increase reference landing distance by 170 ft.
For autobrake and manual speedbrakes, increase reference landing distance by 150 ft.
Reference Distance includes an air distance allowance of 1000 ft from threshold to touchdown.
Actual (unfactored) distances are shown.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

Airspeed Unreliable (Flaps 15)

VREF15

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	130000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 130000 LB	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV
Dry Runway									
MAX MANUAL	3060	190/-160	70/90	-110/380	30/-30	60/-60	N/A	70	150
AUTOBRAKE MAX	3990	190/-200	90/130	-150/480	0/0	90/-90	N/A	0	10
AUTOBRAKE 2	7100	440/-480	230/310	-330/1110	100/-150	200/-200	N/A	340	340
Good Reported Braking Action									
MAX MANUAL	4220	220/-230	110/150	-180/640	100/-80	100/-100	N/A	250	580
AUTOBRAKE MAX	4490	230/-250	120/160	-190/670	90/-70	110/-110	N/A	270	630
AUTOBRAKE 2	7100	440/-480	230/310	-330/1110	100/-150	200/-200	N/A	340	340
Medium Reported Braking Action									
MAX MANUAL	5740	350/-350	180/250	-290/1060	240/-190	150/-150	N/A	690	1720
AUTOBRAKE MAX	5830	360/-360	180/250	-300/1070	230/-180	150/-160	N/A	690	1730
AUTOBRAKE 3	6200	360/-370	180/260	-310/1110	160/-110	170/-170	N/A	440	1460
Poor Reported Braking Action									
MAX MANUAL	7440	510/-500	250/360	-440/1670	590/-390	190/-210	N/A	1450	4100
AUTOBRAKE MAX	7440	510/-500	250/360	-440/1670	600/-390	190/-210	N/A	1450	4090
AUTOBRAKE 3	7490	510/-500	250/360	-440/1680	570/-340	200/-210	N/A	1440	4090

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 1000 ft from threshold to touchdown.
Actual (unfactored) distances are shown.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance
Airspeed Unreliable (Flaps 30)
VREF30

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	130000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 130000 LB	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	2970	170/-140	60/90	-110/370	30/-30	60/-60	N/A	60	130
AUTOBRAKE MAX	3820	170/-180	90/120	-140/470	0/0	90/-90	N/A	0	0
AUTOBRAKE 2	6670	410/-440	210/280	-320/1070	110/-140	190/-190	N/A	330	330

Good Reported Braking Action

MAX MANUAL	4100	210/-220	110/150	-180/640	100/-80	100/-100	N/A	230	540
AUTOBRAKE MAX	4370	220/-240	120/160	-190/660	90/-80	100/-110	N/A	260	590
AUTOBRAKE 2	6670	410/-440	210/280	-320/1070	110/-140	190/-190	N/A	330	330

Medium Reported Braking Action

MAX MANUAL	5510	330/-340	170/230	-290/1040	240/-190	140/-150	N/A	620	1530
AUTOBRAKE MAX	5610	340/-350	170/240	-290/1050	220/-170	140/-150	N/A	620	1540
AUTOBRAKE 3	5930	340/-350	170/240	-300/1090	160/-120	160/-160	N/A	410	1320

Poor Reported Braking Action

MAX MANUAL	7060	470/-470	230/330	-430/1630	560/-370	180/-200	N/A	1280	3500
AUTOBRAKE MAX	7080	480/-470	230/330	-430/1640	570/-370	180/-200	N/A	1270	3500
AUTOBRAKE 3	7140	480/-470	230/330	-430/1640	540/-330	190/-200	N/A	1270	3520

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 1000 ft from threshold to touchdown.
Actual (unfactored) distances are shown.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

Airspeed Unreliable (Flaps 40)

VREF40

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	130000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 130000 LB	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	2930	160/-130	60/90	-110/370	30/-30	60/-60	N/A	60	130
AUTOBRAKE MAX	3720	170/-180	90/120	-140/460	10/0	80/-80	N/A	0	0
AUTOBRAKE 2	6460	390/-420	200/280	-310/1050	100/-130	180/-180	N/A	290	290

Good Reported Braking Action

MAX MANUAL	4060	210/-210	110/150	-180/640	100/-80	100/-100	N/A	230	510
AUTOBRAKE MAX	4330	220/-230	120/160	-190/660	90/-80	100/-100	N/A	250	560
AUTOBRAKE 2	6460	390/-420	200/280	-310/1050	110/-130	180/-180	N/A	290	290

Medium Reported Braking Action

MAX MANUAL	5420	330/-330	160/230	-280/1040	240/-190	140/-140	N/A	580	1430
AUTOBRAKE MAX	5520	340/-340	170/240	-290/1050	220/-170	140/-150	N/A	590	1440
AUTOBRAKE 3	5790	330/-340	170/240	-300/1070	170/-130	150/-160	N/A	420	1280

Poor Reported Braking Action

MAX MANUAL	6910	460/-460	230/330	-420/1620	560/-370	180/-200	N/A	1190	3210
AUTOBRAKE MAX	6940	470/-460	230/330	-420/1620	560/-370	180/-200	N/A	1190	3210
AUTOBRAKE 3	6990	470/-460	230/330	-430/1630	540/-340	180/-200	N/A	1200	3230

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 1000 ft from threshold to touchdown.
Actual (unfactored) distances are shown.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

All Flaps Up Landing

VREF40 + 55

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	130000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 130000 LB	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	3860	460/-210	90/220	-130/440	40/-40	90/-90	130	100	230
AUTOBRAKE MAX	5600	250/-240	140/190	-180/600	10/-10	140/-150	230	10	20
AUTOBRAKE 2	10120	580/-640	350/460	-400/1330	220/-250	310/-310	320	820	930

Good Reported Braking Action

MAX MANUAL	5340	260/-270	150/210	-210/720	120/-100	140/-140	150	330	750
AUTOBRAKE MAX	6050	260/-280	170/230	-230/770	80/-70	160/-160	220	260	680
AUTOBRAKE 2	10120	580/-640	350/460	-400/1330	220/-250	310/-310	320	820	930

Medium Reported Braking Action

MAX MANUAL	7540	430/-450	250/340	-340/1200	300/-250	210/-220	200	940	2340
AUTOBRAKE MAX	7790	440/-460	260/350	-340/1220	290/-230	220/-220	230	970	2400
AUTOBRAKE 3	8860	430/-470	280/380	-370/1310	190/-160	260/-260	350	490	1550

Poor Reported Braking Action

MAX MANUAL	10020	650/-660	360/510	-510/1890	740/-500	280/-300	260	2070	5820
AUTOBRAKE MAX	10010	650/-650	370/510	-510/1890	730/-480	290/-300	280	2050	5780
AUTOBRAKE 3	10350	630/-640	360/510	-520/1910	660/-430	300/-320	350	1840	5620

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 1000 ft from threshold to touchdown.
Actual (unfactored) distances are shown.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

ANTISKID INOPERATIVE (Flaps 15)

VREF15

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	130000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 130000 LB	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV
Dry Runway									
MAX MANUAL	5080	280/-290	140/190	-240/870	150/-130	120/-120	190	400	970
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								
Good Reported Braking Action									
MAX MANUAL	5690	340/-340	160/230	-290/1060	230/-180	140/-140	210	600	1510
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								
Medium Reported Braking Action									
MAX MANUAL	7280	490/-480	230/340	-440/1660	560/-370	180/-200	250	1310	3720
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								
Poor Reported Braking Action									
MAX MANUAL	9730	720/-700	320/500	-730/3070	4470/-860	210/-290	290	3240	12210
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 1000 ft from threshold to touchdown.
Actual (unfactored) distances are shown.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance
ANTISKID INOPERATIVE (Flaps 30)
VREF30

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	130000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 130000 LB	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	4890	270/-280	130/180	-240/860	150/-130	110/-120	190	360	870
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Good Reported Braking Action

MAX MANUAL	5450	320/-320	150/220	-290/1040	220/-170	130/-140	210	540	1330
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Medium Reported Braking Action

MAX MANUAL	6910	450/-450	210/310	-420/1630	540/-350	170/-190	240	1150	3180
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Poor Reported Braking Action

MAX MANUAL	9180	660/-650	300/460	-700/3000	4150/-810	200/-270	270	2830	10190
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 1000 ft from threshold to touchdown.
Actual (unfactored) distances are shown.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

ANTISKID INOPERATIVE (Flaps 40)

VREF40

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	130000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 130000 LB	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	4800	260/-270	130/180	-240/850	150/-130	110/-120	190	340	810
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Good Reported Braking Action

MAX MANUAL	5340	310/-320	150/220	-280/1040	220/-170	130/-130	210	500	1240
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Medium Reported Braking Action

MAX MANUAL	6750	440/-440	210/310	-420/1610	540/-350	160/-180	240	1070	2910
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Poor Reported Braking Action

MAX MANUAL	8930	650/-620	290/450	-690/2970	4010/-790	200/-270	270	2640	9240
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 1000 ft from threshold to touchdown.
Actual (unfactored) distances are shown.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

Jammed or Restricted Flight Controls (Flaps 15)

VREF15

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	130000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 130000 LB	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	2850	180/-150	60/80	-110/360	30/-30	60/-60	100	60	120
AUTOBRAKE MAX	3640	170/-180	80/110	-140/460	0/0	80/-80	170	0	10
AUTOBRAKE 2	6470	410/-440	200/270	-310/1060	60/-100	180/-180	320	150	150

Good Reported Braking Action

MAX MANUAL	3920	210/-210	100/140	-180/620	90/-80	90/-90	150	220	510
AUTOBRAKE MAX	4140	220/-230	110/150	-180/640	80/-60	100/-100	170	240	560
AUTOBRAKE 2	6470	410/-440	200/270	-310/1060	60/-100	180/-180	320	150	150

Medium Reported Braking Action

MAX MANUAL	5350	330/-330	160/230	-280/1030	230/-180	130/-140	200	630	1570
AUTOBRAKE MAX	5380	340/-340	160/230	-280/1030	220/-170	140/-140	220	620	1560
AUTOBRAKE 3	5620	340/-340	160/240	-290/1060	170/-110	150/-150	290	470	1440

Poor Reported Braking Action

MAX MANUAL	6960	490/-470	230/340	-430/1630	570/-370	180/-190	240	1360	3840
AUTOBRAKE MAX	6960	490/-480	230/340	-430/1630	580/-380	180/-200	240	1360	3840
AUTOBRAKE 3	6960	490/-470	230/340	-430/1630	580/-350	180/-200	250	1360	3840

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 1000 ft from threshold to touchdown.
Actual (unfactored) distances are shown.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance
LEADING EDGE FLAPS TRANSIT (Flaps 15)
VREF15 + 15

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	130000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 130000 LB	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV
Dry Runway									
MAX MANUAL	3210	200/-170	70/100	-110/390	40/-40	70/-70	110	80	170
AUTOBRAKE MAX	4180	190/-200	100/140	-150/500	0/0	100/-100	190	0	10
AUTOBRAKE 2	7570	460/-510	250/330	-340/1150	100/-140	220/-220	330	310	310
Good Reported Braking Action									
MAX MANUAL	4480	230/-240	120/170	-190/670	110/-90	110/-110	160	290	670
AUTOBRAKE MAX	4740	250/-260	130/180	-200/690	100/-80	120/-120	180	310	730
AUTOBRAKE 2	7570	460/-510	250/330	-340/1150	100/-140	220/-220	330	310	310
Medium Reported Braking Action									
MAX MANUAL	6140	380/-380	190/270	-310/1100	270/-210	160/-170	210	790	2010
AUTOBRAKE MAX	6190	380/-390	200/280	-310/1100	250/-200	160/-170	240	790	2000
AUTOBRAKE 3	6550	370/-380	200/280	-320/1140	190/-120	180/-180	320	530	1760
Poor Reported Braking Action									
MAX MANUAL	7970	550/-540	280/400	-460/1730	640/-420	210/-230	250	1670	4800
AUTOBRAKE MAX	7970	550/-540	280/400	-460/1730	650/-430	210/-230	250	1670	4800
AUTOBRAKE 3	7990	550/-530	280/400	-460/1730	640/-380	210/-230	300	1660	4790

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 1000 ft from threshold to touchdown.
Actual (unfactored) distances are shown.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

LOSS OF SYSTEM A (Flaps 15)

VREF15

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	130000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 130000 LB	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	3110	190/-150	70/100	-110/390	40/-40	70/-70	130	80	130
AUTOBRAKE MAX	3640	170/-180	80/110	-140/460	0/0	80/-80	170	0	0
AUTOBRAKE 2	6620	400/-430	200/270	-320/1070	0/-10	190/-190	410	0	0

Good Reported Braking Action

MAX MANUAL	4520	250/-260	120/180	-200/690	130/-110	110/-110	210	360	720
AUTOBRAKE MAX	4520	250/-260	130/180	-200/690	110/-90	110/-110	220	350	710
AUTOBRAKE 2	6620	400/-430	200/270	-320/1070	0/-10	190/-190	410	0	0

Medium Reported Braking Action

MAX MANUAL	6200	400/-400	200/280	-320/1140	310/-250	160/-170	270	960	2310
AUTOBRAKE MAX	6150	400/-400	200/280	-320/1130	320/-250	160/-170	270	950	2280
AUTOBRAKE 3	6150	400/-390	200/280	-320/1130	320/-240	160/-170	270	950	2280

Poor Reported Braking Action

MAX MANUAL	8050	580/-560	280/420	-470/1780	720/-470	210/-230	320	1990	5800
AUTOBRAKE MAX	8030	580/-560	280/420	-470/1780	740/-490	210/-230	310	1990	5780
AUTOBRAKE 3	8030	580/-560	280/420	-470/1780	740/-480	210/-230	310	1990	5780

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 1000 ft from threshold to touchdown.
Actual (unfactored) distances are shown.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

LOSS OF SYSTEM A (Flaps 30)

VREF30

BRAKING CONFIGURATION	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
	130000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 130000 LB	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	3040	180/-140	70/90	-110/380	40/-40	60/-60	140	80	120
AUTOBRAKE MAX	3480	160/-170	80/110	-130/440	0/0	80/-80	170	20	30
AUTOBRAKE 2	6240	370/-400	180/250	-300/1040	0/-10	180/-180	390	0	0

Good Reported Braking Action

MAX MANUAL	4370	240/-240	120/170	-200/680	130/-110	110/-110	210	330	650
AUTOBRAKE MAX	4380	240/-250	120/170	-200/690	110/-90	110/-110	220	320	640
AUTOBRAKE 2	6240	370/-400	180/250	-300/1040	0/-10	180/-180	390	0	0

Medium Reported Braking Action

MAX MANUAL	5920	370/-380	180/260	-310/1110	300/-240	150/-160	260	850	2010
AUTOBRAKE MAX	5890	370/-370	180/270	-310/1110	310/-250	150/-160	260	850	2000
AUTOBRAKE 3	5890	370/-370	180/270	-310/1110	310/-240	150/-160	260	850	2000

Poor Reported Braking Action

MAX MANUAL	7610	540/-520	260/380	-460/1740	690/-450	200/-210	300	1730	4850
AUTOBRAKE MAX	7610	540/-520	260/380	-460/1740	700/-460	200/-220	300	1730	4850
AUTOBRAKE 3	7610	540/-520	260/380	-460/1740	700/-460	200/-220	300	1730	4850

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 1000 ft from threshold to touchdown.
Actual (unfactored) distances are shown.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance
LOSS OF SYSTEM A (Flaps 40)
VREF40

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	130000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 130000 LB	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	3030	170/-140	70/100	-110/380	40/-40	60/-60	150	80	120
AUTOBRAKE MAX	3390	160/-170	80/110	-130/440	10/-10	70/-70	170	30	60
AUTOBRAKE 2	6020	360/-380	180/250	-300/1020	0/-10	170/-170	380	0	0

Good Reported Braking Action

MAX MANUAL	4310	240/-240	120/170	-200/680	130/-110	100/-110	210	320	620
AUTOBRAKE MAX	4320	240/-250	120/170	-200/680	120/-90	110/-110	230	310	610
AUTOBRAKE 2	6020	360/-380	180/250	-300/1020	0/-10	170/-170	380	0	0

Medium Reported Braking Action

MAX MANUAL	5780	370/-360	180/260	-310/1110	300/-230	150/-150	260	790	1840
AUTOBRAKE MAX	5770	370/-360	180/270	-310/1100	310/-240	150/-150	260	790	1830
AUTOBRAKE 3	5770	370/-360	180/270	-310/1100	310/-240	150/-150	260	790	1830

Poor Reported Braking Action

MAX MANUAL	7380	520/-500	250/370	-450/1720	680/-440	190/-210	300	1580	4280
AUTOBRAKE MAX	7390	520/-500	250/380	-450/1720	690/-450	190/-210	300	1580	4280
AUTOBRAKE 3	7390	520/-500	250/380	-450/1720	690/-450	190/-210	300	1580	4280

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 1000 ft from threshold to touchdown.
Actual (unfactored) distances are shown.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance
LOSS OF SYSTEM A AND SYSTEM B (Flaps 15)
VREF15

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	130000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 130000 LB	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	4610	220/-240	110/160	-190/640	110/-100	110/-110	240	-30	190
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Good Reported Braking Action

MAX MANUAL	6340	350/-360	180/250	-290/1010	270/-220	160/-160	310	200	1100
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Medium Reported Braking Action

MAX MANUAL	8420	540/-530	270/380	-440/1580	590/-430	210/-220	370	910	3830
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Poor Reported Braking Action

MAX MANUAL	10500	740/-710	360/530	-630/2370	1330/-740	260/-290	400	2180	9700
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 1000 ft from threshold to touchdown.
Actual (unfactored) distances are shown.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance
LOSS OF SYSTEM B (Flaps 15)
VREF15

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	130000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 130000 LB	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	3300	150/-160	80/100	-130/450	50/-50	70/-70	130	110	190
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Good Reported Braking Action

MAX MANUAL	4600	260/-260	130/180	-220/760	140/-120	110/-110	180	380	780
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Medium Reported Braking Action

MAX MANUAL	6210	400/-400	200/280	-340/1240	340/-260	160/-170	230	950	2320
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Poor Reported Braking Action

MAX MANUAL	7940	570/-550	270/390	-500/1940	840/-490	200/-230	270	1910	5490
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 1000 ft from threshold to touchdown.
Actual (unfactored) distances are shown.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance
MANUAL REVERSION (Flaps 15)
VREF15

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	130000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 130000 LB	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	4610	220/-240	110/160	-190/640	110/-100	110/-110	240	-30	190
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Good Reported Braking Action

MAX MANUAL	6340	350/-360	180/250	-290/1010	270/-220	160/-160	310	200	1100
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Medium Reported Braking Action

MAX MANUAL	8420	540/-530	270/380	-440/1580	590/-430	210/-220	370	910	3830
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Poor Reported Braking Action

MAX MANUAL	10500	740/-710	360/530	-630/2370	1330/-740	260/-290	400	2180	9700
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 1000 ft from threshold to touchdown.
Actual (unfactored) distances are shown.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance
One Engine Inoperative Landing (Flaps 15)
VREF15

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	130000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 130000 LB	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	2880	180/-150	60/80	-110/370	30/-30	60/-60	110	0	60
AUTOBRAKE MAX	3640	180/-180	80/110	-140/460	0/0	80/-80	170	0	0
AUTOBRAKE 2	6620	390/-430	190/270	-320/1070	0/-30	190/-190	390	0	0

Good Reported Braking Action

MAX MANUAL	4070	220/-230	110/150	-190/650	110/-90	100/-100	160	0	280
AUTOBRAKE MAX	4330	230/-250	110/150	-190/670	90/-80	110/-110	190	0	300
AUTOBRAKE 2	6620	390/-430	190/270	-320/1070	0/-30	190/-190	390	0	0

Medium Reported Braking Action

MAX MANUAL	5820	360/-370	170/240	-310/1120	300/-230	160/-160	230	0	890
AUTOBRAKE MAX	5870	370/-380	180/250	-310/1120	280/-210	160/-160	260	0	880
AUTOBRAKE 3	5960	370/-380	180/250	-320/1130	280/-180	160/-160	280	0	900

Poor Reported Braking Action

MAX MANUAL	7980	550/-550	260/370	-490/1840	810/-510	220/-230	290	0	2240
AUTOBRAKE MAX	7970	560/-560	260/370	-490/1840	820/-520	220/-230	290	0	2240
AUTOBRAKE 3	7990	560/-560	270/370	-490/1840	810/-490	220/-230	310	0	2250

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 1000 ft from threshold to touchdown.
Actual (unfactored) distances are shown.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

One Engine Inoperative Landing (Flaps 30)

VREF30

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	130000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 130000 LB	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	2780	160/-140	60/80	-100/360	30/-30	60/-60	110	0	60
AUTOBRAKE MAX	3480	160/-170	80/100	-130/440	0/0	80/-80	170	0	0
AUTOBRAKE 2	6220	370/-390	180/250	-300/1040	10/-40	180/-180	370	0	0

Good Reported Braking Action

MAX MANUAL	3940	210/-220	100/140	-180/640	100/-90	100/-100	160	0	250
AUTOBRAKE MAX	4190	220/-230	110/150	-190/660	90/-80	100/-100	190	0	270
AUTOBRAKE 2	6220	370/-390	180/250	-300/1040	10/-40	180/-180	370	0	0

Medium Reported Braking Action

MAX MANUAL	5530	340/-350	160/230	-300/1090	290/-220	150/-150	220	0	780
AUTOBRAKE MAX	5600	350/-360	170/230	-300/1100	270/-200	150/-150	250	0	780
AUTOBRAKE 3	5680	350/-360	170/230	-310/1110	270/-180	150/-150	270	0	800

Poor Reported Braking Action

MAX MANUAL	7480	510/-510	240/340	-470/1780	760/-480	210/-220	270	0	1890
AUTOBRAKE MAX	7480	510/-510	240/340	-470/1780	770/-490	210/-220	270	0	1890
AUTOBRAKE 3	7520	510/-520	240/340	-470/1790	750/-460	210/-220	300	0	1900

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 1000 ft from threshold to touchdown.
Actual (unfactored) distances are shown.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

Stabilizer Trim Inoperative (Flaps 15)

VREF15

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	130000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 130000 LB	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	2850	180/-150	60/80	-110/360	30/-30	60/-60	100	60	120
AUTOBRAKE MAX	3640	170/-180	80/110	-140/460	0/0	80/-80	170	0	10
AUTOBRAKE 2	6470	410/-440	200/270	-310/1060	60/-100	180/-180	320	150	150

Good Reported Braking Action

MAX MANUAL	3920	210/-210	100/140	-180/620	90/-80	90/-90	150	220	510
AUTOBRAKE MAX	4140	220/-230	110/150	-180/640	80/-60	100/-100	170	240	560
AUTOBRAKE 2	6470	410/-440	200/270	-310/1060	60/-100	180/-180	320	150	150

Medium Reported Braking Action

MAX MANUAL	5350	330/-330	160/230	-280/1030	230/-180	130/-140	200	630	1570
AUTOBRAKE MAX	5380	340/-340	160/230	-280/1030	220/-170	140/-140	220	620	1560
AUTOBRAKE 3	5620	340/-340	160/240	-290/1060	170/-110	150/-150	290	470	1440

Poor Reported Braking Action

MAX MANUAL	6960	490/-470	230/340	-430/1630	570/-370	180/-190	240	1360	3840
AUTOBRAKE MAX	6960	490/-480	230/340	-430/1630	580/-380	180/-200	240	1360	3840
AUTOBRAKE 3	6960	490/-470	230/340	-430/1630	580/-350	180/-200	250	1360	3840

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 1000 ft from threshold to touchdown.
Actual (unfactored) distances are shown.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

Trailing Edge Flap Asymmetry (1 ≤ Flap Lever <15)

VREF40 + 30

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	130000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 130000 LB	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	3320	240/-180	80/110	-120/400	40/-30	70/-70	110	80	170
AUTOBRAKE MAX	4540	200/-200	110/150	-160/530	10/-10	110/-110	210	0	10
AUTOBRAKE 2	8070	480/-520	270/370	-350/1190	150/-180	240/-240	320	510	520

Good Reported Braking Action

MAX MANUAL	4580	230/-240	130/180	-190/670	100/-90	110/-120	150	280	640
AUTOBRAKE MAX	4990	240/-250	140/190	-200/700	90/-70	120/-130	200	300	700
AUTOBRAKE 2	8080	470/-520	270/370	-350/1190	150/-180	240/-240	310	510	530

Medium Reported Braking Action

MAX MANUAL	6320	370/-380	200/280	-310/1110	260/-210	170/-170	200	770	1930
AUTOBRAKE MAX	6480	380/-390	210/290	-310/1120	250/-200	170/-180	230	790	1960
AUTOBRAKE 3	7070	370/-390	210/310	-330/1180	170/-120	200/-200	340	450	1470

Poor Reported Braking Action

MAX MANUAL	8260	550/-540	290/420	-460/1740	630/-420	220/-240	240	1660	4680
AUTOBRAKE MAX	8250	550/-540	290/420	-460/1740	640/-420	220/-240	250	1640	4660
AUTOBRAKE 3	8390	540/-530	290/420	-470/1750	590/-360	230/-250	320	1590	4630

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 1000 ft from threshold to touchdown.
Actual (unfactored) distances are shown.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance
Trailing Edge Flap Asymmetry (Flap Lever 15 or 25)
VREF15

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	130000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 130000 LB	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	2850	180/-150	60/80	-110/360	30/-30	60/-60	100	60	120
AUTOBRAKE MAX	3640	170/-180	80/110	-140/460	0/0	80/-80	170	0	10
AUTOBRAKE 2	6470	410/-440	200/270	-310/1060	60/-100	180/-180	320	150	150

Good Reported Braking Action

MAX MANUAL	3920	210/-210	100/140	-180/620	90/-80	90/-90	150	220	510
AUTOBRAKE MAX	4140	220/-230	110/150	-180/640	80/-60	100/-100	170	240	560
AUTOBRAKE 2	6470	410/-440	200/270	-310/1060	60/-100	180/-180	320	150	150

Medium Reported Braking Action

MAX MANUAL	5350	330/-330	160/230	-280/1030	230/-180	130/-140	200	630	1570
AUTOBRAKE MAX	5380	340/-340	160/230	-280/1030	220/-170	140/-140	220	620	1560
AUTOBRAKE 3	5620	340/-340	160/240	-290/1060	170/-110	150/-150	290	470	1440

Poor Reported Braking Action

MAX MANUAL	6960	490/-470	230/340	-430/1630	570/-370	180/-190	240	1360	3840
AUTOBRAKE MAX	6960	490/-480	230/340	-430/1630	580/-380	180/-200	240	1360	3840
AUTOBRAKE 3	6960	490/-470	230/340	-430/1630	580/-350	180/-200	250	1360	3840

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 1000 ft from threshold to touchdown.
Actual (unfactored) distances are shown.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance
Trailing Edge Flap Asymmetry (Flap Lever 30)
VREF30

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	130000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 130000 LB	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	2760	150/-130	60/80	-100/350	30/-30	50/-50	100	50	110
AUTOBRAKE MAX	3480	160/-170	80/100	-130/440	0/0	80/-80	170	0	0
AUTOBRAKE 2	6090	380/-410	190/250	-300/1020	60/-110	170/-170	300	150	150

Good Reported Braking Action

MAX MANUAL	3800	200/-200	100/140	-170/610	90/-80	90/-90	150	210	470
AUTOBRAKE MAX	4020	210/-220	100/140	-180/630	80/-70	90/-90	170	220	510
AUTOBRAKE 2	6090	380/-410	190/250	-300/1020	60/-110	170/-170	300	150	150

Medium Reported Braking Action

MAX MANUAL	5120	310/-320	150/210	-280/1010	230/-180	130/-130	190	560	1390
AUTOBRAKE MAX	5170	320/-320	150/220	-280/1010	210/-160	130/-140	220	560	1380
AUTOBRAKE 3	5360	320/-330	150/220	-280/1040	170/-110	140/-140	280	450	1310

Poor Reported Braking Action

MAX MANUAL	6610	450/-440	210/310	-410/1600	550/-360	170/-180	230	1190	3280
AUTOBRAKE MAX	6620	450/-440	220/310	-410/1600	560/-360	170/-180	230	1190	3290
AUTOBRAKE 3	6620	460/-440	220/310	-420/1600	550/-340	170/-190	250	1190	3290

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 1000 ft from threshold to touchdown.
Actual (unfactored) distances are shown.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance
Trailing Edge Flap Disagree (1 ≤ Indicated Flaps <15)
VREF40 + 30

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	130000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 130000 LB	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV
Dry Runway									
MAX MANUAL	3320	240/-180	80/110	-120/400	40/-30	70/-70	110	80	170
AUTOBRAKE MAX	4540	200/-200	110/150	-160/530	10/-10	110/-110	210	0	10
AUTOBRAKE 2	8070	480/-520	270/370	-350/1190	150/-180	240/-240	320	510	520
Good Reported Braking Action									
MAX MANUAL	4580	230/-240	130/180	-190/670	100/-90	110/-120	150	280	640
AUTOBRAKE MAX	4990	240/-250	140/190	-200/700	90/-70	120/-130	200	300	700
AUTOBRAKE 2	8080	470/-520	270/370	-350/1190	150/-180	240/-240	310	510	530
Medium Reported Braking Action									
MAX MANUAL	6320	370/-380	200/280	-310/1110	260/-210	170/-170	200	770	1930
AUTOBRAKE MAX	6480	380/-390	210/290	-310/1120	250/-200	170/-180	230	790	1960
AUTOBRAKE 3	7070	370/-390	210/310	-330/1180	170/-120	200/-200	340	450	1470
Poor Reported Braking Action									
MAX MANUAL	8260	550/-540	290/420	-460/1740	630/-420	220/-240	240	1660	4680
AUTOBRAKE MAX	8250	550/-540	290/420	-460/1740	640/-420	220/-240	250	1640	4660
AUTOBRAKE 3	8390	540/-530	290/420	-470/1750	590/-360	230/-250	320	1590	4630

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 1000 ft from threshold to touchdown.
Actual (unfactored) distances are shown.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

Trailing Edge Flap Disagree (15 ≤ Indicated Flaps <30)

VREF15

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	130000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 130000 LB	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	2850	180/-150	60/80	-110/360	30/-30	60/-60	100	60	120
AUTOBRAKE MAX	3640	170/-180	80/110	-140/460	0/0	80/-80	170	0	10
AUTOBRAKE 2	6470	410/-440	200/270	-310/1060	60/-100	180/-180	320	150	150

Good Reported Braking Action

MAX MANUAL	3920	210/-210	100/140	-180/620	90/-80	90/-90	150	220	510
AUTOBRAKE MAX	4140	220/-230	110/150	-180/640	80/-60	100/-100	170	240	560
AUTOBRAKE 2	6470	410/-440	200/270	-310/1060	60/-100	180/-180	320	150	150

Medium Reported Braking Action

MAX MANUAL	5350	330/-330	160/230	-280/1030	230/-180	130/-140	200	630	1570
AUTOBRAKE MAX	5380	340/-340	160/230	-280/1030	220/-170	140/-140	220	620	1560
AUTOBRAKE 3	5620	340/-340	160/240	-290/1060	170/-110	150/-150	290	470	1440

Poor Reported Braking Action

MAX MANUAL	6960	490/-470	230/340	-430/1630	570/-370	180/-190	240	1360	3840
AUTOBRAKE MAX	6960	490/-480	230/340	-430/1630	580/-380	180/-200	240	1360	3840
AUTOBRAKE 3	6960	490/-470	230/340	-430/1630	580/-350	180/-200	250	1360	3840

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 1000 ft from threshold to touchdown.
Actual (unfactored) distances are shown.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

Trailing Edge Flap Disagree (30 ≤ Indicated Flaps <40)

VREF30

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	130000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 130000 LB	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	2760	150/-130	60/80	-100/350	30/-30	50/-50	100	50	110
AUTOBRAKE MAX	3480	160/-170	80/100	-130/440	0/0	80/-80	170	0	0
AUTOBRAKE 2	6090	380/-410	190/250	-300/1020	60/-110	170/-170	300	150	150

Good Reported Braking Action

MAX MANUAL	3800	200/-200	100/140	-170/610	90/-80	90/-90	150	210	470
AUTOBRAKE MAX	4020	210/-220	100/140	-180/630	80/-70	90/-90	170	220	510
AUTOBRAKE 2	6090	380/-410	190/250	-300/1020	60/-110	170/-170	300	150	150

Medium Reported Braking Action

MAX MANUAL	5120	310/-320	150/210	-280/1010	230/-180	130/-130	190	560	1390
AUTOBRAKE MAX	5170	320/-320	150/220	-280/1010	210/-160	130/-140	220	560	1380
AUTOBRAKE 3	5360	320/-330	150/220	-280/1040	170/-110	140/-140	280	450	1310

Poor Reported Braking Action

MAX MANUAL	6610	450/-440	210/310	-410/1600	550/-360	170/-180	230	1190	3280
AUTOBRAKE MAX	6620	450/-440	220/310	-410/1600	560/-360	170/-180	230	1190	3290
AUTOBRAKE 3	6620	460/-440	220/310	-420/1600	550/-340	170/-190	250	1190	3290

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 1000 ft from threshold to touchdown.
Actual (unfactored) distances are shown.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

Trailing Edge Flaps Up Landing

VREF40 + 40

BRAKING CONFIGURATION	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
	130000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 130000 LB	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	3500	300/-190	80/110	-120/420	40/-40	80/-80	110	90	180
AUTOBRAKE MAX	4960	220/-220	120/170	-170/560	10/-10	120/-120	210	0	10
AUTOBRAKE 2	8810	510/-560	300/400	-370/1240	190/-210	260/-260	300	640	720

Good Reported Braking Action

MAX MANUAL	4820	240/-250	130/180	-200/680	100/-90	120/-120	140	280	640
AUTOBRAKE MAX	5400	250/-260	150/200	-210/730	80/-60	140/-140	210	240	620
AUTOBRAKE 2	8810	510/-560	300/400	-370/1240	190/-210	260/-260	300	640	720

Medium Reported Braking Action

MAX MANUAL	6720	390/-400	220/300	-320/1140	270/-220	180/-190	190	790	1940
AUTOBRAKE MAX	6950	400/-410	220/310	-320/1150	260/-210	190/-190	220	810	2000
AUTOBRAKE 3	7760	390/-420	240/330	-350/1230	180/-150	220/-230	330	430	1350

Poor Reported Braking Action

MAX MANUAL	8860	580/-580	310/440	-480/1790	670/-450	240/-260	240	1720	4770
AUTOBRAKE MAX	8860	580/-580	310/440	-480/1790	660/-430	250/-260	270	1710	4730
AUTOBRAKE 3	9110	570/-570	310/440	-490/1810	600/-390	260/-270	320	1580	4650

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 1000 ft from threshold to touchdown.
Actual (unfactored) distances are shown.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Recommended Brake Cooling Schedule

Reference Brake Energy Per Brake (Millions of Foot Pounds)

		WIND CORRECTED BRAKES ON SPEED (KIAS)*																	
		80			100			120			140			160			180		
WEIGHT (1000 LB)	OAT (°C)	PRESSURE ALTITUDE (1000 FT)																	
		0	5	10	0	5	10	0	5	10	0	5	10	0	5	10	0	5	10
180	0	15.5	17.5	19.7	23.3	26.2	29.8	32.2	36.5	41.6	42.2	48.0	55.2	53.2	60.7	70.3	63.3	72.5	84.7
	10	16.0	18.0	20.3	24.0	27.1	30.7	33.2	37.6	43.0	43.6	49.5	57.0	54.9	62.6	72.6	65.3	74.8	87.4
	15	16.3	18.3	20.6	24.4	27.5	31.2	33.7	38.2	43.6	44.2	50.3	57.8	55.7	63.6	73.7	66.3	76.0	88.7
	20	16.5	18.6	21.0	24.7	27.9	31.7	34.3	38.8	44.3	44.9	51.0	58.7	56.5	64.5	74.8	67.3	77.1	90.0
	30	17.0	19.1	21.5	25.4	28.7	32.6	35.2	39.9	45.5	46.2	52.5	60.3	58.1	66.3	76.9	69.2	79.2	92.5
	40	17.1	19.2	21.7	25.6	28.9	32.9	35.6	40.3	46.1	46.8	53.2	61.3	59.1	67.5	78.5	70.5	81.0	94.9
	50	17.1	19.3	21.7	25.7	29.1	33.1	35.8	40.7	46.6	47.3	53.9	62.3	59.9	68.7	80.1	71.8	82.7	97.2
160	0	14.3	16.0	18.1	21.2	23.9	27.1	29.2	33.1	37.7	38.2	43.4	49.8	48.0	54.7	63.2	58.0	66.3	77.1
	10	14.7	16.6	18.7	21.9	24.7	28.0	30.2	34.1	38.9	39.5	44.8	51.3	49.6	56.5	65.2	59.8	68.4	79.5
	15	15.0	16.8	18.9	22.2	25.1	28.4	30.6	34.7	39.5	40.1	45.5	52.1	50.3	57.3	66.2	60.7	69.4	80.7
	20	15.2	17.1	19.2	22.6	25.5	28.8	31.1	35.2	40.1	40.7	46.1	52.9	51.1	58.2	67.2	61.6	70.4	81.9
	30	15.6	17.6	19.8	23.2	26.2	29.6	32.0	36.2	41.2	41.8	47.4	54.4	52.5	59.8	69.1	63.4	72.4	84.2
	40	15.7	17.7	19.9	23.4	26.4	29.9	32.3	36.5	41.7	42.3	48.1	55.2	53.3	60.8	70.4	64.5	73.9	86.2
	50	15.7	17.7	19.9	23.5	26.5	30.1	32.5	36.8	42.1	42.7	48.6	56.0	54.0	61.7	71.6	65.5	75.2	88.1
140	0	13.0	14.6	16.5	19.2	21.6	24.4	26.2	29.6	33.7	34.1	38.7	44.2	42.8	48.6	56.0	52.1	59.5	68.9
	10	13.5	15.1	17.0	19.8	22.3	25.2	27.1	30.6	34.8	35.2	39.9	45.6	44.2	50.2	57.8	53.8	61.4	71.1
	15	13.7	15.4	17.3	20.1	22.7	25.6	27.5	31.1	35.3	35.8	40.5	46.3	44.9	51.0	58.7	54.6	62.3	72.2
	20	13.9	15.6	17.6	20.4	23.0	26.0	27.9	31.6	35.9	36.3	41.1	47.0	45.5	51.7	59.5	55.5	63.2	73.2
	30	14.3	16.0	18.0	21.0	23.6	26.7	28.7	32.4	36.9	37.3	42.3	48.4	46.8	53.2	61.2	57.0	65.0	75.3
	40	14.3	16.1	18.1	21.1	23.8	26.9	29.0	32.7	37.3	37.7	42.8	49.0	47.4	54.0	62.2	57.9	66.2	76.9
	50	14.3	16.1	18.2	21.2	23.9	27.1	29.1	32.9	37.5	38.0	43.2	49.6	47.9	54.7	63.2	58.7	67.3	78.4
120	0	11.8	13.3	14.9	17.2	19.3	21.8	23.3	26.2	29.8	30.0	34.0	38.7	37.4	42.5	48.7	45.4	51.7	59.6
	10	12.2	13.7	15.4	17.7	19.9	22.5	24.0	27.1	30.7	31.0	35.1	40.0	38.6	43.8	50.2	46.9	53.3	61.5
	15	12.4	13.9	15.6	18.0	20.2	22.9	24.4	27.5	31.2	31.5	35.6	40.6	39.2	44.5	51.0	47.6	54.2	62.4
	20	12.6	14.1	15.9	18.3	20.6	23.2	24.7	27.9	31.7	32.0	36.1	41.2	39.8	45.2	51.8	48.3	55.0	63.4
	30	12.9	14.5	16.3	18.8	21.1	23.9	25.4	28.7	32.6	32.8	37.2	42.4	40.9	46.4	53.2	49.7	56.5	65.1
	40	13.0	14.6	16.4	18.9	21.3	24.0	25.6	28.9	32.9	33.2	37.6	42.9	41.4	47.0	54.0	50.4	57.4	66.3
	50	13.0	14.6	16.4	18.9	21.3	24.1	25.7	29.1	33.1	33.4	37.8	43.3	41.8	47.5	54.7	51.0	58.2	67.4
100	0	10.6	11.9	13.4	15.1	17.0	19.2	20.3	22.8	25.9	25.9	29.3	33.3	32.1	36.3	41.5	38.7	43.9	50.4
	10	10.9	12.3	13.8	15.6	17.6	19.8	20.9	23.6	26.7	26.8	30.2	34.4	33.1	37.5	42.8	40.0	45.3	52.0
	15	11.1	12.5	14.0	15.9	17.9	20.1	21.2	23.9	27.1	27.2	30.7	34.9	33.6	38.1	43.5	40.6	46.0	52.8
	20	11.3	12.7	14.2	16.1	18.1	20.4	21.6	24.3	27.5	27.6	31.2	35.4	34.1	38.6	44.1	41.2	46.7	53.6
	30	11.6	13.0	14.6	16.6	18.6	21.0	22.2	25.0	28.3	28.4	32.0	36.4	35.1	39.7	45.4	42.3	48.0	55.1
	40	11.6	13.1	14.7	16.6	18.7	21.1	22.3	25.2	28.5	28.6	32.3	36.8	35.4	40.2	45.9	42.8	48.7	56.0
	50	11.6	13.1	14.7	16.7	18.8	21.2	22.4	25.3	28.7	28.7	32.5	37.1	35.7	40.5	46.4	43.2	49.2	56.7
90	0	10.0	11.3	12.6	14.1	15.9	17.9	18.8	21.1	23.9	23.9	27.0	30.6	29.4	33.3	37.9	35.4	40.1	45.9
	10	10.3	11.6	13.0	14.6	16.4	18.5	19.4	21.8	24.7	24.7	27.8	31.6	30.4	34.3	39.1	36.5	41.4	47.4
	15	10.5	11.8	13.3	14.8	16.7	18.8	19.7	22.2	25.0	25.0	28.3	32.1	30.8	34.9	39.7	37.1	42.0	48.1
	20	10.7	12.0	13.5	15.0	16.9	19.1	20.0	22.5	25.4	25.4	28.7	32.5	31.3	35.4	40.3	37.6	42.6	48.8
	30	11.0	12.3	13.8	15.5	17.4	19.6	20.5	23.1	26.1	26.1	29.5	33.5	32.2	36.4	41.5	38.7	43.8	50.2
	40	11.0	12.4	13.9	15.5	17.5	19.7	20.7	23.3	26.3	26.3	29.7	33.8	32.5	36.8	42.0	39.1	44.4	50.9
	50	11.0	12.4	13.9	15.6	17.5	19.8	20.7	23.4	26.5	26.4	29.9	34.0	32.7	37.1	42.3	39.4	44.8	51.5

***To correct for wind, enter table with the brakes on speed minus one half the headwind or plus 1.5 times the tailwind. If ground speed is used for brakes on speed, ignore wind and enter table with sea level, 15°C.**

ADVISORY INFORMATION

Recommended Brake Cooling Schedule
Adjusted Brake Energy Per Brake (Millions of Foot Pounds)
No Reverse Thrust

		REFERENCE BRAKE ENERGY PER BRAKE (MILLIONS OF FOOT POUNDS)								
EVENT		10	20	30	40	50	60	70	80	90
RTO MAX MAN		10	20	30	40	50	60	70	80	90
LANDING	MAX MAN	7.5	15.8	24.6	33.8	43.5	53.5	63.6	73.9	84.2
	MAX AUTO	7.3	15.0	23.2	31.9	41.2	51.0	61.3	72.2	83.7
	AUTOBRAKE 3	7.0	14.2	21.8	29.7	38.1	47.1	56.7	67.1	78.3
	AUTOBRAKE 2	6.6	13.3	20.2	27.3	34.7	42.6	51.0	59.9	69.6
	AUTOBRAKE 1	6.3	12.4	18.6	24.9	31.6	38.6	46.2	54.4	63.5

Two Engine Detent Reverse Thrust

		REFERENCE BRAKE ENERGY PER BRAKE (MILLIONS OF FOOT POUNDS)								
EVENT		10	20	30	40	50	60	70	80	90
RTO MAX MAN		10	20	30	40	50	60	70	80	90
LANDING	MAX MAN	6.9	14.5	22.7	31.4	40.4	49.7	59.3	68.9	78.5
	MAX AUTO	6.0	12.6	19.8	27.6	36.0	45.1	54.8	65.3	76.5
	AUTOBRAKE 3	4.5	9.5	15.1	21.3	28.1	35.6	43.7	52.5	62.0
	AUTOBRAKE 2	2.6	5.9	9.7	14.1	19.1	24.7	31.0	37.9	45.4
	AUTOBRAKE 1	1.8	3.8	6.3	9.1	12.5	16.4	21.0	26.3	32.5

Cooling Time (Minutes) - Category F Steel Brakes

	EVENT ADJUSTED BRAKE ENERGY (MILLIONS OF FOOT POUNDS)								
	16 & BELOW	17	20	23	25	28	32	33 TO 48	49 & ABOVE
	BRAKE TEMPERATURE MONITOR SYSTEM INDICATION ON CDS								
	UP TO 2.4	2.6	3.1	3.5	3.9	4.4	4.9	5.0 TO 7.5	7.5 & ABOVE
INFLIGHT GEAR DOWN	NO SPECIAL PROCEDURE REQUIRED	1	2	3	4	5	6	CAUTION	FUSE PLUG MELT ZONE
GROUND		10	20	30	40	50	60		

Cooling Time (Minutes) - Category M Carbon Brakes

	EVENT ADJUSTED BRAKE ENERGY (MILLIONS OF FOOT POUNDS)								
	16 & BELOW	17	19	20.9	23.5	26.9	29.4	30 TO 41	41 & ABOVE
	BRAKE TEMPERATURE MONITOR SYSTEM INDICATION ON CDS								
	UP TO 2.5	2.6	3	3.3	3.8	4.5	4.9	5.0 TO 7.1	7.1 & ABOVE
INFLIGHT GEAR DOWN	NO SPECIAL PROCEDURE REQUIRED	1	4	5	6	7	7.6	CAUTION	FUSE PLUG MELT ZONE
GROUND		6.7	16.0	24.1	34.2	45.9	53.3		

Observe maximum quick turnaround limit.
Table shows energy per brake added by a single stop with all brakes operating. Energy is assumed to be equally distributed among the operating brakes. Total energy is the sum of residual energy plus energy added.
Add 1.0 million foot pounds per brake for each taxi mile.

When in caution zone, wheel fuse plugs may melt. Delay takeoff and inspect after one hour. If overheat occurs after takeoff, extend gear soon for at least 7 minutes.

When in fuse plug melt zone, clear runway immediately. Unless required, do not set parking brake. Do not approach gear or attempt to taxi for one hour. Tire, wheel and brake replacement may be required. If overheat occurs after takeoff, extend gear soon for at least 12 minutes.

Brake temperature monitor system (BTMS) indication on CDS systems page may be used 10 to 15 minutes after airplane has come to a complete stop or inflight with gear retracted to determine recommended cooling schedule.

Performance Inflight — Chapter PI
Engine Inoperative — Section 23

ENGINE INOP

Initial Max Continuous %N1

Based on .79M, A/C high and anti-ice off

TAT (°C)	PRESSURE ALTITUDE (1000 FT)								
	25	27	29	31	33	35	37	39	41
20	96.1	95.9	95.6	95.5	95.2	94.8	94.3	94.0	93.2
15	96.7	96.5	96.2	96.1	96.0	95.5	95.1	94.8	94.1
10	97.3	97.2	96.8	96.7	96.7	96.2	95.8	95.6	95.0
5	97.5	97.9	97.6	97.4	97.4	97.0	96.6	96.4	95.9
0	96.8	98.1	98.5	98.3	98.2	97.8	97.5	97.2	96.8
-5	96.0	97.3	98.5	99.2	99.1	98.6	98.3	98.1	97.8
-10	95.2	96.5	97.7	99.0	99.9	99.5	99.2	99.0	98.7
-15	94.4	95.8	96.9	98.2	99.5	100.4	100.1	99.9	99.7
-20	93.6	95.0	96.2	97.4	98.7	99.8	100.4	100.2	100.0
-25	92.8	94.2	95.4	96.6	97.9	99.0	99.6	99.4	99.2
-30	91.9	93.4	94.6	95.8	97.0	98.2	98.7	98.5	98.3
-35	91.1	92.6	93.7	94.9	96.2	97.3	97.9	97.7	97.5
-40	90.3	91.8	92.9	94.1	95.3	96.5	97.0	96.8	96.6

%N1 Adjustments for Engine Bleeds

BLEED CONFIGURATION	PRESSURE ALTITUDE (1000 FT)								
	25	27	29	31	33	35	37	39	41
ENGINE ANTI-ICE	-1.2	-1.1	-1.0	-0.9	-0.8	-0.8	-0.8	-0.8	-0.8
ENGINE & WING ANTI-ICE	-4.2	-4.4	-4.5	-4.7	-5.0	-4.8	-4.8	-4.8	-4.8

ENGINE INOP

Max Continuous %N1

37000 FT to 29000 FT Pressure Altitudes

37000 FT PRESS ALT		TAT (°C)											
KIAS	M	-55	-50	-45	-40	-35	-30	-25	-20	-15	-10	-5	0
160	.51	96.0	97.0	97.9	98.7	99.6	98.9	98.1	96.9	95.6	94.0	92.5	91.1
200	.63	95.4	96.3	97.2	98.1	98.9	99.8	99.5	98.7	97.8	96.8	95.6	94.5
240	.74	94.4	95.3	96.2	97.1	98.0	98.8	99.7	100.1	99.3	98.5	97.7	96.7
280	.86	93.7	94.6	95.5	96.4	97.2	98.1	98.9	99.7	100.5	100.2	99.3	98.5
35000 FT PRESS ALT		TAT (°C)											
KIAS	M	-55	-50	-45	-40	-35	-30	-25	-20	-15	-10	-5	0
160	.49	95.9	96.8	97.7	98.6	99.5	99.2	98.4	97.3	96.1	94.7	93.3	92.0
200	.60	95.5	96.4	97.3	98.2	99.1	100.0	99.9	98.9	98.0	97.0	95.8	94.7
240	.71	94.4	95.3	96.2	97.1	98.0	98.8	99.6	100.2	99.5	98.9	98.0	97.0
280	.82	93.2	94.0	94.9	95.8	96.6	97.5	98.3	99.1	99.9	99.7	98.9	98.1
33000 FT PRESS ALT		TAT (°C)											
KIAS	M	-50	-45	-40	-35	-30	-25	-20	-15	-10	-5	0	5
160	.47	96.8	97.7	98.5	99.4	100.2	99.3	98.5	97.3	96.0	94.6	93.2	92.0
200	.58	96.4	97.3	98.2	99.1	99.9	100.8	99.9	99.0	98.0	96.8	95.6	94.5
240	.68	95.3	96.2	97.1	97.9	98.8	99.6	100.4	100.2	99.6	98.7	97.7	96.7
280	.79	93.6	94.5	95.4	96.2	97.1	97.9	98.7	99.5	99.9	99.1	98.2	97.4
320	.89	93.0	93.9	94.7	95.6	96.4	97.2	98.1	98.9	99.7	100.4	100.0	99.2
31000 FT PRESS ALT		TAT (°C)											
KIAS	M	-50	-45	-40	-35	-30	-25	-20	-15	-10	-5	0	5
160	.45	96.7	97.6	98.5	99.4	100.3	100.4	99.5	98.5	97.3	95.9	94.5	93.2
200	.55	96.5	97.3	98.2	99.1	100.0	100.8	101.0	100.1	99.1	98.0	96.7	95.5
240	.66	95.0	95.9	96.8	97.6	98.5	99.3	100.2	100.7	99.9	99.1	98.1	97.1
280	.76	93.2	94.0	94.9	95.7	96.6	97.4	98.2	99.0	99.8	99.1	98.2	97.3
320	.85	91.8	92.6	93.5	94.3	95.1	95.9	96.7	97.5	98.3	99.1	99.3	98.4
29000 FT PRESS ALT		TAT (°C)											
KIAS	M	-45	-40	-35	-30	-25	-20	-15	-10	-5	0	5	10
160	.43	97.5	98.4	99.3	100.1	101.0	100.5	99.6	98.5	97.2	95.7	94.4	93.1
200	.53	96.9	97.8	98.7	99.5	100.4	101.2	100.7	99.7	98.7	97.5	96.2	95.1
240	.63	95.7	96.5	97.4	98.2	99.1	99.9	100.7	100.4	99.5	98.6	97.5	96.6
280	.73	93.6	94.4	95.2	96.1	96.9	97.7	98.5	99.3	99.4	98.5	97.5	96.8
320	.82	91.4	92.3	93.1	93.9	94.7	95.5	96.3	97.0	97.8	98.6	97.8	97.0
360	.91	91.4	92.3	93.1	93.9	94.7	95.5	96.3	97.0	97.8	98.6	99.3	99.4

%N1 Adjustments for Engine Bleeds

BLEED CONFIGURATION	PRESSURE ALTITUDE (1000 FT)				
	29	31	33	35	37
ENGINE ANTI-ICE ON	-0.9	-0.9	-0.8	-0.8	-0.8
ENGINE & WING ANTI-ICE ON	-4.1	-4.3	-4.5	-4.7	-4.7

ENGINE INOP

Max Continuous %N1
27000 FT to 20000 FT Pressure Altitudes

270000 FT PRESS ALT		TAT (°C)											
KIAS	M	-45	-40	-35	-30	-25	-20	-15	-10	-5	0	5	10
160	.41	97.3	98.2	99.1	100.0	100.8	101.5	100.6	99.6	98.4	97.0	95.7	94.4
200	.51	96.3	97.2	98.1	98.9	99.8	100.6	101.1	100.2	99.2	98.1	96.9	95.7
240	.60	95.0	95.9	96.7	97.6	98.4	99.2	100.1	100.7	99.7	98.7	97.7	96.8
280	.70	93.0	93.8	94.6	95.5	96.3	97.1	97.9	98.7	99.4	98.7	97.7	96.9
320	.79	90.9	91.7	92.6	93.4	94.2	95.0	95.7	96.5	97.3	98.0	97.9	97.2
360	.88	90.2	91.0	91.8	92.7	93.5	94.3	95.1	95.9	96.6	97.4	98.2	98.7
25000 FT PRESS ALT		TAT (°C)											
KIAS	M	-40	-35	-30	-25	-20	-15	-10	-5	0	5	10	15
160	.39	98.2	99.0	99.9	100.7	101.6	101.7	100.7	99.6	98.4	97.0	95.8	94.5
200	.49	96.8	97.7	98.5	99.4	100.2	101.0	100.9	99.9	98.9	97.7	96.6	95.5
240	.58	95.1	95.9	96.8	97.6	98.4	99.2	100.0	99.8	98.9	97.9	96.9	96.0
280	.67	93.2	94.1	94.9	95.7	96.5	97.3	98.1	98.8	98.9	97.9	96.9	96.2
320	.76	90.9	91.8	92.6	93.4	94.2	95.0	95.8	96.6	97.3	97.9	97.2	96.5
360	.85	89.6	90.5	91.3	92.1	93.0	93.8	94.6	95.4	96.2	97.0	97.7	97.5
24000 FT PRESS ALT		TAT (°C)											
KIAS	M	-40	-35	-30	-25	-20	-15	-10	-5	0	5	10	15
160	.38	97.7	98.5	99.4	100.3	101.1	101.9	100.8	99.7	98.5	97.2	96.0	94.7
200	.48	96.4	97.2	98.1	98.9	99.7	100.6	101.0	99.9	98.9	97.8	96.7	95.6
240	.57	94.7	95.6	96.4	97.2	98.0	98.8	99.6	99.9	99.0	97.9	97.0	96.1
280	.66	93.0	93.8	94.6	95.4	96.2	97.0	97.8	98.6	99.1	98.0	97.0	96.3
320	.75	90.6	91.4	92.3	93.1	93.9	94.7	95.5	96.3	97.1	97.8	97.2	96.5
360	.83	89.0	89.8	90.7	91.5	92.4	93.2	94.0	94.8	95.6	96.4	97.2	97.2
22000 FT PRESS ALT		TAT (°C)											
KIAS	M	-35	-30	-25	-20	-15	-10	-5	0	5	10	15	20
160	.37	97.5	98.4	99.2	100.1	100.9	101.0	99.9	98.7	97.5	96.3	95.2	94.0
200	.46	96.3	97.1	98.0	98.8	99.6	100.4	100.1	98.9	97.8	96.8	95.8	94.8
240	.55	94.8	95.6	96.4	97.2	98.0	98.8	99.6	99.1	98.1	97.1	96.2	95.4
280	.63	93.2	94.0	94.8	95.6	96.4	97.1	97.9	98.7	98.4	97.4	96.6	95.8
320	.72	90.9	91.8	92.6	93.4	94.2	95.0	95.8	96.6	97.4	97.5	96.8	96.1
360	.80	89.0	89.9	90.7	91.6	92.4	93.2	94.0	94.8	95.6	96.4	97.0	96.4
20000 FT PRESS ALT		TAT (°C)											
KIAS	M	-35	-30	-25	-20	-15	-10	-5	0	5	10	15	20
160	.35	96.5	97.4	98.2	99.0	99.8	100.6	100.2	98.9	97.7	96.6	95.5	94.4
200	.44	95.4	96.2	97.0	97.9	98.7	99.4	100.2	99.1	97.8	96.8	95.8	94.9
240	.53	93.9	94.7	95.5	96.3	97.1	97.9	98.7	99.3	98.2	97.1	96.2	95.4
280	.61	92.4	93.3	94.1	94.8	95.6	96.4	97.2	97.9	98.5	97.6	96.7	95.9
320	.69	90.3	91.1	92.0	92.8	93.6	94.4	95.2	96.0	96.8	97.6	96.9	96.2
360	.77	88.5	89.3	90.2	91.0	91.8	92.6	93.5	94.3	95.1	95.8	96.6	96.4

%N1 Adjustments for Engine Bleeds

BLEED CONFIGURATION	PRESSURE ALTITUDE (1000 FT)				
	20	22	24	25	27
ENGINE ANTI-ICE ON	-0.9	-0.9	-1.0	-1.0	-1.0
ENGINE & WING ANTI-ICE ON	-3.6	-3.8	-3.8	-3.9	-4.0

ENGINE INOP

Max Continuous %N1
18000 FT to 12000 FT Pressure Altitudes

18000 FT PRESS ALT		TAT (°C)											
KIAS	M	-30	-25	-20	-15	-10	-5	0	5	10	15	20	25
160	.34	96.0	96.8	97.6	98.4	99.2	100.0	98.9	97.5	96.5	95.5	94.5	93.5
200	.42	95.1	95.9	96.7	97.5	98.2	99.0	99.3	98.0	96.7	95.9	95.0	94.1
240	.51	93.7	94.5	95.2	96.0	96.8	97.6	98.3	98.2	97.1	96.2	95.4	94.6
280	.59	92.0	92.9	93.7	94.5	95.3	96.1	96.8	97.6	97.5	96.6	95.8	95.1
320	.67	90.3	91.1	92.0	92.8	93.6	94.4	95.2	96.0	96.8	96.9	96.2	95.5
360	.75	88.7	89.5	90.4	91.2	92.0	92.8	93.6	94.4	95.2	96.0	96.4	95.8
16000 FT PRESS ALT		TAT (°C)											
KIAS	M	-30	-25	-20	-15	-10	-5	0	5	10	15	20	25
160	.33	95.0	95.8	96.6	97.4	98.2	99.0	99.4	98.2	97.0	96.1	95.2	94.2
200	.41	93.9	94.7	95.5	96.3	97.1	97.8	98.6	98.2	97.0	96.0	95.2	94.4
240	.49	92.5	93.3	94.1	94.9	95.7	96.5	97.2	98.0	97.3	96.3	95.5	94.7
280	.57	91.0	91.8	92.6	93.5	94.3	95.1	95.9	96.6	97.4	96.7	95.8	95.1
320	.64	89.4	90.3	91.1	91.9	92.8	93.6	94.4	95.2	95.9	96.7	96.1	95.5
360	.72	88.0	88.9	89.7	90.6	91.4	92.2	93.0	93.8	94.6	95.4	96.2	95.8
14000 FT PRESS ALT		TAT (°C)											
KIAS	M	-25	-20	-15	-10	-5	0	5	10	15	20	25	30
160	.31	94.9	95.7	96.5	97.3	98.0	98.8	99.2	98.2	97.3	96.4	95.5	94.6
200	.39	93.6	94.4	95.2	96.0	96.7	97.5	98.3	97.5	96.5	95.7	94.9	94.1
240	.47	92.1	92.9	93.8	94.6	95.4	96.2	96.9	97.4	96.5	95.6	94.8	94.1
280	.54	90.9	91.7	92.5	93.4	94.2	95.0	95.8	96.5	96.8	96.0	95.2	94.5
320	.62	89.6	90.4	91.2	92.1	92.9	93.7	94.5	95.3	96.1	96.2	95.5	94.8
360	.69	88.3	89.1	89.9	90.7	91.6	92.4	93.2	94.0	94.8	95.5	95.8	95.2
12000 FT PRESS ALT		TAT (°C)											
KIAS	M	-20	-15	-10	-5	0	5	10	15	20	25	30	35
160	.30	94.8	95.6	96.4	97.1	97.9	98.6	97.9	96.8	95.9	95.2	94.4	93.5
200	.38	92.7	93.5	94.3	95.1	95.9	96.7	97.1	96.1	95.1	94.4	93.6	92.8
240	.45	91.6	92.5	93.3	94.1	94.9	95.7	96.4	96.4	95.5	94.7	94.0	93.2
280	.52	90.6	91.4	92.2	93.0	93.8	94.6	95.4	96.2	95.9	95.1	94.4	93.7
320	.60	89.5	90.3	91.2	92.0	92.8	93.6	94.4	95.2	96.0	95.5	94.8	94.1
360	.67	88.3	89.1	90.0	90.8	91.6	92.4	93.2	93.9	94.7	95.5	95.1	94.4

%N1 Adjustments for Engine Bleeds

BLEED CONFIGURATION	PRESSURE ALTITUDE (1000 FT)			
	12	14	16	18
ENGINE ANTI-ICE ON	-0.9	-0.9	-0.9	-0.9
ENGINE & WING ANTI-ICE ON	-3.2	-3.4	-3.4	-3.5

ENGINE INOP

Max Continuous %N1
10000 FT to 1000 FT Pressure Altitudes

10000 FT PRESS ALT		TAT (°C)											
KIAS	M	-20	-15	-10	-5	0	5	10	15	20	25	30	35
160	.29	92.7	93.5	94.4	95.2	95.9	96.7	97.5	96.5	95.6	94.9	94.2	93.4
200	.36	91.3	92.1	93.0	93.8	94.6	95.4	96.1	96.1	95.2	94.4	93.7	92.9
240	.43	90.3	91.1	92.0	92.8	93.6	94.4	95.2	95.9	95.4	94.6	93.8	93.1
280	.51	89.5	90.3	91.1	91.9	92.7	93.5	94.3	95.1	95.7	95.0	94.2	93.5
320	.58	88.6	89.4	90.2	91.0	91.8	92.6	93.4	94.2	95.0	95.4	94.7	93.9
360	.65	87.5	88.3	89.2	90.0	90.8	91.6	92.3	93.1	93.9	94.7	95.0	94.3
5000 FT PRESS ALT		TAT (°C)											
KIAS	M	-10	-5	0	5	10	15	20	25	30	35	40	45
160	.26	90.5	91.4	92.2	93.0	93.8	94.5	95.1	94.4	93.6	92.9	92.2	91.4
200	.33	90.0	90.8	91.6	92.4	93.2	93.9	94.7	94.4	93.7	93.0	92.3	91.5
240	.40	89.2	90.0	90.8	91.6	92.4	93.2	93.9	94.4	93.7	92.9	92.2	91.5
280	.46	88.5	89.3	90.1	90.9	91.7	92.5	93.3	94.0	94.0	93.2	92.5	91.8
320	.53	87.8	88.6	89.4	90.2	90.9	91.7	92.5	93.2	94.0	93.6	92.9	92.2
360	.59	86.9	87.7	88.5	89.3	90.1	90.8	91.6	92.3	93.1	93.8	93.3	92.6
3000 FT PRESS ALT		TAT (°C)											
KIAS	M	-5	0	5	10	15	20	25	30	35	40	45	50
160	.26	90.5	91.3	92.1	92.8	93.6	94.4	94.6	93.9	93.2	92.4	91.6	90.7
200	.32	89.9	90.7	91.5	92.3	93.1	93.8	94.6	94.0	93.3	92.5	91.8	91.0
240	.38	88.8	89.6	90.4	91.2	92.0	92.7	93.5	93.5	92.8	92.0	91.3	90.6
280	.45	88.3	89.1	89.9	90.6	91.4	92.2	92.9	93.7	93.1	92.4	91.7	91.0
320	.51	87.6	88.4	89.2	90.0	90.7	91.5	92.2	93.0	93.5	92.8	92.0	91.3
360	.57	86.8	87.6	88.4	89.1	89.9	90.6	91.4	92.1	92.8	93.1	92.4	91.7
1000 FT PRESS ALT		TAT (°C)											
KIAS	M	-5	0	5	10	15	20	25	30	35	40	45	50
160	.25	89.0	89.8	90.6	91.4	92.2	92.9	93.7	93.4	92.7	91.9	91.2	90.3
200	.31	88.7	89.5	90.3	91.0	91.8	92.6	93.3	93.7	93.0	92.2	91.5	90.7
240	.37	87.8	88.6	89.4	90.2	90.9	91.7	92.5	93.2	92.8	92.0	91.3	90.6
280	.43	87.3	88.1	88.8	89.6	90.4	91.1	91.9	92.6	93.1	92.3	91.6	90.9
320	.49	86.7	87.5	88.2	89.0	89.8	90.5	91.3	92.0	92.7	92.7	91.9	91.2
360	.55	85.9	86.7	87.5	88.2	89.0	89.7	90.5	91.2	91.9	92.6	92.3	91.6

%N1 Adjustments for Engine Bleeds

BLEED CONFIGURATION	PRESSURE ALTITUDE (1000 FT)			
	1	3	5	10
ENGINE ANTI-ICE ON	-0.6	-0.8	-0.8	-0.8
ENGINE & WING ANTI-ICE ON	-2.9	-3.0	-3.1	-3.2

ENGINE INOP

MAX CONTINUOUS THRUST

Driftdown Speed/Level Off Altitude

100 ft/min residual rate of climb

WEIGHT (1000 LB)		OPTIMUM DRIFTDOWN SPEED (KIAS)	LEVEL OFF ALTITUDE (FT)		
START DRIFTDOWN	LEVEL OFF		ISA + 10°C & BELOW	ISA + 15°C	ISA + 20°C
170	163	257	18500	17000	15200
160	153	250	20400	19100	17300
150	144	242	22400	21100	19600
140	134	235	24400	23300	21900
130	125	226	26400	25400	24200
120	115	218	28500	27600	26400
110	106	209	30500	29700	28700
100	96	199	32500	31800	30900
90	87	189	34600	33900	33000
80	77	178	36900	36200	35400

Includes APU fuel burn.

ENGINE INOP

MAX CONTINUOUS THRUST

Driftdown/LRC Cruise Range Capability

Ground to Air Miles Conversion

AIR DISTANCE (NM)					GROUND DISTANCE (NM)	AIR DISTANCE (NM)				
HEADWIND COMPONENT (KTS)						TAILWIND COMPONENT (KTS)				
100	80	60	40	20		20	40	60	80	100
140	129	120	113	106	100	95	90	85	82	78
279	259	241	226	212	200	189	180	171	163	156
418	388	361	338	318	300	284	270	256	245	234
558	517	482	451	424	400	379	359	342	326	312
697	646	602	564	530	500	473	449	428	408	390
836	775	722	676	636	600	568	539	513	490	468
975	904	843	789	742	700	663	629	599	571	546
1114	1033	963	902	848	800	757	719	684	653	624
1253	1162	1083	1014	954	900	852	809	770	734	702
1392	1291	1204	1127	1060	1000	947	899	855	816	780
1532	1420	1324	1240	1166	1100	1041	989	941	898	858
1671	1550	1444	1353	1272	1200	1136	1078	1026	979	936
1811	1679	1565	1465	1378	1300	1231	1168	1112	1061	1014
1951	1809	1686	1578	1484	1400	1325	1258	1197	1142	1092
2091	1938	1806	1691	1590	1500	1420	1348	1283	1223	1169
2231	2068	1927	1804	1696	1600	1514	1437	1368	1305	1247
2372	2198	2048	1917	1802	1700	1609	1527	1453	1386	1325
2513	2329	2169	2030	1908	1800	1703	1617	1538	1467	1402

Driftdown/Cruise Fuel and Time

AIR DIST (NM)	FUEL REQUIRED (1000 LB)										TIME (HR:MIN)
	WEIGHT AT START OF DRIFTDOWN (1000 LB)										
	80	90	100	110	120	130	140	150	160	170	
100	0.8	0.8	0.8	0.8	0.9	0.9	1.0	1.1	1.1	1.1	0:17
200	1.7	1.8	1.9	2.0	2.0	2.2	2.3	2.5	2.5	2.6	0:34
300	2.6	2.8	3.0	3.2	3.3	3.5	3.8	4.0	4.1	4.3	0:50
400	3.5	3.7	4.0	4.3	4.6	4.9	5.2	5.6	5.8	6.1	1:07
500	4.3	4.7	5.1	5.4	5.8	6.2	6.6	7.0	7.4	7.8	1:24
600	5.1	5.6	6.1	6.5	7.0	7.5	8.0	8.4	8.9	9.4	1:41
700	5.9	6.5	7.0	7.6	8.1	8.7	9.3	9.9	10.4	11.0	1:58
800	6.7	7.4	8.0	8.7	9.3	9.9	10.6	11.2	11.9	12.5	2:14
900	7.5	8.3	9.0	9.7	10.4	11.2	11.9	12.6	13.3	14.1	2:31
1000	8.3	9.1	9.9	10.7	11.5	12.4	13.2	14.0	14.8	15.7	2:48
1100	9.1	10.0	10.9	11.8	12.7	13.6	14.5	15.4	16.2	17.2	3:05
1200	9.9	10.8	11.8	12.8	13.8	14.7	15.7	16.7	17.7	18.7	3:22
1300	10.7	11.7	12.8	13.8	14.8	15.9	17.0	18.1	19.1	20.3	3:39
1400	11.4	12.5	13.7	14.8	15.9	17.1	18.2	19.4	20.5	21.8	3:56
1500	12.2	13.4	14.6	15.8	17.0	18.2	19.5	20.7	21.9	23.3	4:13
1600	12.9	14.2	15.5	16.8	18.1	19.4	20.7	22.0	23.3	24.8	4:29
1700	13.7	15.0	16.4	17.8	19.1	20.5	21.9	23.3	24.7	26.3	4:46
1800	14.4	15.8	17.3	18.7	20.2	21.7	23.1	24.6	26.1	27.7	5:04

Includes APU fuel burn.
Driftdown at optimum driftdown speed and cruise at LRC speed.

ENGINE INOP

MAX CONTINUOUS THRUST

Long Range Cruise Altitude Capability

100 ft/min residual rate of climb

WEIGHT (1000 LB)	PRESSURE ALTITUDE (FT)		
	ISA + 10°C & BELOW	ISA + 15°C	ISA + 20°C
170	14000	11300	8300
160	16700	14200	11400
150	19300	16800	14400
140	21700	19400	17200
130	24000	22300	20000
120	26400	25000	22700
110	28900	27700	25800
100	31100	30200	28900
90	33300	32500	31400
80	35700	34800	33800

With engine anti-ice on, decrease altitude capability by 2000 ft.
With engine and wing anti-ice on, decrease altitude capability by 6400 ft.

ENGINE INOP

Long Range Cruise Control

WEIGHT (1000 LB)		PRESSURE ALTITUDE (1000 FT)									
		10	15	17	19	21	23	25	27	29	31
170	%N1	89.2	93.3	95.0							
	MACH	.535	.585	.597							
	KIAS	297	296	291							
	FF/ENG	6118	6179	6101							
160	%N1	87.6	91.8	93.4	95.4						
	MACH	.519	.571	.588	.601						
	KIAS	288	288	286	281						
	FF/ENG	5729	5797	5767	5721						
150	%N1	85.8	90.0	91.7	93.5	95.6					
	MACH	.502	.554	.575	.590	.604					
	KIAS	278	280	280	276	272					
	FF/ENG	5342	5406	5415	5366	5363					
140	%N1	83.8	88.1	89.9	91.6	93.5	95.9				
	MACH	.485	.536	.557	.578	.593	.607				
	KIAS	268	270	271	270	266	262				
	FF/ENG	4957	5018	5028	5030	4984	5021				
130	%N1	81.8	86.1	87.9	89.7	91.5	93.4	96.1			
	MACH	.468	.517	.538	.559	.581	.594	.610			
	KIAS	259	260	261	261	261	256	253			
	FF/ENG	4593	4631	4640	4647	4655	4615	4684			
120	%N1	79.8	83.9	85.7	87.5	89.3	91.2	93.3	96.2		
	MACH	.451	.496	.517	.539	.560	.582	.595	.612		
	KIAS	249	250	250	251	251	251	246	243		
	FF/ENG	4245	4246	4256	4260	4271	4283	4258	4340		
110	%N1	77.5	81.5	83.3	85.1	86.9	88.7	90.7	92.9	96.0	
	MACH	.434	.474	.494	.516	.538	.560	.582	.595	.612	
	KIAS	240	238	239	240	241	241	241	236	233	
	FF/ENG	3911	3870	3872	3878	3886	3896	3921	3908	3990	
100	%N1	75.4	79.1	80.7	82.5	84.3	86.2	88.0	90.0	92.2	95.5
	MACH	.416	.454	.471	.491	.513	.535	.558	.580	.594	.611
	KIAS	230	228	228	228	229	230	230	230	226	222
	FF/ENG	3590	3522	3503	3497	3507	3515	3532	3567	3558	3633
90	%N1	73.0	76.4	78.1	79.7	81.5	83.3	85.2	87.0	89.0	91.4
	MACH	.399	.433	.449	.466	.485	.507	.530	.553	.576	.592
	KIAS	220	217	217	216	217	218	218	219	218	215
	FF/ENG	3279	3190	3161	3137	3128	3139	3154	3179	3211	3208
80	%N1	70.2	73.8	75.2	76.8	78.5	80.1	82.0	83.8	85.7	87.7
	MACH	.381	.412	.426	.442	.459	.477	.499	.522	.546	.569
	KIAS	210	207	206	205	204	204	205	206	206	206
	FF/ENG	2978	2878	2837	2803	2779	2764	2780	2803	2826	2849

ENGINE INOP

MAX CONTINUOUS THRUST

Long Range Cruise Diversion Fuel and Time

Ground to Air Miles Conversion

AIR DISTANCE (NM)					GROUND DISTANCE (NM)	AIR DISTANCE (NM)				
HEADWIND COMPONENT (KTS)						TAILWIND COMPONENT (KTS)				
100	80	60	40	20		20	40	60	80	100
308	279	253	233	215	200	190	180	172	164	157
621	561	509	467	431	400	379	360	343	327	314
938	846	767	702	648	600	569	540	514	491	470
1256	1132	1025	937	864	800	758	720	685	654	626
1576	1419	1283	1173	1081	1000	948	899	856	816	781
1899	1708	1543	1409	1298	1200	1137	1079	1026	979	937
2224	1999	1804	1646	1515	1400	1326	1258	1197	1142	1093
2551	2291	2065	1884	1733	1600	1516	1438	1368	1304	1248
2881	2584	2328	2122	1950	1800	1705	1618	1538	1467	1403

Reference Fuel and Time Required at Check Point

AIR DIST (NM)	PRESSURE ALTITUDE (1000 FT)									
	10		14		18		22		26	
	FUEL (1000 LB)	TIME (HR:MIN)	FUEL (1000 LB)	TIME (HR:MIN)	FUEL (1000 LB)	TIME (HR:MIN)	FUEL (1000 LB)	TIME (HR:MIN)	FUEL (1000 LB)	TIME (HR:MIN)
200	2.9	0:44	2.5	0:42	2.3	0:40	2.0	0:38	1.9	0:37
400	5.9	1:27	5.4	1:22	5.0	1:17	4.5	1:13	4.3	1:11
600	8.9	2:10	8.2	2:03	7.6	1:55	7.0	1:48	6.6	1:44
800	11.9	2:53	11.0	2:43	10.2	2:33	9.5	2:24	9.0	2:18
1000	14.8	3:37	13.7	3:25	12.8	3:12	11.9	3:00	11.3	2:52
1200	17.7	4:21	16.5	4:07	15.3	3:51	14.3	3:36	13.5	3:26
1400	20.6	5:06	19.2	4:49	17.8	4:30	16.6	4:13	15.8	4:00
1600	23.4	5:52	21.8	5:32	20.3	5:10	19.0	4:50	18.0	4:35
1800	26.3	6:38	24.5	6:15	22.8	5:51	21.3	5:27	20.2	5:10

Fuel Required Adjustments (1000 LB)

REFERENCE FUEL REQUIRED (1000 LB)	WEIGHT AT CHECK POINT (1000 LB)				
	80	100	120	140	160
5	-0.7	-0.3	0.0	0.7	1.6
10	-1.4	-0.7	0.0	1.4	3.4
15	-2.1	-1.1	0.0	2.1	4.9
20	-2.8	-1.4	0.0	2.7	6.2
25	-3.5	-1.8	0.0	3.2	7.4
30	-4.2	-2.1	0.0	3.6	8.4
35	-4.9	-2.5	0.0	3.9	9.1

Includes APU fuel burn.

ENGINE INOP

MAX CONTINUOUS THRUST

Holding

Flaps Up

WEIGHT (1000 LB)		PRESSURE ALTITUDE (FT)						
		1500	5000	10000	15000	20000	25000	30000
170	%N1	79.1	82.0	86.3	90.8			
	KIAS	242	243	243	245			
	FF/ENG	5600	5590	5620	5710			
160	%N1	77.5	80.2	84.6	89.0	95.1		
	KIAS	235	235	236	237	239		
	FF/ENG	5270	5250	5260	5330	5480		
150	%N1	75.7	78.5	82.8	87.1	92.3		
	KIAS	227	228	228	229	231		
	FF/ENG	4940	4920	4910	4960	5040		
140	%N1	73.8	76.6	80.8	85.2	89.9	98.2	
	KIAS	220	220	221	222	223	224	
	FF/ENG	4610	4590	4570	4600	4630	5010	
130	%N1	71.6	74.7	78.7	83.1	87.7	94.5	
	KIAS	211	212	213	213	214	216	
	FF/ENG	4290	4260	4230	4240	4260	4450	
120	%N1	69.4	72.4	76.5	80.9	85.4	90.8	
	KIAS	202	204	204	205	206	207	
	FF/ENG	3970	3930	3900	3890	3900	3980	
110	%N1	67.2	70.0	74.2	78.4	83.0	87.7	96.3
	KIAS	194	194	195	196	197	198	199
	FF/ENG	3670	3610	3580	3560	3540	3580	3890
100	%N1	64.7	67.4	71.7	75.8	80.3	85.0	91.4
	KIAS	185	185	186	187	187	188	190
	FF/ENG	3360	3300	3260	3230	3200	3220	3360
90	%N1	61.9	64.7	68.7	73.1	77.4	82.0	87.0
	KIAS	178	178	178	178	178	178	180
	FF/ENG	3060	3010	2950	2920	2870	2870	2940
80	%N1	58.9	61.7	65.7	70.0	74.3	78.8	83.6
	KIAS	172	172	172	172	172	172	172
	FF/ENG	2760	2710	2660	2620	2570	2540	2590

This table includes 5% additional fuel for holding in a racetrack pattern.

ENGINE INOP

ADVISORY INFORMATION

Gear Down Landing Rate of Climb Available

Flaps 15

TAT (°C)	RATE OF CLIMB (FT/MIN)						
	PRESSURE ALTITUDE (FT)						
	-2000	0	2000	4000	6000	8000	10000
52	-180	-240					
50	-150	-220	-320				
48	-130	-190	-290				
46	-100	-170	-270	-370			
44	-80	-140	-250	-350			
42	-50	-110	-220	-330	-430		
40	-20	-90	-200	-300	-410		
38	10	-60	-170	-280	-390	-500	
36	30	-40	-150	-260	-370	-480	
34	30	-10	-120	-230	-340	-460	-570
32	30	10	-90	-210	-320	-430	-540
30	30	10	-60	-180	-300	-410	-520
20	40	20	-50	-110	-180	-290	-410
10	50	30	-40	-110	-180	-260	-350
0	50	30	-40	-110	-180	-260	-350
-20	60	40	-30	-110	-190	-270	-360
-40	60	40	-30	-110	-190	-280	-370

Rate of climb capability shown is valid for 130000 lb, gear down at VREF15+5.
Decrease rate of climb 100 ft/min per 10000 lb greater than 130000 lb.
Increase rate of climb 140 ft/min per 10000 lb less than 130000 lb.

Flaps 30

TAT (°C)	RATE OF CLIMB (FT/MIN)						
	PRESSURE ALTITUDE (FT)						
	-2000	0	2000	4000	6000	8000	10000
52	-340	-410					
50	-310	-380	-480				
48	-290	-360	-460				
46	-270	-330	-440	-540			
44	-240	-310	-420	-520			
42	-220	-280	-390	-500	-610		
40	-190	-260	-370	-480	-590		
38	-160	-240	-350	-450	-570	-680	
36	-140	-210	-320	-430	-540	-660	
34	-140	-180	-290	-410	-520	-640	-750
32	-140	-160	-270	-380	-500	-610	-730
30	-140	-160	-240	-360	-480	-590	-710
20	-140	-160	-230	-300	-370	-480	-600
10	-130	-160	-230	-300	-370	-450	-540
0	-130	-150	-230	-300	-370	-460	-550
-20	-130	-160	-230	-300	-390	-470	-560
-40	-140	-160	-240	-320	-400	-490	-590

Rate of climb capability shown is valid for 130000 lb, gear down at VREF30+5.
Decrease rate of climb 100 ft/min per 10000 lb greater than 130000 lb.
Increase rate of climb 140 ft/min per 10000 lb less than 130000 lb.

Performance Inflight — Chapter PI
Gear Down — Section 24

GEAR DOWN

Long Range Cruise Altitude Capability
Max Cruise Thrust, 100 ft/min residual rate of climb

WEIGHT (1000 LB)	PRESSURE ALTITUDE (FT)		
	ISA + 10°C & BELOW	ISA + 15°C	ISA + 20°C
170	19100	16400	13600
160	21600	19100	16300
150	23900	21800	19000
140	26100	24500	22000
130	28400	26900	25200
120	30500	29300	27800
110	32400	31500	30200
100	34400	33500	32400
90	36600	35700	34600
80	39100	38100	37000

GEAR DOWN

Long Range Cruise Control

WEIGHT (1000 LB)		PRESSURE ALTITUDE (1000 FT)									
		10	21	23	25	27	29	31	33	35	37
170	%N1	83.7									
	MACH	.460									
	KIAS	254									
	FF/ENG	4891									
160	%N1	82.0	91.4								
	MACH	.447	.548								
	KIAS	247	245								
	FF/ENG	4586	4570								
150	%N1	80.2	89.6	91.6	94.2						
	MACH	.434	.535	.552	.569						
	KIAS	240	239	237	235						
	FF/ENG	4287	4274	4260	4308						
140	%N1	78.3	87.8	89.5	91.6	94.6					
	MACH	.420	.518	.538	.555	.573					
	KIAS	232	232	231	229	227					
	FF/ENG	3996	3965	3962	3963	4033					
130	%N1	76.4	85.7	87.5	89.3	91.6	94.8				
	MACH	.406	.500	.521	.541	.558	.576				
	KIAS	224	223	224	223	221	218				
	FF/ENG	3709	3655	3656	3661	3676	3756				
120	%N1	74.4	83.5	85.3	87.1	88.9	91.4	94.8			
	MACH	.391	.482	.501	.523	.543	.560	.579			
	KIAS	216	215	215	215	214	212	210			
	FF/ENG	3427	3351	3349	3358	3372	3389	3475			
110	%N1	72.0	81.1	82.9	84.6	86.5	88.3	90.9	94.4		
	MACH	.375	.462	.481	.501	.523	.543	.561	.580		
	KIAS	207	206	206	206	206	205	203	201		
	FF/ENG	3149	3054	3049	3055	3072	3084	3100	3190		
100	%N1	69.5	78.5	80.3	82.1	83.8	85.7	87.6	90.3	93.8	
	MACH	.359	.442	.460	.479	.499	.521	.542	.560	.580	
	KIAS	198	197	197	197	196	197	196	194	192	
	FF/ENG	2881	2764	2753	2758	2773	2787	2796	2810	2896	
90	%N1	66.8	75.7	77.5	79.2	81.0	82.8	84.6	86.6	89.3	93.2
	MACH	.343	.421	.438	.456	.475	.496	.518	.540	.558	.578
	KIAS	189	187	187	187	187	187	187	186	184	182
	FF/ENG	2624	2486	2464	2465	2481	2491	2499	2508	2520	2610
80	%N1	64.0	72.7	74.4	76.2	77.9	79.6	81.4	83.3	85.3	88.2
	MACH	.326	.398	.415	.432	.450	.469	.490	.512	.534	.554
	KIAS	179	177	177	176	176	176	176	176	176	174
	FF/ENG	2373	2220	2189	2182	2196	2202	2208	2212	2220	2244

GEAR DOWN

Long Range Cruise Enroute Fuel and Time

Ground to Air Miles Conversion

AIR DISTANCE (NM) HEADWIND COMPONENT (KTS)					GROUND DISTANCE (NM)	AIR DISTANCE (NM) TAILWIND COMPONENT (KTS)				
100	80	60	40	20		20	40	60	80	100
324	290	260	236	217	200	188	178	168	160	153
655	584	523	474	435	400	377	357	338	321	307
990	881	787	713	653	600	566	535	507	483	461
1330	1181	1054	953	871	800	755	713	676	642	613
1676	1486	1323	1195	1091	1000	943	891	844	803	766
2027	1793	1594	1437	1310	1200	1131	1069	1013	962	918
2385	2106	1868	1681	1531	1400	1319	1246	1180	1121	1069
2749	2422	2143	1926	1751	1600	1507	1423	1347	1279	1220
3120	2742	2421	2172	1973	1800	1695	1600	1514	1437	1370

Reference Fuel and Time Required at Check Point

AIR DIST (NM)	PRESSURE ALTITUDE (1000 FT)									
	10		14		20		24		28	
	FUEL (1000 LB)	TIME (HR:MIN)	FUEL (1000 LB)	TIME (HR:MIN)	FUEL (1000 LB)	TIME (HR:MIN)	FUEL (1000 LB)	TIME (HR:MIN)	FUEL (1000 LB)	TIME (HR:MIN)
200	5.1	0:51	4.6	0:49	4.0	0:46	3.7	0:44	3.4	0:43
400	10.4	1:40	9.6	1:35	8.5	1:28	7.9	1:24	7.4	1:21
600	15.6	2:30	14.5	2:22	12.9	2:11	12.0	2:04	11.3	1:59
800	20.7	3:22	19.3	3:10	17.2	2:55	16.0	2:46	15.1	2:38
1000	25.7	4:14	23.9	4:00	21.4	3:40	20.0	3:27	18.8	3:17
1200	30.5	5:08	28.5	4:50	25.5	4:25	23.8	4:10	22.5	3:57
1400	35.3	6:03	32.9	5:42	29.5	5:12	27.6	4:53	26.1	4:38
1600	39.9	6:59	37.3	6:34	33.4	5:59	31.3	5:37	29.6	5:19
1800	44.5	7:57	41.5	7:28	37.3	6:47	34.9	6:22	33.0	6:01

Fuel Required Adjustments (1000 LB)

REFERENCE FUEL REQUIRED (1000 LB)	WEIGHT AT CHECK POINT (1000 LB)				
	80	100	120	140	160
5	-0.8	-0.4	0.0	0.6	1.5
10	-1.7	-0.8	0.0	1.2	2.9
15	-2.5	-1.2	0.0	1.8	4.3
20	-3.4	-1.7	0.0	2.4	5.5
25	-4.2	-2.1	0.0	2.9	6.6
30	-5.1	-2.5	0.0	3.4	7.7
35	-5.9	-2.9	0.0	3.9	8.6
40	-6.8	-3.4	0.0	4.3	9.5
45	-7.6	-3.8	0.0	4.7	10.2

GEAR DOWN

Descent

VREF40 + 70 KIAS

PRESSURE ALTITUDE (FT)	TIME (MIN)	FUEL (LB)	DISTANCE (NM)
41000	21	590	88
39000	20	580	84
37000	20	570	79
35000	19	560	75
33000	18	550	71
31000	18	540	67
29000	17	530	63
27000	16	520	59
25000	15	500	55
23000	14	490	51
21000	14	470	47
19000	13	450	43
17000	12	440	39
15000	11	410	35
10000	9	360	25
5000	6	290	16
1500	4	230	9

Allowances for a straight-in approach are included.

GEAR DOWN

Holding
Flaps Up

WEIGHT (1000 LB)		PRESSURE ALTITUDE (FT)							
		1500	5000	10000	15000	20000	25000	30000	35000
170	%N1	73.5	76.4	80.5	84.8	89.5			
	KIAS	221	221	221	221	221			
	FF/ENG	4550	4520	4500	4520	4550			
160	%N1	71.9	74.9	78.9	83.3	87.9	94.4		
	KIAS	217	217	217	217	217	217		
	FF/ENG	4310	4280	4260	4260	4270	4430		
150	%N1	70.2	73.3	77.3	81.6	86.1	91.6		
	KIAS	212	212	212	212	212	212		
	FF/ENG	4070	4040	4010	4000	4000	4080		
140	%N1	68.6	71.4	75.6	79.8	84.3	89.2		
	KIAS	207	207	207	207	207	207		
	FF/ENG	3840	3790	3760	3740	3730	3780		
130	%N1	66.8	69.5	73.8	77.9	82.4	87.1	94.6	
	KIAS	202	202	202	202	202	202	202	
	FF/ENG	3600	3550	3510	3490	3470	3490	3700	
120	%N1	64.9	67.6	71.8	75.9	80.4	85.0	90.8	
	KIAS	196	196	196	196	196	196	196	
	FF/ENG	3370	3320	3270	3240	3210	3220	3320	
110	%N1	62.7	65.6	69.6	73.9	78.2	82.7	87.6	
	KIAS	190	190	190	190	190	190	190	
	FF/ENG	3130	3080	3030	3000	2960	2960	3020	
100	%N1	60.5	63.5	67.4	71.7	75.9	80.4	85.1	92.6
	KIAS	184	184	184	184	184	184	184	184
	FF/ENG	2910	2860	2810	2770	2720	2700	2750	2900
90	%N1	58.3	61.0	65.1	69.3	73.5	78.0	82.5	88.1
	KIAS	178	178	178	178	178	178	178	178
	FF/ENG	2680	2630	2590	2540	2490	2460	2490	2550
80	%N1	56.0	58.6	62.8	66.7	71.2	75.4	79.9	84.6
	KIAS	172	172	172	172	172	172	172	172
	FF/ENG	2460	2420	2380	2330	2280	2230	2260	2270

This table includes 5% additional fuel for holding in a racetrack pattern.

Intentionally
Blank

GEAR DOWN

ENGINE INOP

MAX CONTINUOUS THRUST

Driftdown Speed/Level Off Altitude

100 ft/min residual rate of climb

WEIGHT (1000 LB)		OPTIMUM DRIFTDOWN SPEED (KIAS)	LEVEL OFF ALTITUDE (FT)		
START DRIFTDOWN	LEVEL OFF		ISA + 10°C & BELOW	ISA + 15°C	ISA + 20°C
160	150	214	2600		
150	141	210	5600	3300	
140	132	205	8600	6600	4200
130	123	199	11400	9800	7600
120	114	194	14100	13000	11100
110	105	188	16700	15800	14600
100	95	183	19400	18300	17200
90	86	177	22000	21000	19900
80	76	171	24700	23800	22800

Includes APU fuel burn.

Long Range Cruise Altitude Capability

100 ft/min residual rate of climb

WEIGHT (1000 LB)	PRESSURE ALTITUDE (FT)		
	ISA + 10°C & BELOW	ISA + 15°C	ISA + 20°C
140	2300		
130	6500	3600	
120	10500	8100	5300
110	14000	12500	9800
100	17300	16300	15000
90	20600	19500	18300
80	23700	22700	21700

GEAR DOWN
ENGINE INOP

MAX CONTINUOUS THRUST

Long Range Cruise Control

WEIGHT (1000 LB)		PRESSURE ALTITUDE (1000 FT)									
		5	7	9	11	13	15	17	19	21	23
130	%N1	90.1	91.8								
	MACH	.361	.373								
	KIAS	218	217								
	FF/ENG	7007	7011								
120	%N1	87.8	89.4	91.2	93.0						
	MACH	.349	.360	.372	.385						
	KIAS	211	210	209	208						
	FF/ENG	6453	6432	6432	6452						
110	%N1	85.4	87.0	88.5	90.3	92.1	94.8				
	MACH	.337	.348	.359	.371	.383	.397				
	KIAS	204	203	201	200	200	199				
	FF/ENG	5926	5885	5860	5861	5882	5959				
100	%N1	83.0	84.4	85.9	87.5	89.2	91.1	93.7			
	MACH	.325	.335	.345	.356	.368	.381	.395			
	KIAS	197	195	194	193	192	191	190			
	FF/ENG	5423	5366	5324	5299	5299	5309	5350			
90	%N1	80.3	81.7	83.2	84.6	86.2	87.9	89.8	92.2	96.0	
	MACH	.313	.322	.331	.341	.352	.364	.377	.391	.406	
	KIAS	189	188	186	184	183	182	181	181	180	
	FF/ENG	4946	4872	4814	4772	4747	4736	4729	4743	4889	
80	%N1	77.5	78.8	80.2	81.6	83.1	84.7	86.4	88.4	90.5	94.2
	MACH	.300	.309	.317	.326	.336	.347	.359	.373	.388	.404
	KIAS	182	180	178	176	175	173	172	172	172	172
	FF/ENG	4485	4409	4333	4274	4231	4198	4170	4174	4196	4319

GEAR DOWN
ENGINE INOP
MAX CONTINUOUS THRUST

Long Range Cruise Diversion Fuel and Time
Ground to Air Miles Conversion

AIR DISTANCE (NM)					GROUND DISTANCE (NM)	AIR DISTANCE (NM)				
HEADWIND COMPONENT (KTS)						TAILWIND COMPONENT (KTS)				
100	80	60	40	20		20	40	60	80	100
178	155	135	121	110	100	93	87	81	77	73
361	314	274	244	220	200	186	174	163	154	146
546	473	412	366	331	300	279	260	244	230	218
732	634	551	489	441	400	372	347	325	306	290
920	796	692	613	552	500	465	434	407	383	362
1109	958	832	737	663	600	558	520	487	458	434
1300	1122	973	861	774	700	651	607	568	534	505
1493	1287	1115	986	885	800	744	693	648	610	577
1688	1453	1257	1110	997	900	836	779	729	685	648
1884	1620	1400	1235	1108	1000	929	865	809	760	719

Reference Fuel and Time Required at Check Point

AIR DIST (NM)	PRESSURE ALTITUDE (1000 FT)					
	6		10		14	
	FUEL (1000 LB)	TIME (HR:MIN)	FUEL (1000 LB)	TIME (HR:MIN)	FUEL (1000 LB)	TIME (HR:MIN)
100	2.6	0:28	2.4	0:27	2.1	0:26
200	5.5	0:54	5.1	0:52	4.7	0:50
300	8.3	1:21	7.7	1:17	7.3	1:14
400	11.1	1:48	10.3	1:43	9.8	1:38
500	13.8	2:15	12.9	2:09	12.3	2:03
600	16.5	2:42	15.5	2:35	14.7	2:27
700	19.1	3:10	18.0	3:01	17.1	2:52
800	21.8	3:38	20.5	3:28	19.5	3:17
900	24.4	4:06	22.9	3:54	21.8	3:43
1000	26.9	4:35	25.3	4:22	24.1	4:08

Fuel Required Adjustments (1000 LB)

REFERENCE FUEL REQUIRED (1000 LB)	WEIGHT AT CHECK POINT (1000 LB)				
	80	100	120	140	160
2	-0.3	-0.2	0.0	0.3	0.6
6	-1.0	-0.5	0.0	1.0	2.0
10	-1.7	-0.8	0.0	1.8	3.5
14	-2.3	-1.2	0.0	2.5	4.9
18	-3.0	-1.5	0.0	3.2	6.3
22	-3.6	-1.8	0.0	3.8	7.6
26	-4.3	-2.1	0.0	4.4	9.0
30	-5.0	-2.5	0.0	5.0	10.3

Includes APU fuel burn.

GEAR DOWN

ENGINE INOP

MAX CONTINUOUS THRUST

Holding

Flaps Up

WEIGHT (1000 LB)		PRESSURE ALTITUDE (FT)			
		1500	5000	10000	15000
160	%N1	90.8			
	KIAS	217			
	FF/ENG	8330			
150	%N1	88.9	92.1		
	KIAS	212	212		
	FF/ENG	7800	7880		
140	%N1	87.0	90.1		
	KIAS	207	207		
	FF/ENG	7280	7330		
130	%N1	84.9	87.9	92.7	
	KIAS	202	202	202	
	FF/ENG	6760	6790	6890	
120	%N1	82.7	85.7	90.3	
	KIAS	196	196	196	
	FF/ENG	6270	6270	6330	
110	%N1	80.4	83.4	87.8	93.1
	KIAS	190	190	190	190
	FF/ENG	5790	5770	5790	5920
100	%N1	78.0	80.9	85.3	90.1
	KIAS	184	184	184	184
	FF/ENG	5330	5300	5290	5370
90	%N1	75.6	78.3	82.7	87.3
	KIAS	178	178	178	178
	FF/ENG	4890	4840	4820	4850
80	%N1	72.9	75.8	79.9	84.4
	KIAS	172	172	172	172
	FF/ENG	4450	4410	4360	4370

This table includes 5% additional fuel for holding in a racetrack pattern.

Performance Inflight — Chapter PI
Text — Section 26

Introduction

This chapter contains information to supplement performance data from the Flight Management Computer (FMC). In addition, sufficient inflight data is provided to complete a flight with the FMC inoperative. In the event of conflict between data presented in this chapter and that contained in the approved Airplane Flight Manual, the Flight Manual shall always take precedence.

General

Takeoff Speeds

The speeds presented in the Takeoff Speeds table as well as FMC computed takeoff speeds can be used for all performance conditions except where adjustments must be made for anti-skid inoperative, thrust reversers inoperative, improved climb, contaminated runway situations, or brake energy limits.

V1 adjustments are not necessary for equal amounts of clearway and stopway. V1 for takeoff limit weights based on unequal clearway and stopway should be obtained from computerized takeoff speeds calculations for the specific takeoff conditions.

These speeds may be used for weights less than or equal to the performance limited weight subject to the restrictions noted above.

The FMC will protect for minimum control speeds by increasing V1, VR and V2 as required. However, the FMC will not compute takeoff speeds for weights where the required speed increase exceeds the maximum certified speed increase. This typically occurs at full rated thrust and light weights. In this case, the message "V SPEEDS UNAVAILABLE" will appear on the FMC scratchpad and the takeoff speed entries will be blank. In this situation, manually verify takeoff speeds using an approved source of takeoff performance information. Upon verifying the takeoff speeds, takeoff is permitted. When selected takeoff speeds cannot be verified, the options are to select a lower number flap setting, select derate thrust and/or increase airplane gross weight (e.g. add fuel). Selecting derate thrust is the preferred method as this will reduce the minimum control speeds. Note that the assumed temperature method will not help this condition as the minimum control speeds are determined at the actual temperature and therefore are not reduced by an assumed temperature selection.

Normal takeoff speeds, V1, VR, and V2 are read from either the dry or wet table by entering with takeoff flap setting and brake release weight. Use the tables provided to adjust takeoff speeds for altitude and actual temperature or assumed temperature for reduced thrust takeoffs. Slope and wind adjustments to V1 are obtained by entering the Slope and Wind V1 Adjustment table.

V1(MCG)

Regulations prohibit scheduling takeoff with a V1 less than minimum V1 for control on the ground, V1(MCG). It is therefore necessary to compare the adjusted V1 to V1(MCG). The V1(MCG) presented in this manual is conservative for all weight and bleed configurations.

To find V1(MCG) enter the V1(MCG) table with the airport pressure altitude and actual OAT. If the adjusted V1 is less than V1(MCG), set V1 equal to V1(MCG). If the adjusted VR is less than V1(MCG), set VR equal to V1(MCG), and determine a new V2 by adding the difference between the normal VR and V1(MCG) to the normal V2. No takeoff weight adjustment is necessary provided that the actual field length exceeds the minimum field length shown in the Field and Climb Limit Weight table in chapter Performance Dispatch.

Stab Trim

To find takeoff stabilizer trim setting, enter Stab Trim Setting table with anticipated brake release weight and center of gravity (C.G. % MAC) and read required stabilizer trim units.

VREF

This table contains flaps 40, 30 and 15 reference speeds for a given weight.

Flap Maneuver Speeds

This table provides flap maneuver speeds for various flap settings. During flap retraction, selection of the next flap position is initiated when reaching the maneuver speed for the existing flap position. During flap retraction, at least adequate maneuver capability or 30° of bank (15° of bank and 15° overshoot) to stick shaker is provided at the flap retraction speed. Full maneuver capability or at least 40° of bank (25° of bank and 15° overshoot) is provided when the airplane has accelerated to the recommended maneuver speed for the selected flap position.

During flap extension, selection of the flaps to the next flap position should be made when approaching, and before decelerating below, the maneuver speed for the existing flap position. The flap extension speed schedule varies with airplane weight and provides full maneuver capability or at least 40° of bank (25° of bank and 15° overshoot) to stick shaker at all weights.

Slush/Standing Water Takeoff

Experience has shown that aircraft performance may deteriorate significantly on runways covered with snow, slush, standing water or ice. Therefore, reductions in field/obstacle limited takeoff weight and revised takeoff speeds are necessary. The tables are intended for guidance in accordance with advisory material and assume an engine failure at the critical point during the takeoff.

The entire runway is assumed to be completely covered by a contaminant of uniform thickness and density. Therefore this information is conservative when operating under typical cold weather conditions where patches of slush exist and some degree of sanding is common. Takeoffs in slush or standing water depths greater than 0.5 inches (13 mm) are not recommended because of possible airplane damage as a result of spray impingement on the airplane structure. The use of assumed temperature for reduced thrust is not allowed on contaminated runways. Interpolation for slush/standing water depths between the values shown is permitted.

Takeoff weight determination:

1. Enter the Weight Adjustment table with the dry field/obstacle limit weight to obtain the weight reduction for the slush/standing water depth and airport pressure altitude.
2. Adjust field length available for temperature by amount shown beneath V1(MCG) limit weight table.
3. Enter the V1(MCG) Limit Weight table with the adjusted field length and pressure altitude to obtain the slush/standing water limit weight with respect to minimum field length required for V1(MCG) speed.
4. The maximum allowable takeoff weight in slush/standing water is the lesser of the limit weights found in steps 1 and 3.

Takeoff speed determination:

1. Determine takeoff speeds V1, VR and V2 for actual brake release weight using the Dry Runway Takeoff Speeds table for the appropriate flap setting and thrust rating.
2. If V1(MCG) limited, set V1=V1(MCG). If not limited by V1(MCG) considerations, enter the V1 Adjustment table with actual brake release weight to determine the V1 reduction to apply to V1 speed. If the adjusted V1 is less than V1(MCG), set V1=V1(MCG).

Slippery Runway Takeoff

Airplane braking action is reported as good, medium or poor, depending on existing runway conditions. If braking action is reported as good, conditions should not be expected to be as good as on clean, dry runways. The value “good” is comparative and is intended to mean that airplanes should not experience braking or directional control difficulties when stopping. The performance level used to calculate the “good” data is consistent with wet runway testing done on early Boeing jets. The performance level used to calculate the “poor” data reflects a runway covered with wet ice. Performance is based on a 15 ft screen height at the end of the runway. The tables provided are used in the same manner as the Slush/Standing Water tables.

Anti-Skid Inoperative

When operating with anti-skid inoperative, the field limit weight and V1 must be reduced to account for the effect on accelerate-stop performance. Anti-skid inoperative is only allowed on a dry runway. A simplified method which conservatively accounts for the effects of anti-skid inoperative is to reduce the normal dry field/obstacle limited weight by 18300 lb and the V1 associated with the reduced weight by the amount shown in the table below.

ANTI-SKID INOPERATIVE V1 ADJUSTMENTS	
FIELD LENGTH (FT)	V1 ADJUSTMENT (KIAS)
6000	-18
8000	-15
10000	-12
12000	-10
14000	-9

If the resulting V1 is less than V1(MCG), takeoff is permitted with V1 set equal to V1(MCG) provided the dry accelerate-stop distance adjusted for wind and slope exceeds approximately 7300 ft.

Detailed analysis for the specific case from the Airplane Flight Manual may yield a less restrictive penalty.

Thrust Reverser Inoperative

When dispatching on a wet runway with both thrust reversers operative, an operative anti-skid system, and all brakes operating, regulations allow deceleration credit for one thrust reverser in the engine failure case and two thrust reversers in the all engine stop case.

When dispatching on a wet runway with one thrust reverser inoperative, the field/obstacle limited weight and V1 speed must be reduced to account for the effect on accelerate-stop performance. A simplified method, which conservatively accounts for this, is to reduce the normal wet runway/field/obstacle limited weight by 2200 lb and the V1 associated with the reduced weight by 2 knots.

If the resulting V1 is less than minimum V1, takeoff is permitted with V1 set equal to V1(MCG) provided the accelerate-stop distance available adjusted for wind and slope exceeds approximately 5200 ft.

Detailed analysis for the specific case from the Airplane Flight Manual may yield a less restrictive penalty.

Takeoff %N1

To find Max Takeoff %N1 based on normal engine bleed for air conditioning packs on, enter Takeoff %N1 Table with airport pressure altitude and airport OAT and read %N1. Apply %N1 adjustments as provided when applicable.

Assumed Temperature Reduced Thrust

Regulations permit the use of up to 25% takeoff thrust reduction for operation with assumed temperature reduced thrust. Use of assumed temperature reduced thrust is not allowed with anti-skid inoperative or on runways contaminated with standing water, ice, slush, or snow. Use of assumed temperature reduced thrust is not recommended if potential windshear conditions exist.

To find the maximum allowable assumed temperature enter the Maximum Assumed Temperature table with airport pressure altitude and OAT. Compare this temperature to that at which the airplane is performance limited as determined from available takeoff performance data. Next, enter the Maximum Takeoff %N1 table with airport pressure altitude and the lower of the two temperatures previously determined, to obtain a maximum takeoff %N1. Do not use an assumed temperature less than the minimum assumed temperature shown. Enter the %N1 Adjustment table with OAT and the difference between the assumed and actual OAT to obtain a %N1 adjustment. Subtract the %N1 adjustment from the maximum takeoff %N1 found previously to determine the assumed temperature reduced thrust %N1.

Apply %N1 adjustments as provided when applicable.

Max Climb %N1

This table shows Max Climb %N1 for a 280/.78 climb speed schedule, normal engine bleed for packs on or off and anti-ice off. Enter the table with airport pressure altitude and TAT and read %N1. %N1 adjustments are shown for anti-ice operation.

Go-around %N1

To find Max Go-around %N1 based on normal engine bleed for packs on (AUTO) and anti-ice on or off, enter the Go-around %N1 table with airport pressure altitude and reported OAT or TAT and read %N1. For packs OFF or HIGH operation, apply the %N1 adjustment shown below the table.

Flight with Unreliable Airspeed / Turbulent Air Penetration

Pitch attitude and average %N1 information is provided for use in all phases of flight in the event of unreliable airspeed/Mach indications resulting from blocking or freezing of the pitot system. Loss of radome or turbulent air may also cause unreliable airspeed/Mach indications. The cruise table in this section may also be used for turbulent air penetration. The Flight with Unreliable Airspeed - FINAL APPROACH table includes a 10 knot margin for landing.

Pitch attitude is shown in bold type for emphasis since altitude and/or vertical speed indications may also be unreliable.

All Engines

Long Range Cruise Maximum Operating Altitude

These tables provide the maximum operating altitude in the same manner as the FMC. Maximum altitudes are shown for a given cruise weight and maneuver capability. This table considers both thrust and buffet limits, providing the more limiting of the two. Any data that is thrust limited is denoted by an asterisk and represents only a thrust limited condition in level flight with 100 ft/min residual rate of climb. Flying above these altitudes with sustained banks in excess of approximately 15° may cause the airplane to lose speed and/or altitude. The altitudes shown in the table are limited to the maximum certified altitude of 41000 ft.

Long Range Cruise Control

These tables provide target %N1, Long Range Cruise Mach number, IAS and standard day fuel flow per engine for the airplane weight and pressure altitude. As indicated by the shaded area, at optimum altitude .79M approximates the Long Range Cruise Mach schedule.

Long Range Cruise Enroute Fuel and Time

Long Range Cruise Enroute Fuel and Time tables are provided to determine remaining time and fuel required to destination. The data is based on Long Range Cruise and .78/280/250 descent. Tables are presented for low altitudes and high altitudes.

To determine remaining fuel and time required, first enter the Ground to Air Miles Conversion table to convert ground distance and enroute wind to an equivalent still air distance for use with the Reference Fuel and Time tables. Next, enter the Reference Fuel and Time table with air distance from the Ground to Air Miles Conversion table and the desired altitude and read Reference Fuel and Time Required. Lastly, enter the Fuel Required Adjustment table with the Reference Fuel and the actual weight at checkpoint to obtain fuel required to destination.

APU Operation During Flight

For APU operation during flight, increase fuel flow according to the table in the Engine Inoperative text section.

Long Range Cruise Wind-Altitude Trade

Wind is a factor which may justify operations considerably below optimum altitude. For example, a favorable wind component may have an effect on ground speed which more than compensates for the loss in air range.

Using this table, it is possible to determine the break-even wind (advantage necessary or disadvantage that can be tolerated) to maintain the same range at another altitude and long range cruise speed. The tables make no allowance for climb or descent time, fuel or distance, and are based on comparing ground fuel mileage.

Descent

Time, fuel, and distance for descent are shown for a .78/280/250 descent speed schedule. Enter the table with top of descent pressure altitude and read distance, time and fuel. Data is based on flight idle thrust descent in zero wind. Allowances are included for a straight-in approach with gear down and landing flaps at the outer marker.

Holding

Target %N1, indicated airspeed and fuel flow per engine information is tabulated for holding with flaps up based on the FMC optimum holding speed schedule. This is the higher of the maximum endurance speed and the maneuvering speed. Small variations in airspeed will not appreciably affect the overall endurance time. Enter the table with weight and pressure altitude to read %N1, IAS and fuel flow per engine.

Advisory Information

Normal Configuration Landing Distance

The normal configuration distance tables are provided as advisory information to help determine the actual landing distance performance of the airplane for different runway surface conditions and brake configurations.

Flaps 15, 30, and 40 landing distances and adjustments are provided for dry runways as well as runways with good, medium, and poor reported braking action, which are commonly referred to as slippery runway conditions.

If the surface is affected by water, snow or ice, and the braking action is reported as "good", conditions should not be expected to be as good as on clean, dry runways. The value "good" is comparative and is intended to mean that airplanes should not experience braking or directional control difficulties when landing. The performance level used to calculate the "good" data is consistent with wet runway testing done on early Boeing jets. The performance level used to calculate "poor" data reflects runways covered with wet ice.

Dry runway landing performance is shown for max manual braking configuration and autobrake settings max, 3, 2, and 1. The autobrake performance may be used to assist in the selection of the most desirable autobrake setting for a given field length. Selection of an autobrake setting results in a constant rate of deceleration. Maximum effort manual braking should achieve shorter landing distance than the max autobrake setting. The reference landing distance is a reference distance from 50 ft above the threshold to stop based on a reference landing weight and normal approach speed for the selected landing flap at sea level, zero wind, zero slope, and two engine detent reverse thrust. Subsequent columns provide adjustments for off-reference landing weight, altitude, wind, slope, temperature, speed, and reverse thrust. Each adjustment is independently added to the reference landing distance.

Non-normal Configuration Landing Distance

Advisory information is provided to support non-normal configurations that affect the landing performance of the airplane. Landing distances and adjustments are provided for dry runways and runways with good, medium, and poor reported braking action.

Enter the table with the applicable non-normal configuration and read the normal approach speed. The reference landing distance is a reference distance from 50 ft above the threshold to stop based on a reference landing weight and speed at sea level, zero wind, and zero slope. Subsequent columns provide adjustments for off-reference landing weight, altitude, wind, slope, and speed conditions. Each adjustment is independently added to the reference landing distance. Landing distance includes the effect of reverse thrust.

Recommended Brake Cooling Schedule

Advisory information is provided to assist in avoiding the problems associated with hot brakes. For normal operation, most landings are at weights below the AFM quick turnaround limit weight.

Use of the recommended cooling schedule will help avoid brake overheat and fuse plug problems that could result from repeated landings at short time intervals or a rejected takeoff.

Enter the Recommended Brake Cooling Schedule table with the airplane weight and brakes on speed, adjusted for wind at the appropriate temperature and altitude condition. Instructions for applying wind adjustments are included below the table. Linear interpolation may be used to obtain intermediate values. The resulting number is the reference brake energy per brake in millions of foot-pounds, and represents the amount of energy absorbed by each brake during a rejected takeoff. Notes providing adjustments for wind are included below the table.

To determine the energy per brake absorbed during landing, enter the appropriate Adjusted Brake Energy Per Brake table (No Reverse Thrust or 2 Engine Reverse) with the reference brake energy per brake and the type of braking used during landing (Max Manual, Max Auto, or Autobrake). The resulting number is the adjusted brake energy per brake and represents the energy absorbed in each brake during the landing.

The recommended cooling time is found in the appropriate (steel or carbon brakes) final table by entering with the adjusted brake energy per brake. Times are provided for ground cooling and inflight gear down cooling.

Brake Temperature Monitor System (BTMS) indications are also shown. If brake cooling is determined from the BTMS, use the hottest brake indication 10 to 15 minutes after the airplane has come to a complete stop, or inflight with gear retracted to determine recommended cooling schedule.

Engine Inoperative

Initial Max Continuous %N1

The Initial Max Continuous %N1 setting for use following an engine failure is shown. The table is based on the typical all engine cruise speed of .79M to provide a target %N1 setting at the start of driftdown. Once driftdown is established, the Max Continuous %N1 table should be used to determine %N1 for the given conditions.

Max Continuous %N1

Power setting is based on one engine operating with one A/C pack operating and all anti-ice bleeds off. Enter the table with pressure altitude, TAT, and IAS or Mach to read %N1.

It is desirable to maintain engine thrust level within the limits of the Max Cruise thrust rating. However, where thrust level in excess of Max Cruise rating is required, such as for meeting terrain clearance, ATC altitude assignments, or to attain maximum range capability, it is permissible to use the thrust needed up to the Max Continuous thrust rating. The Max Continuous thrust rating is intended primarily for emergency use at the discretion of the pilot and is the maximum thrust that may be used continuously.

Driftdown Speed/Level Off Altitude

The table shows optimum driftdown speed as a function of cruise weight at start of driftdown. Also shown are the approximate weight and pressure altitude at which the airplane will level off considering 100 ft/min residual rate of climb.

The level off altitude is dependent on air temperature (ISA deviation).

Driftdown/LRC Range Capability

This table shows the range capability from the start of driftdown. Driftdown is continued to level off altitude. As weight decreases due to fuel burn, the airplane is accelerated to Long Range Cruise speed. Cruise is continued at level off altitude and Long Range Cruise speed.

To determine fuel required, enter the Ground to Air Miles Conversion table with the desired ground distance and adjust for anticipated winds to obtain air distance to destination. Then enter the Driftdown/Cruise Fuel and Time table with air distance and weight at start of driftdown to determine fuel and time required. If altitudes other than the level off altitude is used, fuel and time required may be obtained by using the Engine Inoperative Long Range Cruise Enroute Fuel and Time table.

Long Range Cruise Altitude Capability

The table shows the maximum altitude that can be maintained at a given weight and air temperature (ISA deviation), based on Long Range Cruise speed, Max Continuous thrust, and 100 ft/min residual rate of climb.

Long Range Cruise Control

The table provides target %N1, engine inoperative Long Range Cruise Mach number, IAS and fuel flow for the airplane weight and pressure altitude. The fuel flow values in this table reflect single engine fuel burn.

APU Operation During Flight

For APU operation during flight, increase fuel flow according to the following table. These increments include the APU fuel flow and the effect of increased drag from the APU door.

PRESSURE ALTITUDE (1000 FT)	APU FUEL FLOW (LB/HR)
39	100
35	100
31	110
25	130
20	150
15	160
10	180
5	200

Long Range Cruise Diversion Fuel and Time

Tables are provided for crews to determine the fuel and time required to proceed to an alternate airfield with one engine inoperative. The data is based on single engine Long Range Cruise speed and .78/280/250 descent. Enter with Air Distance as determined from the Ground to Air Miles Conversion table and read Fuel and Time required at the cruise pressure altitude. Adjust the fuel obtained for deviation from the reference weight at checkpoint as required by entering the off reference fuel adjustments table with the fuel required for the reference weight and the actual weight at checkpoint. Read fuel required and time for the actual weight.

Holding

Single engine holding data is provided in the same format as the all engine holding data and is based on the same assumptions.

Gear Down Landing Rate of Climb Available

Rate of climb data is provided as guidance information in the event an engine inoperative landing (manual or autoland) is planned. The tables show gear down rate of climb available for Flaps 15 and Flaps 30. Enter the table with TAT and pressure altitude to read rate of climb available. Apply adjustments shown to correct for weight.

Alternate Mode EEC

Introduction

No takeoff speed adjustments or other performance adjustments are required of Electronic Engine Control (EEC) in the alternate mode (ALTN EEC switch illuminated) for the 7B18, -7B20, -7B22, -7B24 and -7B24A engine thrust ratings.

Operation with derate and/or assumed temperature reduced thrust is not permitted with the EEC in alternate mode.

Gear Down

This section contains performance for airplane operation with the landing gear extended. The data is based on engine bleeds for normal air conditioning.

Note: The Flight Management Computer System (FMCS) does not contain special provisions for operation with landing gear extended. As a result, the FMCS may generate inappropriate enroute speed schedules, display non-conservative predictions of fuel burn, estimated time of arrival (ETA), maximum altitude, and compute overly shallow descent path. An accurate estimated time of arrival (ETA) is available if current speed or Mach is entered into the VNAV cruise page.

Tables for gear down performance in this section are identical in format and used in the same manner as tables for the gear up configuration previously described.

Performance Inflight — Chapter PI
Table of Contents — Section 30

737-700W CFM56-7B26 KG JAA CATF/M

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General

The table below shows the airplanes that have been identified with the following performance package. Note, some airplanes may be identified with more than one performance package. This configuration table information reflects the Boeing delivered configuration updated for service bulletin incorporations in conformance with the policy stated in the introduction section of the FCOM. The performance data is prepared for the owner/operator named on the title page. The intent of this information is to assist flight crews and airlines in knowing which performance package is applicable to a given airplane. The performance package model identification information is based on Boeing's knowledge of the airline's fleet at a point in time approximately three months prior to the page date. Notice of Errata (NOE) will not be provided to airlines to identify airplanes that are moved between performance packages within this manual or airplanes added to the airline's fleet whose performance packages are already represented in this manual. These types of changes will be updated in the next block revision. Owners/operators are responsible for ensuring the operational documentation they are using is complete and matches the current configuration of their airplanes, and the accuracy and validity of all information furnished by the owner/operator or any other party. Owners/operators receiving active revision service are responsible to ensure that any modifications to the listed airplanes are properly reflected in this manual.

Serial and tabulation number are supplied by Boeing.

Registry Number	Serial Number	Tabulation Number
YX700	YX700	YX700

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Performance Inflight — Chapter PI
General — Section 30

Takeoff Speeds - Dry Runway
Flaps 1 and 5
V1, VR, V2 for Max Takeoff Thrust

WEIGHT (1000 KG)	FLAPS 1			FLAPS 5		
	V1	VR	V2	V1	VR	V2
88	159	162	167	154	158	163
84	154	157	163	150	153	159
80	149	152	159	146	149	155
76	145	147	155	141	144	151
72	141	143	151	137	140	148
68	136	138	147	133	135	144
64	131	133	143	127	130	140
60	125	128	138	122	125	135
56	119	122	134	116	119	130
52	113	116	128	111	114	126
48	108	110	123	105	108	120
44	101	104	118	99	102	115
40	95	98	113	92	95	110

Check V1(MCG) and Minimum Takeoff Weight. Takeoff using -7B26 takeoff thrust at weights less than 56699 kg may be limited.

V1, VR, V2 Adjustments*

TEMP		V1							VR							V2						
		PRESS ALT (1000 FT)							PRESS ALT (1000 FT)							PRESS ALT (1000 FT)						
°C	°F	-2	0	2	4	6	8	10	-2	0	2	4	6	8	10	-2	0	2	4	6	8	10
70	158	7	8						6	7						0	0					
60	140	5	6	8	9				4	5	7	8				0	0	0	0			
50	122	3	4	6	7	9	11	13	3	4	5	6	8	10	11	0	0	0	0	0	0	0
40	104	1	2	4	5	7	9	11	1	2	3	5	6	8	10	0	0	0	0	0	0	0
30	86	0	0	2	4	6	7	9	0	0	2	4	5	7	9	0	0	0	0	0	1	1
20	68	0	0	1	3	5	7	8	0	0	1	3	4	6	8	0	0	0	0	1	1	1
-60	-76	0	0	1	3	5	6	8	0	0	1	3	4	6	7	0	0	0	0	1	1	1

Slope and Wind V1 Adjustments*

WEIGHT (1000 KG)	SLOPE (%)					WIND (KTS)							
	-2	-1	0	1	2	-15	-10	-5	0	10	20	30	40
88	-3	-2	0	2	3	-2	-1	-1	0	0	1	1	1
80	-3	-1	0	2	3	-2	-1	-1	0	0	1	1	1
72	-3	-1	0	1	2	-2	-1	0	0	0	1	1	1
64	-2	-1	0	1	2	-2	-1	0	0	0	1	1	1
56	-2	-1	0	1	2	-2	-1	-1	0	0	1	1	2
48	-1	-1	0	1	1	-2	-1	-1	0	0	1	1	2
40	-1	0	0	1	1	-3	-2	-1	0	1	1	2	2

***V1 not to exceed VR.**

Takeoff Speeds - Dry Runway

Flaps 1 and 5
V1(MCG)
Max Takeoff Thrust

TEMP		PRESSURE ALTITUDE (FT)						
°C	°F	-2000	0	2000	4000	6000	8000	10000
70	158	112	110					
60	140	112	110	108	107			
50	122	115	112	109	107	104	101	99
40	104	120	117	113	110	106	102	99
30	86	122	122	118	114	109	105	101
20	68	123	122	119	115	111	107	103
-60	-76	125	124	120	116	113	109	106

Flaps 10, 15 and 25
V1, VR, V2 for Max Takeoff Thrust

WEIGHT (1000 KG)	FLAPS 10			FLAPS 15			FLAPS 25		
	V1	VR	V2	V1	VR	V2	V1	VR	V2
88	148	150	155						
84	143	146	151	142	142	148			
80	139	142	148	138	138	144	136	136	142
76	135	137	144	134	134	141	132	132	140
72	131	134	141	130	131	138	128	129	137
68	127	130	138	126	127	135	124	125	134
64	123	126	135	121	123	132	120	121	130
60	118	121	131	116	118	128	115	117	127
56	113	116	127	112	113	124	110	112	123
52	108	111	122	107	108	120	105	107	119
48	103	105	118	102	103	116	100	102	115
44	97	100	114	96	98	112	95	97	111
40	91	94	109	90	93	107	89	92	106

Check V1(MCG) and Minimum Takeoff Weight. Takeoff using 7B26 takeoff thrust at weights less than 56699 kg may be limited.

V1, VR, V2 Adjustments*

TEMP		V1							VR							V2						
		PRESS ALT (1000 FT)							PRESS ALT (1000 FT)							PRESS ALT (1000 FT)						
°C	°F	-2	0	2	4	6	8	10	-2	0	2	4	6	8	10	-2	0	2	4	6	8	10
70	158	6	6						4	5						-2	-3					
60	140	4	5	6	7				3	4	5	5				-2	-2	-2	-3			
50	122	2	3	4	5	6	8	10	2	3	3	4	5	6	7	-1	-1	-2	-2	-3	-3	-4
40	104	1	2	3	4	5	6	8	1	1	2	3	4	5	6	0	-1	-1	-1	-2	-3	-3
30	86	0	0	1	3	4	5	6	0	0	1	2	4	5	6	0	0	0	-1	-1	-2	-3
20	68	0	0	1	2	3	5	6	0	0	1	2	3	4	5	0	0	0	-1	-1	-1	-2
-60	-76	0	0	1	2	3	5	6	0	0	1	2	3	4	5	0	0	0	-1	-1	-1	-2

Slope and Wind V1 Adjustments*

WEIGHT (1000 KG)	SLOPE (%)					WIND (KTS)							
	-2	-1	0	1	2	-15	-10	-5	0	10	20	30	40
88	-3	-1	0	1	2	-2	-1	-1	0	0	1	1	1
80	-3	-1	0	1	2	-2	-1	-1	0	0	1	1	1
72	-2	-1	0	1	2	-2	-1	-1	0	0	1	1	1
64	-2	-1	0	1	2	-2	-1	-1	0	0	1	1	1
56	-2	-1	0	1	1	-2	-1	-1	0	0	1	1	1
48	-2	-1	0	1	1	-2	-1	-1	0	0	1	1	2
40	-1	-1	0	0	1	-2	-2	-1	0	0	1	1	2

***V1 not to exceed VR.**

Takeoff Speeds - Dry Runway
Flaps 10, 15 and 25
V1(MCG)
Max Takeoff Thrust

TEMP		PRESSURE ALTITUDE (FT)						
°C	°F	-2000	0	2000	4000	6000	8000	10000
70	158	112	110					
60	140	112	110	108	107			
50	122	115	112	109	107	104	101	99
40	104	120	117	113	110	106	102	99
30	86	122	122	118	114	109	105	101
20	68	123	122	119	115	111	107	103
-60	-76	125	124	120	116	113	109	106

Takeoff Speeds - Wet Runway
Flaps 1 and 5
V1, VR, V2 for Max Takeoff Thrust

WEIGHT (1000 KG)	FLAPS 1			FLAPS 5		
	V1	VR	V2	V1	VR	V2
88	154	162	167	149	158	163
84	148	157	163	144	153	159
80	143	152	159	139	149	155
76	138	147	155	134	144	151
72	133	143	151	130	140	148
68	128	138	147	125	135	144
64	122	133	143	119	130	140
60	116	128	138	114	125	135
56	110	122	134	108	119	130
52	104	116	128	101	114	126
48	98	110	123	95	108	120
44	91	104	118	89	102	115
40	85	98	113	82	95	110

Check V1(MCG) and Minimum Takeoff Weight. Takeoff using 7B26 takeoff thrust at weights less than 56699 kg may be limited.

V1, VR, V2 Adjustment*

TEMP		V1							VR							V2						
		PRESS ALT (1000 FT)							PRESS ALT (1000 FT)							PRESS ALT (1000 FT)						
°C	°F	-2	0	2	4	6	8	10	-2	0	2	4	6	8	10	-2	0	2	4	6	8	10
70	158	9	11						6	7						0	0					
60	140	7	8	10	12				4	5	7	8				0	0	0	0			
50	122	4	5	7	9	11	13	16	3	4	5	6	8	10	11	0	0	0	0	0	0	0
40	104	1	3	4	6	8	11	13	1	2	3	5	6	8	10	0	0	0	0	0	0	0
30	86	0	0	2	4	7	9	11	0	0	2	4	5	7	9	0	0	0	0	0	1	1
20	68	0	0	1	3	6	8	10	0	0	1	3	4	6	8	0	0	0	0	1	1	1
-60	-76	0	0	1	3	5	8	10	0	0	1	3	4	6	7	0	0	0	0	1	1	1

Slope and Wind V1 Adjustment*

WEIGHT (1000 KG)	SLOPE (%)					WIND (KTS)							
	-2	-1	0	1	2	-15	-10	-5	0	10	20	30	40
88	-5	-2	0	3	5	-4	-2	-1	0	1	1	2	3
80	-5	-2	0	2	5	-4	-2	-1	0	1	1	2	3
72	-4	-2	0	2	4	-4	-2	-1	0	1	1	2	3
64	-4	-2	0	2	4	-4	-2	-1	0	1	1	2	3
56	-3	-2	0	2	3	-4	-3	-1	0	1	2	2	3
48	-2	-1	0	1	3	-4	-3	-1	0	1	2	3	4
40	-2	-1	0	1	2	-5	-3	-1	0	1	2	3	4

***V1 not to exceed VR.**

V1(MCG)
Max Takeoff Thrust

TEMP		PRESSURE ALTITUDE (FT)						
°C	°F	-2000	0	2000	4000	6000	8000	10000
70	158	112	110					
60	140	112	110	108	107			
50	122	115	112	109	107	104	101	99
40	104	120	117	113	110	106	102	99
30	86	122	122	118	114	109	105	101
20	68	123	122	119	115	111	107	103
-60	-76	125	124	120	116	113	109	106

Takeoff Speeds - Wet Runway
Flaps 10, 15 and 25
V1, VR, V2 for Max Takeoff Thrust

WEIGHT (1000 KG)	FLAPS 10			FLAPS 15			FLAPS 25		
	V1	VR	V2	V1	VR	V2	V1	VR	V2
88	143	150	155						
84	138	146	151	138	142	148			
80	133	142	148	133	138	144	130	136	142
76	129	137	144	128	134	141	126	132	140
72	124	134	141	124	131	138	122	129	137
68	120	130	138	119	127	135	118	125	134
64	115	126	135	114	123	132	113	121	130
60	110	121	131	109	118	128	108	117	127
56	105	116	127	104	113	124	102	112	123
52	99	111	122	98	108	120	97	107	119
48	94	105	118	93	103	116	91	102	115
44	88	100	114	87	98	112	86	97	111
40	82	94	109	81	93	107	80	92	106

Check V1(MCG) and Minimum Takeoff Weight. Takeoff using -7B26 derate takeoff thrust at weights less than 56699 kg may be limited.

V1, VR, V2 Adjustment*

TEMP		V1							VR							V2						
		PRESS ALT (1000 FT)							PRESS ALT (1000 FT)							PRESS ALT (1000 FT)						
°C	°F	-2	0	2	4	6	8	10	-2	0	2	4	6	8	10	-2	0	2	4	6	8	10
70	158	8	9						4	5						-2	-3					
60	140	6	6	8	9				3	4	5	5				-2	-2	-2	-3			
50	122	3	4	6	7	9	11	13	2	3	3	4	5	6	7	-1	-1	-2	-2	-3	-3	-4
40	104	1	2	4	5	6	8	10	1	1	2	3	4	5	6	0	-1	-1	-1	-2	-3	-3
30	86	0	0	2	3	5	7	8	0	0	1	2	4	5	6	0	0	0	-1	-1	-2	-3
20	68	0	0	1	3	4	6	7	0	0	1	2	3	4	5	0	0	0	-1	-1	-1	-2
-60	-76	0	0	1	3	4	6	7	0	0	1	2	3	4	5	0	0	0	-1	-1	-1	-2

Slope and Wind V1 Adjustment*

WEIGHT (1000 KG)	SLOPE (%)					WIND (KTS)							
	-2	-1	0	1	2	-15	-10	-5	0	10	20	30	40
88	-4	-2	0	2	4	-3	-2	-1	0	1	1	2	2
80	-4	-2	0	2	4	-3	-2	-1	0	1	1	2	2
72	-4	-2	0	2	4	-4	-2	-1	0	1	1	2	3
64	-3	-2	0	2	3	-4	-3	-1	0	1	1	2	3
56	-3	-2	0	1	3	-4	-3	-1	0	1	2	2	3
48	-2	-1	0	1	2	-4	-3	-1	0	1	2	3	3
40	-2	-1	0	1	2	-5	-3	-1	0	1	2	3	4

***V1 not to exceed VR.**

V1(MCG)
Max Takeoff Thrust

TEMP		PRESSURE ALTITUDE (FT)						
°C	°F	-2000	0	2000	4000	6000	8000	10000
70	158	112	110					
60	140	112	110	108	107			
50	122	115	112	109	107	104	101	99
40	104	120	117	113	110	106	102	99
30	86	122	122	118	114	109	105	101
20	68	123	122	119	115	111	107	103
-60	-76	125	124	120	116	113	109	106

Stab Trim Setting
Max Takeoff Thrust
Flaps 1 and 5

WEIGHT	C.G. (%MAC)									
(1000 KG)	9	11	13	16	20	23	26	28	30	33
80	8 1/2	8 1/2	8 1/2	7 3/4	6 3/4	6 1/4	5 3/4	5 1/4	5	4 1/4
70	8 1/2	8 1/2	8 1/4	7 1/4	6 1/2	5 3/4	5 1/4	4 3/4	4 1/2	4
60	8 1/2	8 1/4	7 1/2	6 1/2	5 3/4	5 1/4	4 1/2	4 1/4	4	4
50	7 1/2	7	6 1/2	5 1/2	5	4 1/4	4	4	4	4
45	6 1/4	6	5 1/2	5	4 1/4	4	4	4	4	4

Flaps 10, 15 and 25

WEIGHT	C.G. (%MAC)									
(1000 KG)	9	12	14	16	18	23	26	28	31	33
80	8 1/2	8 1/2	8 1/2	7 1/2	7	5 3/4	5 1/4	4 3/4	4	4
70	8 1/2	8 1/4	7 1/2	6 3/4	6 1/4	5	4 1/4	4	4	4
60	8 1/2	7 1/4	6 1/4	5 3/4	5 1/4	4 1/4	4	4	4	4
50	7	5 1/2	5 1/4	4 3/4	4 1/4	4	4	4	4	4
45	5 1/2	5	4 1/2	4 1/4	4	4	4	4	4	4

VREF

Based on 10000 ft reference pressure altitude

WEIGHT (1000 KG)	FLAPS		
	40	30	15
85	159	161	167
80	154	156	162
75	149	151	157
70	144	146	152
65	139	141	147
60	133	135	140
55	127	129	134
50	120	123	127
45	114	117	121

Flap Maneuver Speeds

FLAP POSITION	MANEUVER SPEED
UP	VREF40 + 70
1	VREF40 + 50
5	VREF40 + 30
10	VREF40 + 30
15	VREF40 + 20
25	VREF40 + 10
30	VREF30
40	VREF40

ADVISORY INFORMATION

Slush/Standing Water Takeoff

Maximum Reverse Thrust

Weight Adjustments (1000 KG)

DRY FIELD/OBSTACLE LIMIT WEIGHT (1000 KG)	SLUSH/STANDING WATER DEPTH								
	3 mm (0.12 INCHES)			6 mm (0.25 INCHES)			13 mm (0.50 INCHES)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
90	-10.5	-13.4	-16.4	-12.6	-15.5	-18.5	-17.1	-20.1	-23.0
85	-9.6	-12.6	-15.5	-11.4	-14.4	-17.3	-15.3	-18.2	-21.2
80	-8.8	-11.7	-14.7	-10.3	-13.2	-16.2	-13.5	-16.4	-19.4
75	-7.9	-10.9	-13.8	-9.2	-12.1	-15.1	-11.8	-14.7	-17.7
70	-7.1	-10.0	-13.0	-8.1	-11.0	-14.0	-10.2	-13.1	-16.1
65	-6.2	-9.1	-12.1	-7.0	-9.9	-12.9	-8.7	-11.6	-14.6
60	-5.3	-8.2	-11.2	-5.9	-8.8	-11.8	-7.2	-10.2	-13.1
55	-4.3	-7.3	-10.2	-4.8	-7.8	-10.7	-5.9	-8.9	-11.8
50	-3.4	-6.4	-9.3	-3.8	-6.7	-9.7	-4.7	-7.6	-10.6
45	-2.5	-5.4	-8.4	-2.7	-5.7	-8.6	-3.4	-6.4	-9.3
40	-1.5	-4.5	-7.4	-1.7	-4.6	-7.6	-2.2	-5.1	-8.1

V1(MCG) Limit Weight (1000 KG)

ADJUSTED FIELD LENGTH (M)	SLUSH/STANDING WATER DEPTH								
	3 mm (0.12 INCHES)			6 mm (0.25 INCHES)			13 mm (0.50 INCHES)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
1600							32.8		
1800	35.8			39.6			44.6		
2000	47.3			50.9	33.6		56.2	38.4	
2200	58.9	41.3		62.3	44.9		67.5	50.1	32.2
2400	70.5	52.8	35.3	73.9	56.3	39.0	78.5	61.6	44.0
2600	82.3	64.4	46.7	85.5	67.8	50.3	89.3	72.7	55.6
2800	94.1	76.1	58.3	97.2	79.4	61.8	100.0	83.6	66.9
3000		87.9	69.9		91.1	73.3		94.4	77.9
3200		99.7	81.7			84.9			88.7
3400			93.5			96.7			99.4

1. **Enter Weight Adjustment table with slush/standing water depth and dry field/obstacle limit weight to obtain slush/standing water weight adjustment.**
2. **Adjust field length available by -50 m/+45 m for every 5°C above/below 4°C.**
3. **Find V1(MCG) limit weight for adjusted field length and pressure altitude.**
4. **Max allowable slush/standing water limited weight is lesser of weights from 1 and 3.**

ADVISORY INFORMATION

Slush/Standing Water Takeoff
Maximum Reverse Thrust
V1 Adjustment (KIAS)

WEIGHT (1000 KG)	SLUSH/STANDING WATER DEPTH								
	3 mm (0.12 INCHES)			6 mm (0.25 INCHES)			13 mm (0.50 INCHES)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
90	-14	-9	-4	-7	-2	0	0	0	0
85	-16	-11	-6	-10	-5	0	0	0	0
80	-17	-12	-7	-12	-7	-2	0	0	0
75	-19	-14	-9	-14	-9	-4	-3	0	0
70	-20	-15	-10	-16	-11	-6	-6	-1	0
65	-21	-16	-11	-17	-12	-7	-9	-4	0
60	-21	-16	-11	-19	-14	-9	-12	-7	-2
55	-22	-17	-12	-20	-15	-10	-15	-10	-5
50	-24	-19	-14	-22	-17	-12	-17	-12	-7
45	-31	-26	-21	-28	-23	-18	-21	-16	-11
40	-42	-37	-32	-38	-33	-28	-25	-20	-15

1. **Obtain V1, VR and V2 for the actual weight using the Dry Runway Takeoff Speeds table.**
2. **If V1(MCG) limited, set V1 = V1(MCG). If not V1(MCG) limited, enter V1 Adjustment table with the actual weight to obtain V1 speed adjustment. If adjusted V1 is less than V1(MCG), set V1 = V1(MCG). V1 not to exceed VR.**

ADVISORY INFORMATION

Slush/Standing Water Takeoff

No Reverse Thrust

Weight Adjustments (1000 KG)

DRY FIELD/OBSTACLE LIMIT WEIGHT (1000 KG)	SLUSH/STANDING WATER DEPTH								
	3 mm (0.12 INCHES)			6 mm (0.25 INCHES)			13 mm (0.50 INCHES)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
90	-13.9	-16.4	-18.9	-16.2	-18.7	-21.2	-21.0	-23.5	-26.0
85	-12.9	-15.4	-17.9	-14.8	-17.3	-19.8	-18.8	-21.3	-23.8
80	-11.8	-14.3	-16.8	-13.4	-15.9	-18.4	-16.7	-19.2	-21.7
75	-10.8	-13.3	-15.8	-12.1	-14.5	-17.0	-14.7	-17.2	-19.7
70	-9.8	-12.3	-14.8	-10.8	-13.3	-15.8	-13.0	-15.5	-18.0
65	-8.8	-11.3	-13.8	-9.6	-12.1	-14.6	-11.4	-13.9	-16.3
60	-7.9	-10.4	-12.9	-8.5	-11.0	-13.5	-9.9	-12.4	-14.9
55	-7.0	-9.5	-12.0	-7.5	-10.0	-12.5	-8.6	-11.1	-13.6
50	-6.2	-8.7	-11.1	-6.6	-9.1	-11.6	-7.5	-10.0	-12.5
45	-5.3	-7.8	-10.3	-5.8	-8.2	-10.7	-6.6	-9.0	-11.5
40	-4.5	-7.0	-9.5	-5.0	-7.5	-10.0	-5.8	-8.2	-10.7

V1(MCG) Limit Weight (1000 KG)

ADJUSTED FIELD LENGTH (M)	SLUSH/STANDING WATER DEPTH								
	3 mm (0.12 INCHES)			6 mm (0.25 INCHES)			13 mm (0.50 INCHES)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
2200							34.2		
2400							45.5		
2600	30.8			41.1			56.9	38.8	
2800	41.9			52.5	34.4		68.6	50.1	32.0
3000	53.4	35.2		64.7	45.6		80.5	61.6	43.3
3200	65.9	46.4		77.8	57.3	38.8	92.7	73.3	54.6
3400	79.5	58.3	39.7	91.8	69.8	50.2		85.4	66.2
3600	94.6	71.2	51.0		83.3	62.2		97.6	78.1
3800		85.5	63.3		97.5	75.1			90.3
4000			76.7			89.0			
4200			91.5						

1. **Enter Weight Adjustment table with slush/standing water depth and dry field/obstacle limit weight to obtain slush/standing water weight adjustment.**
2. **Adjust field length available by -65 m/+65 m for every 5°C above/below 4°C.**
3. **Find V1(MCG) limit weight for adjusted field length and pressure altitude.**
4. **Max allowable slush/standing water limited weight is lesser of weights from 1 and 3.**

ADVISORY INFORMATION

Slush/Standing Water Takeoff
No Reverse Thrust
V1 Adjustment (KIAS)

WEIGHT (1000 KG)	SLUSH/STANDING WATER DEPTH								
	3 mm (0.12 INCHES)			6 mm (0.25 INCHES)			13 mm (0.50 INCHES)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
90	-25	-15	-5	-14	-4	0	0	0	0
85	-26	-16	-6	-17	-7	0	0	0	0
80	-28	-18	-8	-20	-10	0	0	0	0
75	-30	-20	-10	-23	-13	-3	-5	0	0
70	-31	-21	-11	-26	-16	-6	-11	-1	0
65	-33	-23	-13	-29	-19	-9	-17	-7	0
60	-35	-25	-15	-31	-21	-11	-21	-11	-1
55	-36	-26	-16	-33	-23	-13	-26	-16	-6
50	-38	-28	-18	-35	-25	-15	-30	-20	-10
45	-39	-29	-19	-37	-27	-17	-33	-23	-13
40	-41	-31	-21	-39	-29	-19	-36	-26	-16

1. **Obtain V1, VR and V2 for the actual weight using the Dry Runway Takeoff Speeds table.**
2. **If V1(MCG) limited, set V1 = V1(MCG). If not V1(MCG) limited, enter V1 Adjustment table with the actual weight to obtain V1 speed adjustment. If adjusted V1 is less than V1(MCG), set V1 = V1(MCG). V1 not to exceed VR.**

ADVISORY INFORMATION

Slippery Runway Takeoff
Maximum Reverse Thrust
Weight Adjustment (1000 KG)

DRY FIELD/OBSTACLE LIMIT WEIGHT (1000 KG)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
90	-1.3	-1.3	-1.3	-6.7	-6.7	-6.7	-11.4	-11.4	-11.4
85	-1.3	-1.3	-1.3	-6.4	-6.4	-6.4	-10.6	-10.6	-10.6
80	-1.4	-1.4	-1.4	-6.0	-6.0	-6.0	-9.9	-9.9	-9.9
75	-1.4	-1.4	-1.4	-5.7	-5.7	-5.7	-9.2	-9.2	-9.2
70	-1.4	-1.4	-1.4	-5.3	-5.3	-5.3	-8.5	-8.5	-8.5
65	-1.4	-1.4	-1.4	-5.0	-5.0	-5.0	-7.8	-7.8	-7.8
60	-1.4	-1.4	-1.4	-4.6	-4.6	-4.6	-7.2	-7.2	-7.2
55	-1.3	-1.3	-1.3	-4.2	-4.2	-4.2	-6.6	-6.6	-6.6
50	-1.2	-1.2	-1.2	-3.9	-3.9	-3.9	-6.0	-6.0	-6.0
45	-1.1	-1.1	-1.1	-3.5	-3.5	-3.5	-5.4	-5.4	-5.4
40	-1.0	-1.0	-1.0	-3.2	-3.2	-3.2	-4.8	-4.8	-4.8

V1(MCG) Limit Weight (1000 KG)

ADJUSTED FIELD LENGTH (M)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
1200	34.6								
1400	50.7	34.7							
1600	67.8	50.8	34.9	33.4					
1800	86.5	68.0	51.0	46.3					
2000		86.7	68.1	59.7	42.4				
2200			86.8	74.0	55.6	38.7	38.1		
2400				89.4	69.7	51.7	48.0	30.0	
2600					84.7	65.4	58.0	39.8	
2800						80.2	68.3	49.7	31.7
3000						96.0	78.9	59.7	41.5
3200							89.7	70.1	51.4
3400								80.7	61.5
3600								91.6	71.9
3800									82.6
4000									93.5

1. **Enter Weight Adjustment table with reported braking action and dry field/obstacle limit weight to obtain slippery runway weight adjustment.**
2. **Adjust “Good” field length available by -35 m/+30 m for every 5°C above/below 4°C.**
   Adjust “Medium” field length available by -35 m/+30 m for every 5°C above/below 4°C.
   Adjust “Poor” field length available by -50 m/+45 m for every 5°C above/below 4°C.
3. **Find V1(MCG) limit weight for adjusted field length and pressure altitude.**
4. **Max allowable slippery runway limited weight is lesser of weights from 1 and 3.**

ADVISORY INFORMATION

Slippery Runway Takeoff
Maximum Reverse Thrust
V1 Adjustment (KIAS)

WEIGHT (1000 KG)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
90	-5	-2	0	-14	-11	-9	-25	-22	-20
85	-6	-3	-1	-15	-12	-10	-27	-24	-22
80	-6	-4	-1	-16	-14	-11	-29	-26	-24
75	-7	-5	-2	-18	-15	-13	-30	-28	-25
70	-8	-6	-3	-19	-17	-14	-32	-30	-27
65	-9	-7	-4	-20	-18	-15	-34	-31	-29
60	-10	-8	-5	-22	-19	-17	-35	-33	-30
55	-11	-9	-6	-23	-20	-18	-37	-34	-32
50	-12	-9	-7	-24	-22	-19	-38	-36	-33
45	-13	-10	-8	-25	-23	-20	-40	-37	-35
40	-14	-11	-9	-27	-24	-22	-41	-39	-36

1. **Obtain V1, VR and V2 for the actual weight using the Dry Runway Takeoff Speeds table.**
2. **If V1(MCG) limited, set V1 = V1(MCG). If not V1(MCG) limited, enter V1 Adjustment table with the actual weight to obtain V1 speed adjustment. If adjusted V1 is less than V1(MCG), set V1 = V1(MCG).V1 not to exceed VR.**

ADVISORY INFORMATION

Slippery Runway Takeoff
No Reverse Thrust
Weight Adjustments (1000 KG)

DRY FIELD/OBSTACLE LIMIT WEIGHT (1000 KG)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
90	-1.6	-2.0	-2.4	-8.0	-8.4	-8.8	-13.7	-14.1	-14.5
85	-2.3	-2.7	-3.1	-8.4	-8.8	-9.2	-13.4	-13.8	-14.3
80	-2.8	-3.2	-3.6	-8.6	-9.0	-9.4	-13.0	-13.5	-13.9
75	-3.1	-3.5	-3.9	-8.5	-8.9	-9.3	-12.4	-12.8	-13.2
70	-3.1	-3.5	-3.9	-8.1	-8.5	-8.9	-11.5	-11.9	-12.3
65	-2.8	-3.2	-3.6	-7.4	-7.8	-8.2	-10.3	-10.7	-11.1
60	-2.2	-2.6	-3.0	-6.4	-6.8	-7.3	-8.8	-9.2	-9.6
55	-1.4	-1.8	-2.2	-5.2	-5.6	-6.0	-7.1	-7.5	-7.9
50	-0.2	-0.6	-1.1	-3.6	-4.0	-4.4	-5.1	-5.5	-5.9
45	0.0	0.0	0.0	-1.7	-2.1	-2.5	-2.8	-3.2	-3.6
40	0.0	0.0	0.0	0.0	0.0	-0.4	-0.3	-0.8	-1.2

V1(MCG) Limit Weight (1000 KG)

ADJUSTED FIELD LENGTH (M)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
1600	43.9								
1800	68.6	40.0							
2000	91.5	65.0	36.1						
2200		88.1	61.4						
2400			84.7	44.4					
2600				65.2	38.2				
2800				86.1	58.9	32.0			
3000					79.8	52.7			
3200						73.5			
3400						94.5			
3600							34.8		
3800							49.9		
4000							65.3	38.6	
4200							81.1	53.7	
4400							97.3	69.2	42.3
4600								85.1	57.6
4800									73.2
5000									89.2

1. **Enter Weight Adjustment table with reported braking action and dry field/obstacle limit weight to obtain slippery runway weight adjustment.**
2. **Adjust "Good" field length available by -45 m/+45 m for every 5°C above/below 4°C.
Adjust "Medium" field length available by -45 m/+45 m for every 5°C above/below 4°C.
Adjust "Poor" field length available by -65 m/+65 m for every 5°C above/below 4°C.**
3. **Find V1(MCG) limit weight for adjusted field length and pressure altitude.**
4. **Max allowable slippery runway limited weight is lesser of weights from 1 and 3.**

ADVISORY INFORMATION

Slippery Runway Takeoff
No Reverse Thrust
V1 Adjustment (KIAS)

WEIGHT (1000 KG)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
90	-9	-1	0	-22	-14	-7	-40	-33	-25
85	-9	-1	0	-23	-15	-8	-43	-35	-28
80	-9	-2	0	-24	-16	-9	-46	-38	-31
75	-10	-3	0	-26	-18	-11	-49	-42	-34
70	-12	-4	0	-28	-21	-13	-52	-45	-37
65	-14	-7	0	-32	-24	-17	-56	-48	-41
60	-17	-10	-2	-36	-28	-21	-59	-52	-44
55	-21	-13	-6	-41	-33	-26	-63	-56	-48
50	-25	-18	-10	-46	-39	-31	-67	-59	-52
45	-30	-23	-15	-52	-45	-37	-71	-63	-56
40	-36	-29	-21	-59	-52	-44	-75	-67	-60

1. **Obtain V1, VR and V2 for the actual weight using the Dry Runway Takeoff Speeds table.**
2. **If V1(MCG) limited, set V1 = V1(MCG). If not V1(MCG) limited, enter V1 Adjustment table with the actual weight to obtain V1 speed adjustment. If adjusted V1 is less than V1(MCG), set V1 = V1(MCG). V1 not to exceed VR.**

Takeoff %N1

Based on engine bleeds for packs on, engine and wing anti-ice on or off

OAT (°C)	AIRPORT PRESSURE ALTITUDE (FT)												
	-2000	-1000	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
60	94.8	95.4	95.8	95.9	96.0	96.1	96.2	96.3	96.2	95.9	95.8	95.7	95.7
55	95.4	96.0	96.5	96.6	96.7	96.8	96.9	97.1	96.9	96.6	96.3	95.7	95.0
50	96.0	96.6	97.1	97.3	97.4	97.6	97.7	97.8	97.7	97.4	97.1	96.6	96.1
45	96.8	97.4	97.8	98.0	98.1	98.3	98.4	98.5	98.4	98.1	97.8	97.5	97.1
40	97.4	98.1	98.6	98.7	98.8	98.9	99.0	99.2	99.1	98.8	98.5	98.4	98.1
35	98.0	98.7	99.4	99.5	99.6	99.7	99.8	99.9	99.8	99.5	99.2	99.1	99.0
30	97.6	98.8	100.3	100.3	100.4	100.4	100.5	100.5	100.4	100.3	100.0	99.9	99.9
25	96.8	98.1	99.5	100.1	100.7	100.8	100.7	100.7	100.7	100.7	100.6	100.6	100.7
20	96.0	97.3	98.8	99.3	99.9	100.2	100.5	100.8	100.8	100.9	100.8	100.8	100.8
15	95.2	96.5	98.0	98.6	99.2	99.5	99.8	100.1	100.5	100.9	101.1	101.1	101.1
10	94.5	95.8	97.2	97.8	98.4	98.7	99.0	99.4	99.7	100.1	100.5	101.0	101.5
5	93.7	95.0	96.4	97.0	97.6	98.0	98.3	98.6	99.0	99.4	99.8	100.3	100.7
0	92.9	94.2	95.6	96.3	96.9	97.2	97.5	97.9	98.2	98.6	99.0	99.5	100.0
-5	92.0	93.4	94.8	95.5	96.1	96.4	96.7	97.1	97.5	97.9	98.3	98.7	99.2
-10	91.2	92.6	94.0	94.7	95.3	95.6	96.0	96.3	96.7	97.1	97.5	98.0	98.4
-15	90.4	91.7	93.2	93.9	94.5	94.8	95.2	95.6	95.9	96.3	96.7	97.2	97.6
-20	89.6	90.9	92.4	93.0	93.7	94.0	94.4	94.8	95.2	95.6	95.9	96.4	96.8
-25	88.7	90.1	91.6	92.2	92.9	93.2	93.6	94.0	94.4	94.8	95.2	95.6	96.0
-30	87.9	89.2	90.7	91.4	92.0	92.4	92.8	93.2	93.6	94.0	94.3	94.8	95.2
-35	87.0	88.4	89.9	90.5	91.2	91.6	91.9	92.4	92.8	93.1	93.5	94.0	94.4
-40	86.1	87.5	89.0	89.7	90.3	90.7	91.1	91.5	91.9	92.3	92.7	93.1	93.6
-45	85.3	86.6	88.2	88.8	89.5	89.9	90.3	90.7	91.1	91.5	91.9	92.3	92.7
-50	84.4	85.7	87.3	87.9	88.6	89.0	89.4	89.9	90.3	90.6	91.0	91.5	91.9

%N1 Adjustments for Engine Bleeds

BLEED CONFIGURATION	AIRPORT PRESSURE ALTITUDE (FT)												
	-2000	-1000	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
PACKS OFF	0.7	0.7	0.7	0.7	0.7	0.7	0.8	0.8	0.8	0.8	0.8	0.9	1.0

Assumed Temperature Reduced Thrust

Maximum Assumed Temperature (Table 1 of 3)

Based on 25% Takeoff Thrust Reduction

OAT (°C)	AIRPORT PRESSURE ALTITUDE (FT)											
	-1000	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
55	73	71	69	67								
50	73	71	69	67	65	63						
45	73	71	69	67	65	63	61	59	57			
40	73	71	69	67	65	63	61	59	57	55		
35	71	71	69	67	65	63	61	59	57	55	53	
30	69	67	67	67	65	63	61	59	57	55	53	51
25	69	67	66	64	65	63	61	59	57	55	53	51
20	69	67	66	64	64	63	61	59	57	55	53	51
15	69	67	66	64	64	63	61	59	57	55	53	51
10 & BELOW	69	67	66	64	64	63	61	59	57	55	53	51

Takeoff %N1 (Table 2 of 3)

Based on engine bleed for packs on, engine and wing anti-ice on or off

ASSUMED TEMP (°C)	AIRPORT PRESSURE ALTITUDE (FT)											
	-1000	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
75	93.4	93.7	94.2	94.7	95.4	96.1	96.9	97.3	97.6	97.8	97.8	97.7
70	94.1	94.4	94.4	94.4	94.7	95.4	96.2	96.6	96.9	97.1	97.1	97.1
65	94.8	95.1	95.2	95.2	95.3	95.4	95.5	96.0	96.2	96.5	96.4	96.4
60	95.4	95.8	95.9	96.0	96.1	96.2	96.3	96.2	95.9	95.8	95.7	95.7
55	96.0	96.5	96.6	96.7	96.8	96.9	97.1	96.9	96.6	96.3	95.7	95.0
50	96.6	97.1	97.3	97.4	97.6	97.7	97.8	97.7	97.4	97.1	96.6	96.1
45	97.4	97.8	98.0	98.1	98.3	98.4	98.5	98.4	98.1	97.8	97.5	97.1
40	98.1	98.6	98.7	98.8	98.9	99.0	99.2	99.1	98.8	98.5	98.4	98.1
35	98.7	99.4	99.5	99.6	99.7	99.8	99.9	99.8	99.5	99.2	99.1	99.0
30	98.8	100.3	100.3	100.4	100.4	100.5	100.5	100.4	100.3	100.0	99.9	99.9
25	98.1	99.5	100.1	100.7	100.8	100.7	100.7	100.7	100.7	100.6	100.6	100.7
20	97.3	98.8	99.3	99.9	100.2	100.5	100.8	100.8	100.9	100.8	100.8	100.8
15	96.5	98.0	98.6	99.2	99.5	99.8	100.1	100.5	100.9	101.1	101.1	101.1
10	95.8	97.2	97.8	98.4	98.7	99.0	99.4	99.7	100.1	100.5	101.0	101.5
MINIMUM ASSUMED TEMP (°C)	32	30	28	26	24	22	20	18	16	15	12	10

With engine bleed for packs off, increase %N1 by 1.0.

Assumed Temperature Reduced Thrust

%N1 Adjustment for Temperature Difference (Table 3 of 3)

ASSUMED TEMP MINUS OAT (°C)	OUTSIDE AIR TEMPERATURE (°C)													
	-40	-20	0	5	10	15	20	25	30	35	40	45	50	55
110	14.9													
100	14.9	10.9												
90	14.0	11.7												
80	12.9	11.6	7.8											
70	11.2	10.7	8.6	7.8	6.3									
60	9.2	9.5	8.5	8.4	7.1	6.3	4.9							
50	7.8	7.8	7.5	7.1	6.9	7.0	5.6	4.9	3.4					
40		6.0	6.2	6.1	5.9	5.8	5.7	5.6	4.7	4.4	5.3			
30		4.6	4.6	4.6	4.6	4.5	4.4	4.3	4.3	4.2	4.1	4.0	3.9	
20			2.9	3.0	3.0	3.0	3.0	3.0	2.9	2.9	2.8	2.8	2.7	2.6
10			1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.4	1.4	1.4	1.4
0			0	0	0	0	0	0	0	0	0	0	0	0

1. **Determine Maximum Assumed Temperature allowed from Table 1.**
2. **Find Maximum %N1 from Table 2 using the desired assumed temperature (no greater than temperature from Table 1).**
3. **Use the difference between assumed temperature and OAT to determine the %N1 adjustment from Table 3.**
4. **Subtract %N1 adjustment from Maximum %N1 in Table 2.**

Takeoff Speeds - Dry Runway (24K Derate)
Flaps 1 and 5
V1, VR, V2

WEIGHT (1000 KG)	FLAPS 1			FLAPS 5		
	V1	VR	V2	V1	VR	V2
72	143	145	151	140	142	147
68	138	140	147	135	137	143
64	133	135	143	130	132	139
60	128	130	138	125	127	135
56	122	124	133	119	122	130
52	116	118	129	113	116	126
48	110	112	123	108	110	121
44	104	106	118	101	104	115
40	97	100	113	94	97	110

Check V1(MCG).

V1, VR, V2 Adjustments*

TEMP		V1							VR							V2						
		PRESS ALT (1000 FT)							PRESS ALT (1000 FT)							PRESS ALT (1000 FT)						
°C	°F	-2	0	2	4	6	8	10	-2	0	2	4	6	8	10	-2	0	2	4	6	8	10
70	158	7	8						5	6						-1	-1					
60	140	5	6	7	9				4	5	6	7				-1	-1	-1	-2			
50	122	3	4	5	7	8	10	11	2	3	5	6	7	8	10	-1	-1	-1	-1	-1	-1	-2
40	104	1	2	4	5	7	8	10	1	2	3	5	6	7	9	0	0	0	0	-1	-1	-1
30	86	0	0	2	3	5	7	8	0	0	2	3	5	6	8	0	0	0	0	0	0	0
20	68	0	0	1	2	3	5	7	0	0	1	2	3	5	6	0	0	0	0	1	0	0
-60	-76	0	0	1	2	3	4	5	0	0	1	2	3	4	5	0	0	0	0	1	1	1

Slope and Wind V1 Adjustments*

WEIGHT (1000 KG)	SLOPE (%)					WIND (KTS)							
	-2	-1	0	1	2	-15	-10	-5	0	10	20	30	40
84	-3	-1	0	1	2	-2	-1	-1	0	0	1	1	1
76	-2	-1	0	1	1	-2	-1	0	0	0	1	1	1
68	-2	-1	0	1	1	-1	-1	0	0	0	1	1	1
60	-2	-1	0	1	1	-1	-1	0	0	0	1	1	1
52	-1	0	0	1	1	-1	-1	0	0	0	1	1	1
44	-1	0	0	1	1	-2	-1	0	0	1	1	1	2
40	-1	0	0	1	2	-2	-1	0	0	1	1	2	2

***V1 not to exceed VR.**

V1(MCG)

TEMP		PRESSURE ALTITUDE (FT)						
°C	°F	-2000	0	2000	4000	6000	8000	10000
70	158	102	99					
60	140	102	99	97	96			
50	122	104	101	98	96	94	92	90
40	104	109	106	102	99	95	92	90
30	86	112	111	107	103	99	95	92
20	68	112	112	109	107	103	99	96
-60	-76	114	113	110	108	105	102	100

Takeoff Speeds - Dry Runway (24K Derate)
Flaps 10, 15 and 25
V1, VR, V2

WEIGHT (1000 KG)	FLAPS 10			FLAPS 15			FLAPS 25		
	V1	VR	V2	V1	VR	V2	V1	VR	V2
76	138	138	144	135	135	140			
72	134	135	140	132	132	138	130	130	136
68	129	131	137	128	128	134	126	126	133
64	125	126	134	124	124	131	122	122	130
60	120	122	130	119	119	127	117	118	126
56	115	117	126	114	115	123	112	113	122
52	110	112	122	109	110	119	107	108	118
48	105	106	117	104	105	115	102	103	114
44	99	101	113	98	99	111	97	98	110
40	93	95	108	92	94	106	91	93	105

Check V1(MCG).

V1, VR, V2 Adjustments*

TEMP		V1							VR							V2						
		PRESS ALT (1000 FT)							PRESS ALT (1000 FT)							PRESS ALT (1000 FT)						
°C	°F	-2	0	2	4	6	8	10	-2	0	2	4	6	8	10	-2	0	2	4	6	8	10
70	158	6	6						4	5						-2	-2					
60	140	4	5	6	7				3	4	5	6				-2	-2	-2	-3			
50	122	3	3	4	6	7	8	10	2	3	4	5	5	6	8	-1	-1	-2	-2	-3	-3	-4
40	104	1	2	3	4	5	6	8	1	1	3	3	4	5	6	0	-1	-1	-2	-2	-3	-3
30	86	0	0	1	2	4	5	6	0	0	1	2	3	4	5	0	0	0	-1	-1	-2	-2
20	68	0	0	1	1	2	4	5	0	0	1	1	2	3	4	0	0	0	0	-1	-1	-2
-60	-76	0	0	1	1	2	3	4	0	0	1	1	2	3	4	0	0	0	0	-1	-1	-1

Slope and Wind V1 Adjustments*

WEIGHT (1000 KG)	SLOPE (%)					WIND (KTS)							
	-2	-1	0	1	2	-15	-10	-5	0	10	20	30	40
76	-3	-1	0	1	1	-2	-1	-1	0	0	1	1	1
68	-2	-1	0	1	1	-2	-1	-1	0	0	1	1	1
60	-2	-1	0	1	1	-2	-1	-1	0	0	1	1	1
52	-2	-1	0	1	1	-2	-1	-1	0	0	1	1	1
44	-1	-1	0	1	1	-2	-2	-1	0	0	1	1	1
40	-1	-1	0	0	1	-2	-2	-1	0	0	1	1	1

***V1 not to exceed VR.**

V1(MCG)

TEMP		PRESSURE ALTITUDE (FT)						
°C	°F	-2000	0	2000	4000	6000	8000	10000
70	158	102	99					
60	140	102	99	97	96			
50	122	104	101	98	96	94	92	90
40	104	109	106	102	99	95	92	90
30	86	112	111	107	103	99	95	92
20	68	112	112	109	107	103	99	96
-60	-76	114	113	110	108	105	102	100

Takeoff Speeds - Wet Runway (24K Derate)
Flaps 1 and 5
V1, VR, V2

WEIGHT (1000 KG)	FLAPS 1			FLAPS 5		
	V1	VR	V2	V1	VR	V2
80	146	154	158	142	150	155
76	141	149	154	137	146	151
72	136	145	151	133	142	147
68	131	140	147	128	137	144
64	126	135	143	123	132	140
60	120	130	138	117	127	135
56	114	124	133	111	122	131
52	108	118	129	105	116	126
48	101	112	123	99	110	121
44	94	106	118	92	104	115
40	88	100	113	85	97	110

Check V1(MCG).

V1, VR, V2 Adjustment*

TEMP		V1							VR							V2						
		PRESS ALT (1000 FT)							PRESS ALT (1000 FT)							PRESS ALT (1000 FT)						
°C	°F	-2	0	2	4	6	8	10	-2	0	2	4	6	8	10	-2	0	2	4	6	8	10
70	158	9	11						5	6						-1	-1					
60	140	7	8	10	11				4	5	6	7				-1	-1	-1	-2			
50	122	4	5	7	9	11	13	15	2	3	5	6	7	8	10	-1	-1	-1	-1	-1	-1	-2
40	104	1	3	5	7	9	10	13	1	2	3	5	6	7	9	0	0	0	-1	-1	-1	-1
30	86	0	0	2	4	6	8	10	0	0	2	3	5	6	8	0	0	0	0	0	0	0
20	68	0	0	1	2	4	6	8	0	0	1	2	3	5	6	0	0	0	0	1	0	0
-60	-76	0	0	1	2	4	5	6	0	0	1	2	3	4	5	0	0	0	0	1	1	1

Slope and Wind V1 Adjustment*

WEIGHT (1000 KG)	SLOPE (%)					WIND (KTS)							
	-2	-1	0	1	2	-15	-10	-5	0	10	20	30	40
80	-4	-2	0	3	5	-3	-2	-1	0	1	1	2	3
72	-4	-2	0	2	4	-3	-2	-1	0	1	1	2	2
64	-4	-2	0	2	4	-4	-2	-1	0	1	1	2	3
56	-3	-2	0	2	3	-4	-2	-1	0	1	2	2	3
48	-2	-1	0	2	3	-4	-2	-1	0	1	2	3	4
40	-1	0	0	2	3	-4	-2	-1	0	1	3	4	5

***V1 not to exceed VR.**

V1(MCG)

TEMP		PRESSURE ALTITUDE (FT)						
°C	°F	-2000	0	2000	4000	6000	8000	10000
70	158	102	99					
60	140	102	99	97	96			
50	122	104	101	98	96	94	92	90
40	104	109	106	102	99	95	92	90
30	86	112	111	107	103	99	95	92
20	68	112	112	109	107	103	99	96
-60	-76	114	113	110	108	105	102	100

Takeoff Speeds - Wet Runway (24K Derate)
Flaps 10, 15 and 25
V1, VR, V2

WEIGHT (1000 KG)	FLAPS 10			FLAPS 15			FLAPS 25		
	V1	VR	V2	V1	VR	V2	V1	VR	V2
76	132	138	144	132	135	140			
72	127	135	140	127	132	138	125	130	136
68	123	131	137	122	128	134	121	126	133
64	118	126	134	118	124	131	116	122	130
60	113	122	130	112	119	127	111	118	126
56	107	117	126	107	115	123	105	113	122
52	102	112	122	101	110	119	100	108	118
48	96	106	117	95	105	115	94	103	114
44	91	101	113	90	99	111	89	98	110
40	85	95	108	84	94	106	83	93	105

Check V1(MCG).

V1, VR, V2 Adjustment*

TEMP		V1							VR							V2						
		PRESS ALT (1000 FT)							PRESS ALT (1000 FT)							PRESS ALT (1000 FT)						
°C	°F	-2	0	2	4	6	8	10	-2	0	2	4	6	8	10	-2	0	2	4	6	8	10
70	158	8	9						4	5						-2	-2					
60	140	6	7	8	10				3	4	5	6				-2	-2	-2	-3			
50	122	4	4	6	8	9	11	14	2	3	4	5	5	6	8	-1	-1	-2	-2	-3	-3	-4
40	104	1	2	4	5	7	9	11	1	1	3	3	4	5	6	0	-1	-1	-2	-2	-3	-3
30	86	0	0	2	3	5	6	8	0	0	1	2	3	4	5	0	0	0	-1	-1	-2	-2
20	68	0	0	1	2	3	5	6	0	0	1	1	2	3	4	0	0	0	0	-1	-1	-2
-60	-76	0	0	1	2	3	4	5	0	0	1	1	2	3	4	0	0	0	0	-1	-1	-1

Slope and Wind V1 Adjustment*

WEIGHT (1000 KG)	SLOPE (%)					WIND (KTS)							
	-2	-1	0	1	2	-15	-10	-5	0	10	20	30	40
76	-4	-2	0	2	4	-4	-2	-1	0	1	1	2	2
72	-4	-2	0	2	4	-4	-2	-1	0	1	1	2	2
64	-3	-2	0	2	3	-4	-2	-1	0	1	1	2	3
56	-3	-2	0	1	3	-4	-3	-1	0	1	1	2	3
48	-2	-1	0	1	2	-4	-3	-1	0	1	2	3	3
40	-2	-1	0	1	2	-5	-3	-1	0	1	2	3	4

***V1 not to exceed VR.**

V1(MCG)

TEMP		PRESSURE ALTITUDE (FT)						
°C	°F	-2000	0	2000	4000	6000	8000	10000
70	158	102	99					
60	140	102	99	97	96			
50	122	104	101	98	96	94	92	90
40	104	109	106	102	99	95	92	90
30	86	112	111	107	103	99	95	92
20	68	112	112	109	107	103	99	96
-60	-76	114	113	110	108	105	102	100

Stab Trim Setting (24K Derate)

Flaps 1 and 5

WEIGHT (1000 KG)	C.G. (%MAC)									
	9	11	13	16	20	24	26	28	30	33
80	8 1/2	8 1/2	8 1/2	7 3/4	6 3/4	6	5 1/2	5 1/4	4 3/4	4 1/4
70	8 1/2	8 1/2	8 1/4	7 1/2	6 3/4	6	5 1/2	5	4 3/4	4
60	8 1/2	8 1/4	7 3/4	7	6 1/4	5 1/2	5	4 1/2	4 1/4	4
50	7 3/4	7 1/4	6 3/4	6	5 1/4	4 1/2	4 1/4	4	4	4
45	6 3/4	6 1/2	6	5 1/2	4 3/4	4 1/4	4	4	4	4

Flaps 10, 15 and 25

WEIGHT (1000 KG)	C.G. (%MAC)									
	9	11	13	16	20	23	26	28	31	33
80	8 1/2	8 1/2	8 1/4	7 1/4	6 1/2	5 3/4	5	4 3/4	4	4
70	8 1/2	8 1/2	8 1/4	7	6 1/4	5 1/2	5	4 1/2	4	4
60	8 1/2	8 1/4	7 1/2	6 1/2	5 3/4	5	4 1/2	4	4	4
50	7 1/2	7	6 1/2	5 1/2	4 3/4	4 1/4	4	4	4	4
45	6 1/4	6	5 1/2	5	4 1/2	4	4	4	4	4

ADVISORY INFORMATION

Slush/Standing Water Takeoff (24K Derate)

Maximum Reverse Thrust

Weight Adjustments (1000 KG)

24K DERATE DRY FIELD/OBSTACLE LIMIT WEIGHT (1000 KG)	SLUSH/STANDING WATER DEPTH								
	3 mm (0.12 INCHES)			6 mm (0.25 INCHES)			13 mm (0.50 INCHES)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
90	-12.1	-14.8	-17.5	-14.7	-17.4	-20.1	-20.2	-22.9	-25.6
85	-10.7	-13.4	-16.1	-12.8	-15.6	-18.3	-17.4	-20.2	-22.9
80	-9.4	-12.1	-14.8	-11.2	-13.9	-16.6	-14.9	-17.6	-20.3
75	-8.2	-10.9	-13.7	-9.6	-12.4	-15.1	-12.6	-15.4	-18.1
70	-7.2	-9.9	-12.6	-8.3	-11.0	-13.7	-10.7	-13.4	-16.1
65	-6.2	-9.0	-11.7	-7.1	-9.8	-12.6	-9.0	-11.7	-14.5
60	-5.4	-8.2	-10.9	-6.1	-8.8	-11.6	-7.6	-10.4	-13.1
55	-4.8	-7.5	-10.2	-5.3	-8.0	-10.7	-6.5	-9.3	-12.0
50	-4.2	-6.9	-9.6	-4.6	-7.3	-10.0	-5.7	-8.4	-11.1
45	-3.6	-6.3	-9.0	-3.9	-6.7	-9.4	-4.9	-7.6	-10.3
40	-3.0	-5.8	-8.5	-3.3	-6.0	-8.7	-4.0	-6.7	-9.5

V1(MCG) Limit Weight (1000 KG)

ADJUSTED FIELD LENGTH (M)	SLUSH/STANDING WATER DEPTH								
	3 mm (0.12 INCHES)			6 mm (0.25 INCHES)			13 mm (0.50 INCHES)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
1400							34.9		
1600	39.5			42.7			47.8		
1800	53.3	32.4		56.4	35.6		61.2	40.9	
2000	67.6	46.0		70.5	49.1		75.2	54.1	34.2
2200	82.4	60.0	38.8	85.2	63.0	42.0	89.9	67.7	47.1
2400	97.6	74.5	52.6		77.4	55.7		82.1	60.5
2600		89.6	66.8		92.3	69.8		97.0	74.5
2800			81.6			84.4			89.1
3000			96.8			99.4			

1. **Enter Weight Adjustment table with slush/standing water depth and 24K Derate dry field/obstacle limit weight to obtain slush/standing water weight adjustment.**
2. **Adjust field length available by -40 m/+35 m for every 5°C above/below 4°C.**
3. **Find V1(MCG) limit weight for adjusted field length and pressure altitude.**
4. **Max allowable slush/standing water limited weight is lesser of weights from 1 and 3.**

ADVISORY INFORMATION

Slush/Standing Water Takeoff (24K Derate)
Maximum Reverse Thrust
V1 Adjustment (KIAS)

WEIGHT (1000 KG)	SLUSH/STANDING WATER DEPTH								
	3 mm (0.12 INCHES)			6 mm (0.25 INCHES)			13 mm (0.50 INCHES)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
90	-12	-7	-2	-4	0	0	0	0	0
85	-13	-8	-3	-6	-1	0	0	0	0
80	-15	-10	-5	-9	-4	0	0	0	0
75	-16	-11	-6	-11	-6	-1	-2	0	0
70	-17	-12	-7	-13	-8	-3	-4	0	0
65	-19	-14	-9	-15	-10	-5	-6	-1	0
60	-20	-15	-10	-16	-11	-6	-9	-4	0
55	-20	-15	-10	-18	-13	-8	-12	-7	-2
50	-21	-16	-11	-19	-14	-9	-15	-10	-5
45	-23	-18	-13	-21	-16	-11	-17	-12	-7
40	-25	-20	-15	-23	-18	-13	-19	-14	-9

1. **Obtain V1, VR and V2 for the actual weight using the 24K Derate Dry Runway Takeoff Speeds table.**
2. **If V1(MCG) limited, set V1 = V1(MCG). If not V1(MCG) limited, enter V1 Adjustment table with the actual weight to obtain V1 speed adjustment. If adjusted V1 is less than V1(MCG), set V1 = V1(MCG). V1 not to exceed VR.**

ADVISORY INFORMATION

Slush/Standing Water Takeoff (24K Derate)

No Reverse Thrust

Weight Adjustments (1000 KG)

24K DERATE DRY FIELD/OBSTACLE LIMIT WEIGHT (1000 KG)	SLUSH/STANDING WATER DEPTH								
	3 mm (0.12 INCHES)			6 mm (0.25 INCHES)			13 mm (0.50 INCHES)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
90	-15.1	-18.3	-21.5	-17.8	-21.0	-24.1	-23.3	-26.5	-29.6
85	-13.7	-16.9	-20.0	-15.9	-19.1	-22.3	-20.6	-23.7	-26.9
80	-12.3	-15.5	-18.7	-14.2	-17.3	-20.5	-18.0	-21.1	-24.3
75	-11.1	-14.3	-17.4	-12.5	-15.7	-18.9	-15.6	-18.8	-22.0
70	-9.9	-13.1	-16.3	-11.1	-14.3	-17.4	-13.5	-16.7	-19.9
65	-8.9	-12.1	-15.3	-9.8	-13.0	-16.1	-11.7	-14.9	-18.1
60	-8.0	-11.1	-14.3	-8.7	-11.8	-15.0	-10.2	-13.4	-16.5
55	-7.1	-10.3	-13.5	-7.7	-10.8	-14.0	-8.9	-12.1	-15.2
50	-6.4	-9.6	-12.7	-6.8	-10.0	-13.2	-7.9	-11.0	-14.2
45	-5.8	-8.9	-12.1	-6.2	-9.3	-12.5	-7.1	-10.3	-13.5
40	-5.2	-8.4	-11.6	-5.7	-8.8	-12.0	-6.6	-9.8	-12.9

V1(MCG) Limit Weight (1000 KG)

ADJUSTED FIELD LENGTH (M)	SLUSH/STANDING WATER DEPTH								
	3 mm (0.12 INCHES)			6 mm (0.25 INCHES)			13 mm (0.50 INCHES)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
2000							38.5		
2200				35.3			53.2		
2400	39.7			51.9			68.6	44.3	
2600	57.1			69.3	41.9		85.1	59.3	35.6
2800	76.4	46.5		87.7	58.7	32.0		75.1	50.2
3000	97.7	64.6	36.3		76.5	48.5		92.0	65.5
3200		84.7	53.5		95.2	65.7			81.7
3400			72.4			83.9			98.8
3600			93.4						

1. **Enter Weight Adjustment table with slush/standing water depth and 24K Derate dry field/obstacle limit weight to obtain slush/standing water weight adjustment.**
2. **Adjust field length available by -50 m/+50 m for every 5°C above/below 4°C.**
3. **Find V1(MCG) limit weight for adjusted field length and pressure altitude.**
4. **Max allowable slush/standing water limited weight is lesser of weights from 1 and 3.**

ADVISORY INFORMATION

Slush/Standing Water Takeoff (24K Derate)

No Reverse Thrust

V1 Adjustment (KIAS)

WEIGHT (1000 KG)	SLUSH/STANDING WATER DEPTH								
	3 mm (0.12 INCHES)			6 mm (0.25 INCHES)			13 mm (0.50 INCHES)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
90	-20	-13	-5	-8	0	0	0	0	0
85	-22	-15	-7	-11	-4	0	0	0	0
80	-24	-17	-9	-15	-8	0	0	0	0
75	-26	-19	-11	-19	-11	-4	0	0	0
70	-28	-21	-13	-22	-14	-7	-3	0	0
65	-30	-22	-15	-25	-17	-10	-10	-3	0
60	-32	-24	-17	-27	-20	-12	-16	-9	-1
55	-33	-26	-18	-30	-22	-15	-22	-14	-7
50	-35	-27	-20	-32	-25	-17	-26	-18	-11
45	-36	-29	-21	-34	-27	-19	-29	-22	-14
40	-38	-30	-23	-36	-29	-21	-32	-25	-17

1. **Obtain V1, VR and V2 for the actual weight using the 24K Derate Dry Runway Takeoff Speeds table.**
2. **If V1(MCG) limited, set V1 = V1(MCG). If not V1(MCG) limited, enter V1 Adjustment table with the actual weight to obtain V1 speed adjustment. If adjusted V1 is less than V1(MCG), set V1 = V1(MCG). V1 not to exceed VR.**

ADVISORY INFORMATION

Slippery Runway Takeoff (24K Derate)
Maximum Reverse Thrust
Weight Adjustment (1000 KG)

24K DERATE DRY FIELD/OBSTACLE LIMIT WEIGHT (1000 KG)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
90	-1.3	-1.3	-1.3	-6.8	-6.8	-6.8	-11.6	-11.6	-11.6
85	-1.4	-1.4	-1.4	-6.4	-6.4	-6.4	-10.7	-10.7	-10.7
80	-1.4	-1.4	-1.4	-6.0	-6.0	-6.0	-9.9	-9.9	-9.9
75	-1.4	-1.4	-1.4	-5.6	-5.6	-5.6	-9.2	-9.2	-9.2
70	-1.4	-1.4	-1.4	-5.3	-5.3	-5.3	-8.4	-8.4	-8.4
65	-1.4	-1.4	-1.4	-4.9	-4.9	-4.9	-7.8	-7.8	-7.8
60	-1.3	-1.3	-1.3	-4.6	-4.6	-4.6	-7.2	-7.2	-7.2
55	-1.3	-1.3	-1.3	-4.2	-4.2	-4.2	-6.6	-6.6	-6.6
50	-1.2	-1.2	-1.2	-3.9	-3.9	-3.9	-6.0	-6.0	-6.0
45	-1.1	-1.1	-1.1	-3.6	-3.6	-3.6	-5.5	-5.5	-5.5
40	-1.1	-1.1	-1.1	-3.2	-3.2	-3.2	-4.9	-4.9	-4.9

V1(MCG) Limit Weight (1000 KG)

ADJUSTED FIELD LENGTH (M)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
1200	46.0								
1400	67.8	49.5	31.6	30.8					
1600	90.2	71.4	53.1	46.6					
1800		93.9	75.0	63.1	43.1		30.1		
2000			97.5	80.8	59.4	39.6	40.9		
2200				99.5	76.8	55.7	52.0	32.8	
2400					95.3	72.8	63.6	43.6	
2600						91.2	75.9	54.8	35.4
2800							88.9	66.6	46.3
3000								79.0	57.7
3200								92.3	69.6
3400									82.2
3600									95.6

1. **Enter Weight Adjustment table with reported braking action and 24K Derate dry field/obstacle limit weight to obtain slippery runway weight adjustment.**
2. **Adjust "Good" field length available by -30 m/+25 m for every 5°C above/below 4°C.**
   Adjust "Medium" field length available by -30 m/+25 m for every 5°C above/below 4°C.
   Adjust "Poor" field length available by -45 m/+40 m for every 5°C above/below 4°C.
3. **Find V1(MCG) limit weight for adjusted field length and pressure altitude.**
4. **Max allowable slippery runway limited weight is lesser of weights from 1 and 3.**

ADVISORY INFORMATION

Slippery Runway Takeoff (24K Derate)
Maximum Reverse Thrust
V1 Adjustment (KIAS)

WEIGHT (1000 KG)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
90	-4	-1	0	-12	-9	-7	-22	-19	-17
85	-5	-2	0	-13	-10	-8	-24	-21	-19
80	-5	-3	0	-14	-12	-9	-25	-23	-20
75	-6	-4	-1	-16	-13	-11	-27	-25	-22
70	-7	-5	-2	-17	-14	-12	-29	-27	-24
65	-8	-6	-3	-18	-16	-13	-31	-28	-26
60	-9	-7	-4	-20	-17	-15	-33	-30	-28
55	-10	-8	-5	-21	-19	-16	-34	-32	-29
50	-11	-9	-6	-23	-20	-18	-36	-34	-31
45	-12	-10	-7	-24	-22	-19	-38	-35	-33
40	-13	-11	-8	-26	-23	-21	-39	-37	-34

1. **Obtain V1, VR and V2 for the actual weight using the 24K Derate Dry Runway Takeoff Speeds table.**
2. **If V1(MCG) limited, set V1 = V1(MCG). If not V1(MCG) limited, enter V1 Adjustment table with the actual weight to obtain V1 speed adjustment. If adjusted V1 is less than V1(MCG), set V1 = V1(MCG). V1 not to exceed VR.**

ADVISORY INFORMATION

Slippery Runway Takeoff (24K Derate)

No Reverse Thrust

Weight Adjustments (1000 KG)

24K DERATE DRY FIELD/OBSTACLE LIMIT WEIGHT (1000 KG)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
90	-2.0	-2.4	-2.8	-8.6	-8.9	-9.3	-14.4	-14.8	-15.2
85	-2.3	-2.7	-3.1	-8.4	-8.8	-9.2	-13.8	-14.1	-14.5
80	-2.6	-3.0	-3.3	-8.3	-8.7	-9.1	-13.1	-13.4	-13.8
75	-2.8	-3.1	-3.5	-8.1	-8.5	-8.9	-12.3	-12.7	-13.1
70	-2.8	-3.2	-3.6	-7.8	-8.2	-8.6	-11.5	-11.9	-12.2
65	-2.9	-3.2	-3.6	-7.5	-7.8	-8.2	-10.6	-11.0	-11.4
60	-2.8	-3.2	-3.5	-7.0	-7.4	-7.8	-9.6	-10.0	-10.4
55	-2.6	-3.0	-3.4	-6.4	-6.8	-7.2	-8.6	-9.0	-9.4
50	-2.4	-2.7	-3.1	-5.8	-6.2	-6.6	-7.6	-7.9	-8.3
45	-2.0	-2.4	-2.8	-5.1	-5.5	-5.9	-6.4	-6.8	-7.2
40	-1.6	-2.0	-2.4	-4.3	-4.7	-5.1	-5.2	-5.6	-6.0

V1(MCG) Limit Weight (1000 KG)

ADJUSTED FIELD LENGTH (M)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
1400	43.0								
1600	73.6	37.9							
1800		69.3	32.7						
2000		96.2	65.0						
2200			92.3	55.0					
2400				81.8	44.2				
2600					72.0	33.3			
2800					97.9	61.9			
3000						88.3			
3200							30.0		
3400							50.8		
3600							71.9	30.6	
3800							93.5	51.3	
4000								72.4	31.1
4200								94.0	51.8
4400									73.0
4600									94.5

1. **Enter Weight Adjustment table with reported braking action and 24K Derate dry field/obstacle limit weight to obtain slippery runway weight adjustment.**
2. **Adjust “Good” field length available by -35 m/+35 m for every 5°C above/below 4°C.**
   Adjust “Medium” field length available by -35 m/+35 m for every 5°C above/below 4°C.
   Adjust “Poor” field length available by -60 m/+60 m for every 5°C above/below 4°C.
3. **Find V1(MCG) limit weight for adjusted field length and pressure altitude.**
4. **Max allowable slippery runway limited weight is lesser of weights from 1 and 3.**

ADVISORY INFORMATION

Slippery Runway Takeoff (24K Derate)
No Reverse Thrust
V1 Adjustment (KIAS)

WEIGHT (1000 KG)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
90	-8	-3	0	-19	-14	-9	-35	-30	-25
85	-8	-3	0	-20	-15	-10	-38	-33	-28
80	-8	-3	0	-21	-16	-11	-41	-36	-31
75	-9	-4	0	-23	-18	-13	-44	-39	-34
70	-10	-5	0	-25	-20	-15	-47	-42	-37
65	-12	-7	-2	-28	-23	-18	-51	-46	-41
60	-14	-9	-4	-31	-26	-21	-55	-50	-45
55	-16	-11	-6	-34	-29	-24	-59	-54	-49
50	-19	-14	-9	-38	-33	-28	-63	-58	-53
45	-23	-18	-13	-43	-38	-33	-67	-62	-57
40	-27	-22	-17	-47	-42	-37	-72	-67	-62

1. **Obtain V1, VR and V2 for the actual weight using the 24K Derate Dry Runway Takeoff Speeds table.**
2. **If V1(MCG) limited, set V1 = V1(MCG). If not V1(MCG) limited, enter V1 Adjustment table with the actual weight to obtain V1 speed adjustment. If adjusted V1 is less than V1(MCG), set V1 = V1(MCG). V1 not to exceed VR.**

Takeoff %N1 - (24K Derate)

Based on engine bleeds for packs on, engine and wing anti-ice on or off

OAT (°C)	AIRPORT PRESSURE ALTITUDE (FT)												
	-2000	-1000	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
60	90.3	90.8	91.2	91.2	91.1	91.1	91.0	91.1	91.2	91.0	91.2	91.3	91.4
55	91.0	91.6	92.0	92.0	92.0	91.9	91.9	91.9	92.0	91.9	91.7	91.3	90.8
50	91.8	92.4	92.8	92.8	92.8	92.7	92.7	92.7	92.7	92.6	92.6	92.2	91.8
45	92.6	93.2	93.6	93.6	93.6	93.6	93.5	93.5	93.5	93.4	93.3	93.1	92.8
40	93.4	94.0	94.4	94.4	94.4	94.3	94.3	94.2	94.2	94.1	94.1	94.0	93.8
35	94.2	94.8	95.2	95.2	95.2	95.1	95.1	95.0	95.0	94.9	94.8	94.8	94.7
30	93.8	95.0	96.1	96.0	96.0	96.0	95.9	95.8	95.8	95.7	95.7	95.6	95.6
25	93.1	94.3	95.4	95.9	96.4	96.7	96.7	96.6	96.6	96.5	96.4	96.4	96.3
20	92.3	93.5	94.6	95.1	95.7	96.3	96.9	97.6	97.5	97.5	97.4	97.3	97.2
15	91.6	92.7	93.8	94.3	94.9	95.5	96.1	96.8	97.5	98.2	98.6	98.6	98.5
10	90.8	92.0	93.0	93.6	94.1	94.7	95.3	96.0	96.7	97.5	98.2	99.1	100.0
5	90.0	91.2	92.2	92.8	93.3	93.9	94.5	95.2	95.9	96.7	97.4	98.4	99.3
0	89.2	90.4	91.4	92.0	92.5	93.1	93.7	94.4	95.1	95.9	96.7	97.6	98.5
-5	88.4	89.6	90.6	91.2	91.7	92.3	92.9	93.6	94.3	95.1	95.9	96.8	97.7
-10	87.6	88.8	89.8	90.4	90.9	91.5	92.1	92.8	93.5	94.3	95.1	96.1	97.0
-15	86.8	88.0	89.0	89.5	90.0	90.6	91.3	92.0	92.7	93.5	94.3	95.3	96.2
-20	86.0	87.1	88.2	88.7	89.2	89.8	90.5	91.2	91.9	92.6	93.5	94.5	95.4
-25	85.2	86.3	87.3	87.9	88.4	89.0	89.6	90.3	91.0	91.8	92.6	93.7	94.6
-30	84.4	85.5	86.5	87.0	87.5	88.1	88.8	89.5	90.2	91.0	91.8	92.9	93.8
-35	83.5	84.6	85.6	86.2	86.6	87.3	87.9	88.6	89.3	90.1	91.0	92.1	93.0
-40	82.7	83.8	84.8	85.3	85.8	86.4	87.0	87.8	88.5	89.3	90.1	91.2	92.2
-45	81.8	82.9	83.9	84.4	84.9	85.5	86.2	86.9	87.6	88.4	89.3	90.4	91.4
-50	81.0	82.0	83.0	83.5	84.0	84.6	85.3	86.0	86.7	87.5	88.4	89.5	90.5

%N1 Adjustments for Engine Bleeds

BLEED CONFIGURATION	AIRPORT PRESSURE ALTITUDE (FT)												
	-2000	-1000	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
PACKS OFF	0.7	0.7	0.7	0.7	0.7	0.7	0.8	0.8	0.8	0.8	0.8	0.9	1.0

Assumed Temperature Reduced Thrust (24K Derate)
Maximum Assumed Temperature (Table 1 of 3)
Based on 25% Takeoff Thrust Reduction

OAT (°C)	AIRPORT PRESSURE ALTITUDE (FT)											
	-1000	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
55	73	71	69	67								
50	73	71	69	67	65	63						
45	73	71	69	67	65	63	61	59	57			
40	73	71	69	67	65	63	61	59	57	55		
35	67	67	67	67	65	63	61	59	57	55	53	
30	64	61	62	61	61	61	61	59	57	55	53	51
25	64	61	59	57	56	56	57	57	57	55	53	51
20	64	61	59	57	56	54	53	53	53	53	52	51
15	64	61	59	57	56	54	53	52	50	49	48	47
10 & BELOW	64	61	59	57	56	54	53	52	50	48	45	43

Takeoff %N1 (Table 2 of 3)
Based on engine bleed for packs on, engine and wing anti-ice on or off

ASSUMED TEMP (°C)	AIRPORT PRESSURE ALTITUDE (FT)											
	-1000	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
75	88.3	88.6	89.1	89.6	90.2	90.8	91.5	92.2	92.7	93.1	93.3	93.4
70	89.1	89.5	89.4	89.3	89.6	90.1	90.8	91.6	92.0	92.5	92.6	92.7
65	90.0	90.4	90.3	90.2	90.2	90.1	90.2	90.9	91.4	91.8	91.9	92.1
60	90.8	91.2	91.2	91.1	91.1	91.0	91.1	91.2	91.0	91.2	91.3	91.4
55	91.6	92.0	92.0	92.0	91.9	91.9	91.9	92.0	91.9	91.7	91.3	90.8
50	92.4	92.8	92.8	92.8	92.7	92.7	92.7	92.7	92.6	92.6	92.2	91.8
45	93.2	93.6	93.6	93.6	93.6	93.5	93.5	93.5	93.4	93.3	93.1	92.8
40	94.0	94.4	94.4	94.4	94.3	94.3	94.2	94.2	94.1	94.1	94.0	93.8
35	94.8	95.2	95.2	95.2	95.1	95.1	95.0	95.0	94.9	94.8	94.8	94.7
30	95.0	96.1	96.0	96.0	96.0	95.9	95.8	95.8	95.7	95.7	95.6	95.6
25	94.3	95.4	95.9	96.4	96.7	96.7	96.6	96.6	96.5	96.4	96.4	96.3
20	93.5	94.6	95.1	95.7	96.3	96.9	97.6	97.5	97.5	97.4	97.3	97.2
15	92.7	93.8	94.3	94.9	95.5	96.1	96.8	97.5	98.2	98.6	98.6	98.5
10	92.0	93.0	93.6	94.1	94.7	95.3	96.0	96.7	97.5	98.2	99.1	100.0
MINIMUM ASSUMED TEMP (°C)	32	30	28	26	24	22	20	18	16	15	12	10

With engine bleed for packs off, increase %N1 by 1.0

Assumed Temperature Reduced Thrust (24K Derate)
%N1 Adjustment for Temperature Difference (Table 3 of 3)

ASSUMED TEMP MINUS OAT (°C)	OUTSIDE AIR TEMPERATURE (°C)													
	-40	-20	0	5	10	15	20	25	30	35	40	45	50	55
110	12.1													
100	11.3	8.5												
90	11.7	8.9												
80	12.5	8.0	5.5											
70	11.3	8.4	5.9	5.6	4.0									
60	9.7	9.2	4.8	4.7	4.4	4.2	2.6							
50	7.8	7.9	5.3	3.5	3.3	3.6	3.0	2.7	1.2					
40		6.4	6.0	5.5	3.7	3.2	3.7	3.0	2.8	3.0	3.7			
30		4.6	4.6	4.6	4.5	4.3	4.2	4.0	4.1	4.0	3.9	3.8	3.7	
20			3.1	3.1	3.1	3.0	2.9	2.9	2.8	2.7	2.7	2.6	2.6	2.5
10			1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.4	1.4	1.4	1.3	1.3
0			0	0	0	0	0	0	0	0	0	0	0	0

1. **Determine Maximum Assumed Temperature allowed from Table 1.**
2. **Find Maximum %N1 from Table 2 using the desired assumed temperature (no greater than temperature from Table 1).**
3. **Use the difference between assumed temperature and OAT to determine the %N1 adjustment from Table 3.**
4. **Subtract %N1 adjustment from Maximum %N1 in Table 2.**

Takeoff Speeds - Dry Runway (22K Derate)
Flaps 1 and 5
V1, VR, V2

WEIGHT (1000 KG)	FLAPS 1			FLAPS 5		
	V1	VR	V2	V1	VR	V2
80	153	154	157	150	150	153
76	149	150	154	146	147	151
72	145	146	151	142	143	147
68	140	141	147	137	138	143
64	135	136	143	132	134	139
60	130	131	138	127	128	135
56	124	125	133	121	123	130
52	118	119	128	115	117	126
48	112	113	123	109	111	121
44	106	107	118	103	105	115
40	99	101	112	96	99	110

Check V1(MCG).

V1, VR, V2 Adjustments*

TEMP		V1							VR							V2						
		PRESS ALT (1000 FT)							PRESS ALT (1000 FT)							PRESS ALT (1000 FT)						
°C	°F	-2	0	2	4	6	8	10	-2	0	2	4	6	8	10	-2	0	2	4	6	8	10
70	158	6	7						6	6						-1	-1					
60	140	5	6	7	8				4	5	6	7				-1	-1	-1	-1			
50	122	3	4	5	6	8	9	11	3	3	5	6	7	8	10	-1	-1	-1	-1	-1	-1	-1
40	104	1	2	3	5	6	8	9	1	2	3	4	6	7	9	0	0	0	-1	-1	-1	-1
30	86	0	0	1	3	5	6	8	0	0	2	3	4	6	7	0	0	0	0	0	0	0
20	68	0	0	1	2	3	5	7	0	0	1	2	3	5	6	0	0	0	0	1	0	0
-60	-76	0	0	1	2	3	4	5	0	0	1	2	3	4	5	0	0	0	0	1	1	1

Slope and Wind V1 Adjustments*

WEIGHT (1000 KG)	SLOPE (%)					WIND (KTS)							
	-2	-1	0	1	2	-15	-10	-5	0	10	20	30	40
80	-2	-1	0	1	1	-1	-1	0	0	0	1	1	1
72	-2	-1	0	1	1	-1	-1	0	0	0	1	1	1
64	-2	-1	0	1	1	-1	-1	0	0	0	1	1	1
56	-2	-1	0	1	1	-1	-1	0	0	0	1	1	1
48	-1	0	0	1	1	-2	-1	0	0	0	1	1	1
40	0	0	0	1	1	-2	-1	0	0	1	1	1	1

***V1 not to exceed VR.**

V1(MCG)

TEMP		PRESSURE ALTITUDE (FT)						
°C	°F	-2000	0	2000	4000	6000	8000	10000
70	158	98	96					
60	140	98	96	95	93			
50	122	100	98	95	93	91	89	87
40	104	105	103	99	96	92	89	87
30	86	108	108	104	100	97	92	89
20	68	108	108	106	104	101	96	93
-60	-76	110	109	107	105	103	100	98

Takeoff Speeds - Dry Runway (22K Derate)
Flaps 10, 15 and 25
V1, VR, V2

WEIGHT (1000 KG)	FLAPS 10			FLAPS 15			FLAPS 25		
	V1	VR	V2	V1	VR	V2	V1	VR	V2
72	135	135	140	132	132	137			
68	131	131	137	129	129	134			
64	126	127	133	125	125	131	123	123	129
60	122	123	129	120	120	127	119	119	126
56	117	118	125	115	116	123	114	114	122
52	111	113	121	110	111	119	109	109	118
48	106	107	117	105	106	115	104	104	114
44	100	102	112	99	100	110	98	99	109
40	95	96	108	93	95	106	92	94	105

Check V1(MCG).

V1, VR, V2 Adjustments*

TEMP		V1							VR							V2						
		PRESS ALT (1000 FT)							PRESS ALT (1000 FT)							PRESS ALT (1000 FT)						
°C	°F	-2	0	2	4	6	8	10	-2	0	2	4	6	8	10	-2	0	2	4	6	8	10
70	158	5	6						4	5						-2	-2					
60	140	4	5	6	7				3	4	5	5				-2	-2	-2	-3			
50	122	3	3	4	5	6	8	9	2	3	4	4	5	6	7	-1	-1	-2	-2	-3	-3	-3
40	104	1	2	2	4	5	6	7	1	1	2	3	4	5	6	0	-1	-1	-2	-2	-3	-3
30	86	0	0	1	2	3	5	6	0	0	1	2	3	4	5	0	0	-1	-1	-1	-2	-2
20	68	0	0	0	1	2	3	5	0	0	1	1	2	3	4	0	0	0	0	-1	-1	-2
-60	-76	0	0	0	1	2	2	3	0	0	1	1	2	2	3	0	0	0	0	-1	-1	-1

Slope and Wind V1 Adjustments*

WEIGHT (1000 KG)	SLOPE (%)					WIND (KTS)							
	-2	-1	0	1	2	-15	-10	-5	0	10	20	30	40
72	-2	-1	0	1	1	0	0	1	0	1	1	1	1
68	-2	-1	0	1	1	0	0	0	0	0	1	1	1
64	-2	-1	0	1	1	0	0	0	0	0	1	1	1
60	-2	-1	0	1	1	-1	0	0	0	0	1	1	1
56	-2	-1	0	1	1	-1	-1	0	0	0	1	1	1
52	-2	-1	0	1	1	-1	-1	0	0	0	1	1	1
48	-1	-1	0	1	1	-2	-1	-1	0	0	1	1	1
44	-1	-1	0	1	1	-2	-1	-1	0	0	1	1	1
40	-1	0	0	1	1	-2	-1	-1	0	0	1	1	1

***V1 not to exceed VR.**

V1(MCG)

TEMP		PRESSURE ALTITUDE (FT)						
°C	°F	-2000	0	2000	4000	6000	8000	10000
70	158	98	96					
60	140	98	96	95	93			
50	122	100	98	95	93	91	89	87
40	104	105	103	99	96	92	89	87
30	86	108	108	104	100	97	92	89
20	68	108	108	106	104	101	96	93
-60	-76	110	109	107	105	103	100	98

Takeoff Speeds - Wet Runway (22K Derate)
Flaps 1 and 5
V1, VR, V2

WEIGHT (1000 KG)	FLAPS 1			FLAPS 5		
	V1	VR	V2	V1	VR	V2
80	148	154	157	146	150	153
76	144	150	154	140	147	151
72	139	146	151	135	143	147
68	134	141	147	130	138	143
64	128	136	143	125	134	139
60	123	131	138	119	128	135
56	116	125	133	113	123	130
52	110	119	128	107	117	126
48	103	113	123	101	111	121
44	97	107	118	94	105	115
40	90	101	112	87	99	110

Check V1(MCG).

V1, VR, V2 Adjustment*

TEMP		V1							VR							V2						
		PRESS ALT (1000 FT)							PRESS ALT (1000 FT)							PRESS ALT (1000 FT)						
°C	°F	-2	0	2	4	6	8	10	-2	0	2	4	6	8	10	-2	0	2	4	6	8	10
70	158	10	11						6	6						-1	-1					
60	140	7	8	10	11				4	5	6	7				-1	-1	-1	-1			
50	122	4	5	7	9	10	13	15	3	3	5	6	7	8	10	-1	-1	-1	-1	-1	-1	-1
40	104	2	3	4	6	8	11	12	1	2	3	4	6	7	9	0	0	0	-1	-1	-1	-1
30	86	0	0	2	4	6	8	10	0	0	2	3	4	6	7	0	0	0	0	0	0	0
20	68	0	0	1	2	3	6	8	0	0	1	2	3	5	6	0	0	0	0	1	0	0
-60	-76	0	0	1	2	3	4	6	0	0	1	2	3	4	5	0	0	0	0	1	1	1

Slope and Wind V1 Adjustment*

WEIGHT (1000 KG)	SLOPE (%)					WIND (KTS)							
	-2	-1	0	1	2	-15	-10	-5	0	10	20	30	40
80	-5	-2	0	3	5	-2	-1	0	0	1	2	2	2
72	-4	-2	0	3	5	-3	-2	-1	0	1	1	2	2
64	-4	-2	0	2	4	-3	-2	-1	0	1	1	2	2
56	-3	-2	0	2	3	-3	-2	-1	0	1	1	2	3
48	-2	-1	0	2	3	-4	-2	-1	0	1	2	3	3
40	-1	0	0	2	3	-4	-2	-1	0	1	3	4	4

***V1 not to exceed VR.**

V1(MCG)

TEMP		PRESSURE ALTITUDE (FT)						
°C	°F	-2000	0	2000	4000	6000	8000	10000
70	158	98	96					
60	140	98	96	95	93			
50	122	100	98	95	93	91	89	87
40	104	105	103	99	96	92	89	87
30	86	108	108	104	100	97	92	89
20	68	108	108	106	104	101	96	93
-60	-76	110	109	107	105	103	100	98

Takeoff Speeds - Wet Runway (22K Derate)
Flaps 10, 15 and 25
V1, VR, V2

WEIGHT (1000 KG)	FLAPS 10			FLAPS 15			FLAPS 25		
	V1	VR	V2	V1	VR	V2	V1	VR	V2
72	129	135	140	130	132	137			
68	125	131	137	125	129	134			
64	120	127	133	120	125	131	118	123	129
60	115	123	129	115	120	127	113	119	126
56	110	118	125	109	116	123	108	114	122
52	104	113	121	103	111	119	102	109	118
48	98	107	117	97	106	115	96	104	114
44	92	102	112	92	100	110	91	99	109
40	86	96	108	86	95	106	85	94	105

Check V1(MCG).

V1, VR, V2 Adjustment*

TEMP		V1							VR							V2						
		PRESS ALT (1000 FT)							PRESS ALT (1000 FT)							PRESS ALT (1000 FT)						
°C	°F	-2	0	2	4	6	8	10	-2	0	2	4	6	8	10	-2	0	2	4	6	8	10
70	158	8	9						4	5						-2	-2					
60	140	6	7	8	10				3	4	5	5				-2	-2	-2	-3			
50	122	4	5	6	7	9	11	13	2	3	4	4	5	6	7	-1	-1	-2	-2	-3	-3	-3
40	104	1	2	3	5	6	9	10	1	1	2	3	4	5	6	0	-1	-1	-2	-2	-3	-3
30	86	0	0	1	3	4	6	8	0	0	1	2	3	4	5	0	0	0	-1	-1	-2	-2
20	68	0	0	1	1	2	4	6	0	0	1	1	2	3	4	0	0	0	0	-1	-1	-2
-60	-76	0	0	1	1	2	3	4	0	0	1	1	2	3	3	0	0	0	0	-1	-1	-1

Slope and Wind V1 Adjustment*

WEIGHT (1000 KG)	SLOPE (%)					WIND (KTS)							
	-2	-1	0	1	2	-15	-10	-5	0	10	20	30	40
72	-4	-2	0	2	3	-3	-2	-1	0	0	1	2	2
68	-4	-2	0	1	3	-4	-2	-1	0	1	1	2	2
64	-4	-2	0	1	3	-4	-2	-1	0	1	1	2	2
60	-3	-2	0	1	3	-4	-2	-1	0	1	1	2	2
56	-3	-2	0	1	3	-4	-2	-1	0	1	1	2	3
52	-3	-1	0	1	3	-4	-3	-1	0	1	1	2	3
48	-3	-1	0	1	2	-4	-3	-1	0	1	2	2	3
44	-2	-1	0	1	2	-4	-3	-1	0	1	2	2	3
40	-2	-1	0	1	2	-5	-3	-1	0	1	2	3	4

***V1 not to exceed VR.**

V1(MCG)

TEMP		PRESSURE ALTITUDE (FT)						
°C	°F	-2000	0	2000	4000	6000	8000	10000
70	158	98	96					
60	140	98	96	95	93			
50	122	100	98	95	93	91	89	87
40	104	105	103	99	96	92	89	87
30	86	108	108	104	100	97	92	89
20	68	108	108	106	104	101	96	93
-60	-76	110	109	107	105	103	100	98

Stab Trim Setting (22K Derate)

Flaps 1 and 5

WEIGHT (1000 KG)	C.G. (%MAC)									
	9	11	13	16	20	24	28	30	32	33
80	8 1/2	8 1/2	8 1/2	7 3/4	7	6 1/4	5 1/2	5	4 3/4	4 1/2
70	8 1/2	8 1/2	8 1/2	7 3/4	7	6	5 1/4	5	4 1/2	4 1/4
60	8 1/2	8 1/4	7 3/4	7 1/4	6 1/4	5 1/2	4 3/4	4 1/2	4	4
50	7 3/4	7 1/2	7	6 1/4	5 3/4	5	4 1/4	4	4	4
45	7	6 3/4	6 1/2	6	5 1/4	4 1/2	4	4	4	4

Flaps 10, 15 and 25

WEIGHT (1000 KG)	C.G. (%MAC)									
	9	11	13	16	20	24	28	30	32	33
80	8 1/2	8 1/2	8 1/2	7 1/2	6 3/4	5 3/4	5	4 1/2	4	4
70	8 1/2	8 1/2	8 1/4	7 1/2	6 1/2	5 3/4	4 3/4	4 1/2	4	4
60	8 1/2	8 1/4	7 3/4	6 3/4	6	5	4 1/4	4	4	4
50	7 1/2	7 1/4	6 3/4	6	5 1/4	4 1/4	4	4	4	4
45	6 3/4	6 1/4	6	5 1/2	4 3/4	4	4	4	4	4

ADVISORY INFORMATION

Slush/Standing Water Takeoff (22K Derate)
Maximum Reverse Thrust
Weight Adjustments (1000 KG)

22K DERATE DRY FIELD/OBSTACLE LIMIT WEIGHT (1000 KG)	SLUSH/STANDING WATER DEPTH								
	3 mm (0.12 INCHES)			6 mm (0.25 INCHES)			13 mm (0.50 INCHES)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
90	-13.2	-16.4	-19.6	-16.3	-19.4	-22.6	-24.2	-27.3	-30.5
85	-11.5	-14.7	-17.9	-14.1	-17.2	-20.4	-20.4	-23.6	-26.8
80	-10.0	-13.1	-16.3	-12.0	-15.2	-18.4	-17.0	-20.2	-23.3
75	-8.6	-11.8	-14.9	-10.2	-13.4	-16.5	-14.0	-17.2	-20.3
70	-7.4	-10.5	-13.7	-8.6	-11.8	-15.0	-11.4	-14.6	-17.8
65	-6.3	-9.5	-12.7	-7.3	-10.5	-13.6	-9.3	-12.5	-15.7
60	-5.4	-8.6	-11.8	-6.2	-9.4	-12.5	-7.7	-10.9	-14.0
55	-4.8	-7.9	-11.1	-5.3	-8.5	-11.7	-6.5	-9.7	-12.8
50	-4.2	-7.4	-10.5	-4.6	-7.8	-11.0	-5.6	-8.8	-12.0
45	-3.7	-6.8	-10.0	-4.0	-7.2	-10.3	-4.8	-8.0	-11.2
40	-3.1	-6.3	-9.5	-3.3	-6.5	-9.7	-4.0	-7.2	-10.4

V1(MCG) Limit Weight (1000 KG)

ADJUSTED FIELD LENGTH (M)	SLUSH/STANDING WATER DEPTH								
	3 mm (0.12 INCHES)			6 mm (0.25 INCHES)			13 mm (0.50 INCHES)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
1400	31.1			34.0			38.5		
1600	44.9			47.7			52.0	33.6	
1800	59.3	39.8		61.9	42.5		65.9	47.0	
2000	74.3	53.9	34.7	76.8	56.6	37.5	80.1	60.7	42.0
2200	90.1	68.7	48.6	92.3	71.2	51.3	94.7	74.8	55.6
2400		84.1	63.1		86.5	65.7		89.3	69.5
2600			78.3			80.7			83.8
2800			94.2			96.4			98.4

1. **Enter Weight Adjustment table with slush/standing water depth and 22K Derate dry field/obstacle limit weight to obtain slush/standing water weight adjustment.**
2. **Adjust field length available by -40 m/+35 m for every 5°C above/below 4°C.**
3. **Find V1(MCG) limit weight for adjusted field length and pressure altitude.**
4. **Max allowable slush/standing water limited weight is lesser of weights from 1 and 3.**

ADVISORY INFORMATION

Slush/Standing Water Takeoff (22K Derate)
Maximum Reverse Thrust
V1 Adjustment (KIAS)

WEIGHT (1000 KG)	SLUSH/STANDING WATER DEPTH								
	3 mm (0.12 INCHES)			6 mm (0.25 INCHES)			13 mm (0.50 INCHES)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
85	-11	-9	-6	-3	-1	0	0	0	0
80	-13	-10	-8	-6	-3	-1	0	0	0
75	-14	-12	-9	-8	-6	-3	0	0	0
70	-15	-13	-10	-11	-8	-6	0	0	0
65	-17	-14	-12	-13	-10	-8	-4	-1	0
60	-18	-15	-13	-15	-12	-10	-7	-4	-2
55	-19	-17	-14	-16	-14	-11	-10	-8	-5
50	-20	-18	-15	-18	-15	-13	-13	-10	-8
45	-21	-19	-16	-20	-17	-15	-15	-13	-10
40	-22	-20	-17	-21	-18	-16	-18	-15	-13

1. **Obtain V1, VR and V2 for the actual weight using the 22K Derate Dry Runway Takeoff Speeds table.**
2. **If V1(MCG) limited, set V1 = V1(MCG). If not V1(MCG) limited, enter V1 Adjustment table with the actual weight to obtain V1 speed adjustment. If adjusted V1 is less than V1(MCG), set V1 = V1(MCG). V1 not to exceed VR.**

ADVISORY INFORMATION

Slush/Standing Water Takeoff (22K Derate)

No Reverse Thrust

Weight Adjustments (1000 KG)

22K DERATE DRY FIELD/OBSTACLE LIMIT WEIGHT (1000 KG)	SLUSH/STANDING WATER DEPTH								
	3 mm (0.12 INCHES)			6 mm (0.25 INCHES)			13 mm (0.50 INCHES)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
90	-15.6	-18.3	-21.0	-18.6	-21.3	-24.0	-24.9	-27.6	-30.4
85	-13.7	-16.4	-19.1	-16.2	-18.9	-21.6	-21.4	-24.2	-26.9
80	-11.9	-14.7	-17.4	-14.0	-16.7	-19.4	-18.2	-20.9	-23.7
75	-10.4	-13.1	-15.8	-12.0	-14.7	-17.4	-15.4	-18.1	-20.8
70	-9.0	-11.7	-14.4	-10.3	-13.0	-15.7	-13.0	-15.7	-18.4
65	-7.8	-10.5	-13.2	-8.8	-11.5	-14.2	-10.9	-13.6	-16.4
60	-6.8	-9.5	-12.2	-7.5	-10.3	-13.0	-9.2	-12.0	-14.7
55	-6.0	-8.7	-11.4	-6.5	-9.3	-12.0	-8.0	-10.7	-13.4
50	-5.3	-8.0	-10.7	-5.7	-8.5	-11.2	-7.0	-9.7	-12.4
45	-4.6	-7.4	-10.1	-5.0	-7.7	-10.4	-6.1	-8.8	-11.5
40	-4.0	-6.7	-9.4	-4.2	-6.9	-9.6	-5.1	-7.8	-10.6

V1(MCG) Limit Weight (1000 KG)

ADJUSTED FIELD LENGTH (M)	SLUSH/STANDING WATER DEPTH								
	3 mm (0.12 INCHES)			6 mm (0.25 INCHES)			13 mm (0.50 INCHES)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
1600							33.7		
1800	30.3			37.5			47.9		
2000	46.5			53.2			62.8	39.3	
2200	63.2	36.7		69.4	43.7		78.4	53.8	30.9
2400	80.7	53.1		86.3	59.6	34.4	94.9	68.9	45.0
2600	98.7	70.1	43.2		76.1	50.0		85.0	59.7
2800		87.9	59.8		93.2	66.1			75.2
3000			77.1			82.9			91.6
3200			95.1						

1. **Enter Weight Adjustment table with slush/standing water depth and 22K Derate dry field/obstacle limit weight to obtain slush/standing water weight adjustment.**
2. **Adjust field length available by -55 m/+55 m for every 5°C above/below 4°C.**
3. **Find V1(MCG) limit weight for adjusted field length and pressure altitude.**
4. **Max allowable slush/standing water limited weight is lesser of weights from 1 and 3.**

ADVISORY INFORMATION

Slush/Standing Water Takeoff (22K Derate)

No Reverse Thrust

V1 Adjustment (KIAS)

WEIGHT (1000 KG)	SLUSH/STANDING WATER DEPTH								
	3 mm (0.12 INCHES)			6 mm (0.25 INCHES)			13 mm (0.50 INCHES)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
90	-15	-7	0	-2	0	0	0	0	0
85	-16	-9	-1	-5	0	0	0	0	0
80	-18	-10	-3	-9	-1	0	0	0	0
75	-20	-12	-5	-12	-4	0	0	0	0
70	-21	-13	-6	-15	-7	0	0	0	0
65	-22	-15	-7	-17	-10	-2	-5	0	0
60	-24	-16	-9	-20	-12	-5	-10	-2	0
55	-25	-17	-10	-22	-14	-7	-14	-6	0
50	-26	-19	-11	-24	-16	-9	-17	-10	-2
45	-27	-20	-12	-25	-18	-10	-20	-13	-5
40	-28	-21	-13	-26	-19	-11	-23	-15	-8

1. **Obtain V1, VR and V2 for the actual weight using the 22K Derate Dry Runway Takeoff Speeds table.**
2. **If V1(MCG) limited, set V1 = V1(MCG). If not V1(MCG) limited, enter V1 Adjustment table with the actual weight to obtain V1 speed adjustment. If adjusted V1 is less than V1(MCG), set V1 = V1(MCG). V1 not to exceed VR.**

ADVISORY INFORMATION

Slippery Runway Takeoff (22K Derate)

Maximum Reverse Thrust

Weight Adjustment (1000 KG)

22K DERATE DRY FIELD/OBSTACLE LIMIT WEIGHT (1000 KG)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
90	-1.6	-1.6	-1.6	-6.9	-6.9	-6.9	-11.8	-11.8	-11.8
85	-1.5	-1.5	-1.5	-6.4	-6.4	-6.4	-10.8	-10.8	-10.8
80	-1.3	-1.3	-1.3	-5.9	-5.9	-5.9	-9.8	-9.8	-9.8
75	-1.2	-1.2	-1.2	-5.4	-5.4	-5.4	-9.0	-9.0	-9.0
70	-1.1	-1.1	-1.1	-5.0	-5.0	-5.0	-8.2	-8.2	-8.2
65	-1.1	-1.1	-1.1	-4.7	-4.7	-4.7	-7.6	-7.6	-7.6
60	-1.1	-1.1	-1.1	-4.4	-4.4	-4.4	-7.0	-7.0	-7.0
55	-1.1	-1.1	-1.1	-4.1	-4.1	-4.1	-6.5	-6.5	-6.5
50	-1.2	-1.2	-1.2	-3.9	-3.9	-3.9	-6.1	-6.1	-6.1
45	-1.3	-1.3	-1.3	-3.7	-3.7	-3.7	-5.8	-5.8	-5.8
40	-1.4	-1.4	-1.4	-3.6	-3.6	-3.6	-5.6	-5.6	-5.6

V1(MCG) Limit Weight (1000 KG)

ADJUSTED FIELD LENGTH (M)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
1200	50.3	32.0							
1400	72.5	53.9	35.5	35.2					
1600	95.0	76.1	57.4	51.3	31.7				
1800		98.7	79.7	68.4	47.6		34.3		
2000				86.9	64.5	44.1	45.1		
2200					82.7	60.7	56.5	36.9	
2400						78.6	68.6	47.8	
2600						97.8	81.6	59.4	39.6
2800							95.6	71.7	50.6
3000								85.0	62.4
3200								99.1	74.9
3400									88.4

1. **Enter Weight Adjustment table with reported braking action and 22K Derate dry field/obstacle limit weight to obtain slippery runway weight adjustment.**
2. **Adjust “Good” field length available by -25 m/+25 m for every 5°C above/below 4°C.**
   Adjust “Medium” field length available by -25 m/+25 m for every 5°C above/below 4°C.
   Adjust “Poor” field length available by -40 m/+35 m for every 5°C above/below 4°C.
3. **Find V1(MCG) limit weight for adjusted field length and pressure altitude.**
4. **Max allowable slippery runway limited weight is lesser of weights from 1 and 3.**

ADVISORY INFORMATION

Slippery Runway Takeoff (22K Derate)
Maximum Reverse Thrust
V1 Adjustment (KIAS)

WEIGHT (1000 KG)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
85	-4	-2	0	-12	-9	-7	-21	-19	-16
80	-5	-2	0	-13	-10	-8	-23	-20	-18
75	-6	-3	-1	-14	-12	-9	-25	-22	-20
70	-6	-4	-1	-15	-13	-10	-27	-24	-22
65	-7	-5	-2	-17	-14	-12	-28	-26	-23
60	-8	-6	-3	-18	-16	-13	-30	-28	-25
55	-9	-7	-4	-20	-17	-15	-32	-30	-27
50	-10	-8	-5	-21	-19	-16	-34	-31	-29
45	-12	-9	-7	-23	-20	-18	-36	-33	-31
40	-13	-10	-8	-25	-22	-20	-38	-35	-33

1. **Obtain V1, VR and V2 for the actual weight using the 22K Derate Dry Runway Takeoff Speeds table.**
2. **If V1(MCG) limited, set V1 = V1(MCG). If not V1(MCG) limited, enter V1 Adjustment table with the actual weight to obtain V1 speed adjustment. If adjusted V1 is less than V1(MCG), set V1 = V1(MCG). V1 not to exceed VR.**

ADVISORY INFORMATION

Slippery Runway Takeoff (22K Derate)

No Reverse Thrust

Weight Adjustments (1000 KG)

22K DERATE DRY FIELD/OBSTACLE LIMIT WEIGHT (1000 KG)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
90	-2.6	-2.9	-3.3	-9.5	-9.8	-10.2	-15.7	-16.0	-16.4
85	-2.6	-2.9	-3.3	-8.9	-9.3	-9.7	-14.5	-14.9	-15.2
80	-2.6	-2.9	-3.3	-8.4	-8.8	-9.2	-13.4	-13.7	-14.1
75	-2.6	-2.9	-3.3	-8.0	-8.4	-8.7	-12.3	-12.7	-13.0
70	-2.6	-3.0	-3.3	-7.6	-7.9	-8.3	-11.3	-11.7	-12.0
65	-2.6	-3.0	-3.3	-7.2	-7.5	-7.9	-10.3	-10.7	-11.1
60	-2.6	-3.0	-3.3	-6.8	-7.2	-7.5	-9.4	-9.8	-10.2
55	-2.6	-3.0	-3.3	-6.5	-6.8	-7.2	-8.6	-9.0	-9.3
50	-2.6	-3.0	-3.3	-6.2	-6.5	-6.9	-7.8	-8.2	-8.5
45	-2.6	-3.0	-3.3	-5.9	-6.3	-6.6	-7.1	-7.4	-7.8
40	-2.6	-3.0	-3.3	-5.6	-6.0	-6.4	-6.4	-6.7	-7.1

V1(MCG) Limit Weight (1000 KG)

ADJUSTED FIELD LENGTH (M)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT(FT)			PRESS ALT(FT)			PRESS ALT(FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
1400	52.8								
1600	80.5								
1800		51.2							
2000		79.3		39.8					
2200			49.6	68.4					
2400			78.0	94.0	56.0				
2600					82.8	42.9			
2800						71.1			
3000						96.5			
3200							46.7		
3400							68.1	43.5	
3600							89.5	64.9	40.3
3800								86.3	61.7
4000									83.0

1. **Enter Weight Adjustment table with reported braking action and 22K Derate dry field/obstacle limit weight to obtain slippery runway weight adjustment.**
2. **Adjust "Good" field length available by -35 m/+35 m for every 5°C above/below 4°C.**
   Adjust "Medium" field length available by -35 m/+35 m for every 5°C above/below 4°C.
   Adjust "Poor" field length available by -55 m/+55 m for every 5°C above/below 4°C.
3. **Find V1(MCG) limit weight for adjusted field length and pressure altitude.**
4. **Max allowable slippery runway limited weight is lesser of weights from 1 and 3.**

ADVISORY INFORMATION

Slippery Runway Takeoff (22K Derate)
No Reverse Thrust
V1 Adjustment (KIAS)

WEIGHT (1000 KG)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
90	-8	-3	0	-18	-13	-8	-31	-26	-21
85	-8	-3	0	-19	-14	-9	-34	-29	-24
80	-8	-3	0	-19	-14	-9	-37	-32	-27
75	-8	-3	0	-21	-16	-11	-40	-35	-30
70	-9	-4	0	-23	-18	-13	-43	-38	-33
65	-11	-6	-1	-25	-20	-15	-47	-42	-37
60	-12	-7	-2	-28	-23	-18	-50	-45	-40
55	-14	-9	-4	-31	-26	-21	-54	-49	-44
50	-17	-12	-7	-35	-30	-25	-58	-53	-48
45	-20	-15	-10	-39	-34	-29	-62	-57	-52
40	-24	-19	-14	-44	-39	-34	-66	-61	-56

1. **Obtain V1, VR and V2 for the actual weight using the 22K Derate Dry Runway Takeoff Speeds table.**
2. **If V1(MCG) limited, set V1 = V1(MCG). If not V1(MCG) limited, enter V1 Adjustment table with the actual weight to obtain V1 speed adjustment. If adjusted V1 is less than V1(MCG), set V1 = V1(MCG). V1 not to exceed VR.**

Takeoff %N1 (22K Derate)

Based on engine bleeds for packs on, engine and wing anti-ice on or off

OAT (°C)	AIRPORT PRESSURE ALTITUDE (FT)												
	-2000	-1000	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
60	87.7	88.3	88.7	88.8	88.9	89.1	89.2	89.2	89.1	88.6	88.3	88.7	89.2
55	88.5	89.1	89.5	89.7	89.8	89.9	90.0	90.0	90.0	89.5	89.0	88.8	88.6
50	89.3	89.8	90.4	90.5	90.6	90.7	90.9	90.8	90.8	90.4	89.9	89.7	89.6
45	90.2	90.7	91.2	91.3	91.4	91.5	91.7	91.6	91.6	91.2	90.8	90.7	90.5
40	91.1	91.6	92.1	92.2	92.3	92.4	92.5	92.4	92.4	92.1	91.7	91.6	91.5
35	91.9	92.5	93.0	93.1	93.2	93.2	93.3	93.3	93.2	92.9	92.5	92.5	92.4
30	91.5	92.6	93.8	93.9	94.0	94.0	94.1	94.0	93.9	93.7	93.4	93.3	93.2
25	90.8	91.9	93.1	93.7	94.4	94.8	94.9	94.8	94.8	94.4	94.0	94.0	94.0
20	90.0	91.1	92.3	93.0	93.6	94.3	95.0	95.6	95.6	95.3	94.9	94.8	94.7
15	89.3	90.4	91.6	92.2	92.8	93.6	94.3	94.8	95.3	95.9	96.1	95.9	95.5
10	88.5	89.6	90.8	91.4	92.1	92.8	93.5	94.0	94.5	95.1	95.7	96.4	97.1
5	87.8	88.9	90.0	90.7	91.3	92.0	92.7	93.2	93.7	94.3	94.9	95.6	96.3
0	87.0	88.1	89.2	89.9	90.5	91.2	91.9	92.4	92.9	93.5	94.1	94.8	95.5
-5	86.2	87.3	88.4	89.1	89.7	90.4	91.1	91.6	92.1	92.7	93.3	94.0	94.7
-10	85.4	86.5	87.6	88.3	88.9	89.6	90.3	90.8	91.3	91.9	92.5	93.2	93.9
-15	84.6	85.7	86.8	87.5	88.1	88.8	89.4	90.0	90.5	91.1	91.7	92.4	93.1
-20	83.8	84.9	86.0	86.6	87.3	87.9	88.6	89.1	89.7	90.3	90.8	91.6	92.3
-25	83.0	84.1	85.2	85.8	86.4	87.1	87.8	88.3	88.8	89.4	90.0	90.7	91.5
-30	82.2	83.3	84.4	85.0	85.6	86.3	86.9	87.4	88.0	88.6	89.2	89.9	90.6
-35	81.4	82.4	83.5	84.1	84.7	85.4	86.1	86.6	87.1	87.7	88.3	89.0	89.8
-40	80.6	81.6	82.7	83.3	83.9	84.5	85.2	85.7	86.2	86.8	87.4	88.2	88.9
-45	79.7	80.7	81.8	82.4	83.0	83.7	84.3	84.8	85.3	86.0	86.6	87.3	88.0
-50	78.9	79.9	80.9	81.5	82.1	82.8	83.4	83.9	84.5	85.1	85.7	86.4	87.2

%N1 Adjustments for Engine Bleeds

BLEED CONFIGURATION	AIRPORT PRESSURE ALTITUDE (FT)												
	-2000	-1000	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
PACKS OFF	0.7	0.7	0.7	0.7	0.7	0.7	0.8	0.8	0.8	0.8	0.9	0.9	0.9

Assumed Temperature Reduced Thrust (22K Derate)
Maximum Assumed Temperature (Table 1 of 3)
Based on 25% Takeoff Thrust Reduction

OAT (°C)	AIRPORT PRESSURE ALTITUDE (FT)											
	-1000	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
55	73	71	69	67								
50	73	71	69	67	65	63						
45	73	71	69	67	65	63	61	59	57			
40	72	71	69	67	65	63	61	59	57	55		
35	66	66	66	66	65	63	61	59	57	55	53	
30	63	61	61	61	61	61	61	59	57	55	53	51
25	63	61	59	57	56	56	56	56	56	55	53	51
20	63	61	59	57	55	53	51	51	51	50	50	50
15	63	61	59	57	55	53	51	50	47	45	45	45
10 & BELOW	63	61	59	57	55	53	51	50	47	45	43	41

Takeoff %N1 (Table 2 of 3)
Based on engine bleeds for packs on, engine and wing anti-ice on or off

ASSUMED TEMP (°C)	AIRPORT PRESSURE ALTITUDE (FT)											
	-1000	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
75	85.7	86.0	86.7	87.4	88.2	88.9	89.5	90.1	90.2	90.2	90.6	91.1
70	86.6	87.0	87.1	87.1	87.5	88.3	88.9	89.4	89.5	89.6	90.0	90.4
65	87.4	87.8	88.0	88.0	88.2	88.3	88.3	88.8	88.9	88.9	89.4	89.8
60	88.3	88.7	88.8	88.9	89.1	89.2	89.2	89.1	88.6	88.3	88.7	89.2
55	89.1	89.5	89.7	89.8	89.9	90.0	90.0	90.0	89.5	89.0	88.8	88.6
50	89.8	90.4	90.5	90.6	90.7	90.9	90.8	90.8	90.4	89.9	89.7	89.6
45	90.7	91.2	91.3	91.4	91.5	91.7	91.6	91.6	91.2	90.8	90.7	90.5
40	91.6	92.1	92.2	92.3	92.4	92.5	92.4	92.4	92.1	91.7	91.6	91.5
35	92.5	93.0	93.1	93.2	93.2	93.3	93.3	93.2	92.9	92.5	92.5	92.4
30	92.6	93.8	93.9	94.0	94.0	94.1	94.0	93.9	93.7	93.4	93.3	93.2
25	91.9	93.1	93.7	94.4	94.8	94.9	94.8	94.8	94.4	94.0	94.0	94.0
20	91.1	92.3	93.0	93.6	94.3	95.0	95.6	95.6	95.3	94.9	94.8	94.7
15	90.4	91.6	92.2	92.8	93.6	94.3	94.8	95.3	95.9	96.1	95.9	95.5
10	89.6	90.8	91.4	92.1	92.8	93.5	94.0	94.5	95.1	95.7	96.4	97.1
MINIMUM ASSUMED TEMP (°C)	32	30	28	26	24	22	20	18	16	15	12	10

With engine bleed for packs off, increase %N1 by 0.9.

Assumed Temperature Reduced Thrust (22K Derate)
%N1 Adjustment for Temperature Difference (Table 3 of 3)

ASSUMED TEMP MINUS OAT (°C)	OUTSIDE AIR TEMPERATURE (°C)													
	-40	-20	0	5	10	15	20	25	30	35	40	45	50	55
110	11.6													
100	10.3	7.9												
90	10.8	8.4												
80	12.2	7.1	5.0											
70	11.0	7.6	5.4	5.2	3.5									
60	9.6	9.0	4.1	4.0	3.9	3.8	2.1							
50	8.0	7.7	4.5	2.8	2.6	2.7	2.6	2.4	0.8					
40		6.2	5.9	4.7	3.0	2.6	2.7	2.8	2.6	2.5	2.9			
30		4.7	4.6	4.5	4.4	4.2	4.1	4.0	4.0	3.9	3.8	3.7	3.6	
20			3.1	3.0	3.0	3.0	2.9	2.8	2.7	2.7	2.6	2.6	2.5	2.4
10			1.5	1.5	1.5	1.5	1.5	1.5	1.4	1.4	1.4	1.3	1.3	1.3
0			0	0	0	0	0	0	0	0	0	0	0	0

1. **Determine Maximum Assumed Temperature allowed from Table 1.**
2. **Find Maximum %N1 from Table 2 using the desired assumed temperature (no greater than temperature from Table 1).**
3. **Use the difference between assumed temperature and OAT to determine the %N1 adjustment from Table 3.**
4. **Subtract %N1 adjustment from Maximum %N1 in Table 2.**

Max Climb %N1

Based on engine bleed for packs on or off and anti-ice off

TAT (°C)	PRESSURE ALTITUDE (FT)/SPEED (KIAS/MACH)									
	0	5000	10000	15000	20000	25000	30000	35000	37000	41000
	280	280	280	280	280	280	280	.78	.78	.78
60	89.4	89.7	89.7	89.8	89.6	91.4	93.0	94.4	94.5	92.8
55	90.2	90.5	90.5	90.7	90.0	90.8	92.4	93.7	93.8	92.1
50	90.9	91.2	91.3	91.5	91.0	90.8	91.7	93.0	93.1	91.4
45	91.6	91.9	92.1	92.3	91.9	91.7	91.7	92.3	92.4	90.7
40	92.4	92.6	92.9	93.1	92.7	92.5	92.5	91.6	91.7	90.0
35	92.9	93.3	93.6	93.8	93.6	93.3	93.3	92.4	91.7	90.1
30	92.2	94.1	94.3	94.6	94.4	94.1	94.0	93.2	92.6	91.1
25	91.5	94.1	95.0	95.2	95.2	94.8	94.7	94.0	93.4	92.1
20	90.7	93.3	95.8	96.0	95.9	95.6	95.4	94.7	94.2	93.0
15	90.0	92.5	95.2	96.8	96.7	96.3	96.1	95.5	95.0	94.0
10	89.2	91.8	94.4	97.1	97.6	97.0	96.7	96.2	95.8	94.9
5	88.4	91.0	93.6	96.3	98.5	97.9	97.4	97.0	96.6	95.8
0	87.7	90.2	92.8	95.5	97.9	99.0	98.4	97.8	97.5	96.7
-5	86.9	89.4	92.0	94.7	97.2	98.9	99.4	98.6	98.3	97.7
-10	86.1	88.6	91.2	93.9	96.4	98.1	99.7	99.5	99.2	98.7
-15	85.3	87.8	90.3	93.1	95.6	97.4	98.9	100.5	100.1	99.7
-20	84.5	87.0	89.5	92.3	94.8	96.6	98.1	100.2	100.7	100.3
-25	83.7	86.1	88.7	91.4	94.1	95.8	97.3	99.3	99.9	99.5
-30	82.9	85.3	87.8	90.6	93.3	95.0	96.5	98.5	99.0	98.7
-35	82.0	84.5	87.0	89.8	92.4	94.1	95.6	97.6	98.2	97.8
-40	81.2	83.6	86.1	88.9	91.6	93.3	94.8	96.8	97.3	96.9

%N1 Adjustments for Engine Bleeds

BLEED CONFIGURATION	PRESSURE ALTITUDE (1000 FT)					
	0	10	20	30	35	41
ENGINE ANTI-ICE	-0.6	-0.8	-0.9	-0.9	-0.8	-0.8
ENGINE & WING ANTI-ICE*	-1.8	-2.1	-2.5	-2.7	-3.0	-3.0

***Dual bleed sources**

Go-around %N1

Based on engine bleed for packs on, engine and wing anti-ice on or off

AIRPORT OAT		TAT (°C)	AIRPORT PRESSURE ALTITUDE (FT)											
°C	°F		-2000	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
57	134	60	95.0	96.2	96.8									
52	125	55	95.9	96.7	96.6	96.8	97.5							
47	116	50	96.6	97.6	97.8	97.8	97.7	97.5	98.2	98.8				
42	108	45	97.4	98.4	98.5	98.6	98.7	98.8	98.7	98.5	98.5	99.0		
37	99	40	98.0	99.1	99.2	99.3	99.4	99.5	99.6	99.5	99.1	98.9	98.8	99.1
32	90	35	98.1	99.9	100.0	100.1	100.1	100.3	100.3	100.2	99.9	99.6	99.6	99.5
27	81	30	97.3	99.8	100.4	100.7	100.7	100.7	100.7	100.7	100.6	100.4	100.4	100.3
22	72	25	96.6	99.1	99.7	100.2	100.6	100.9	100.9	100.9	100.9	100.9	100.9	100.8
17	63	20	95.8	98.3	98.9	99.5	99.8	100.2	100.5	100.9	101.0	101.1	101.0	101.0
12	54	15	95.0	97.5	98.1	98.7	99.1	99.4	99.8	100.1	100.5	100.9	101.3	101.2
7	45	10	94.2	96.8	97.4	98.0	98.3	98.7	99.0	99.4	99.8	100.2	100.5	100.9
2	36	5	93.4	96.0	96.6	97.2	97.6	97.9	98.3	98.7	99.0	99.4	99.8	100.2
-3	27	0	92.6	95.2	95.8	96.4	96.8	97.2	97.5	97.9	98.3	98.7	99.0	99.4
-8	18	-5	91.8	94.4	95.0	95.6	96.0	96.4	96.8	97.2	97.5	97.9	98.3	98.6
-13	9	-10	91.0	93.6	94.2	94.8	95.2	95.6	96.0	96.4	96.8	97.1	97.5	97.9
-17	1	-15	90.2	92.8	93.4	94.0	94.4	94.8	95.2	95.6	96.0	96.4	96.7	97.1
-22	-8	-20	89.3	92.0	92.6	93.2	93.6	94.0	94.4	94.8	95.2	95.6	95.9	96.3
-27	-17	-25	88.5	91.1	91.8	92.4	92.8	93.2	93.6	94.0	94.4	94.8	95.1	95.5
-32	-26	-30	87.6	90.3	90.9	91.6	92.0	92.4	92.8	93.3	93.6	94.0	94.3	94.7
-37	-35	-35	86.8	89.4	90.1	90.7	91.1	91.6	92.0	92.4	92.8	93.2	93.5	93.9
-42	-44	-40	85.9	88.6	89.2	89.9	90.3	90.7	91.2	91.6	92.0	92.4	92.7	93.0
-47	-53	-45	85.0	87.7	88.4	89.0	89.4	89.9	90.3	90.8	91.2	91.5	91.9	92.2
-52	-62	-50	84.1	86.8	87.5	88.2	88.6	89.0	89.5	90.0	90.3	90.7	91.0	91.4

%N1 Adjustments for Engine Bleeds

BLEED CONFIGURATION	PRESSURE ALTITUDE (FT)											
	-2000	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
PACKS OFF	0.6	0.8	0.8	0.8	0.8	0.8	0.8	0.9	0.9	0.9	1.0	0.9
A/C HIGH	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1

Flight With Unreliable Airspeed/Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

CLIMB (280/.76)

Flaps Up, Set Max Climb Thrust

PRESSURE ALTITUDE (FT)		WEIGHT (1000 KG)				
		40	50	60	70	80
40000	**PITCH ATT**	**4.0**	**4.0**	**4.5**		
	V/S (FT/MIN)	1800	1200	600		
30000	**PITCH ATT**	**4.0**	**4.0**	**4.0**	**4.0**	**4.0**
	V/S (FT/MIN)	2600	2000	1500	1200	900
20000	**PITCH ATT**	**7.5**	**6.5**	**6.5**	**6.0**	**6.0**
	V/S (FT/MIN)	4200	3300	2700	2200	1800
10000	**PITCH ATT**	**11.0**	**9.5**	**8.5**	**8.5**	**8.0**
	V/S (FT/MIN)	5700	4500	3700	3000	2600
SEA LEVEL	**PITCH ATT**	**15.0**	**12.5**	**11.5**	**10.5**	**10.0**
	V/S (FT/MIN)	6800	5400	4400	3700	3200

CRUISE (.76/280)

Flaps Up, %N1 for Level Flight

PRESSURE ALTITUDE (FT)		WEIGHT (1000 KG)				
		40	50	60	70	80
40000	**PITCH ATT**	**2.0**	**2.5**	**3.5**		
	%N1	**82.4**	**85.0**	**89.0**		
35000	**PITCH ATT**	**1.0**	**2.0**	**2.5**	**3.0**	**3.5**
	%N1	**80.7**	**82.1**	**84.1**	**86.5**	**90.5**
30000	**PITCH ATT**	**1.0**	**1.5**	**2.0**	**2.5**	**3.0**
	%N1	**80.2**	**81.0**	**82.2**	**83.8**	**85.7**
25000	**PITCH ATT**	**1.0**	**1.5**	**2.0**	**2.5**	**3.5**
	%N1	**76.6**	**77.4**	**78.5**	**80.0**	**81.9**
20000	**PITCH ATT**	**1.0**	**1.5**	**2.0**	**3.0**	**3.5**
	%N1	**73.0**	**73.8**	**74.8**	**76.1**	**77.9**
15000	**PITCH ATT**	**1.0**	**1.5**	**2.5**	**3.0**	**3.5**
	%N1	**69.2**	**70.0**	**71.1**	**72.3**	**74.0**

Flight With Unreliable Airspeed/Turbulent Air Penetration
Altitude and/or vertical speed indications may also be unreliable.

DESCENT (.76/280)
Flaps Up, Set Idle Thrust

PRESSURE ALTITUDE (FT)		WEIGHT (1000 KG) 40	50	60	70	80
40000	**PITCH ATT**	**-1.5**	**-0.5**	**0.5**	**1.0**	**1.5**
	V/S (FT/MIN)	-2800	-2500	-2400	-2600	-2700
30000	**PITCH ATT**	**-3.0**	**-2.0**	**-1.0**	**0.0**	**0.5**
	V/S (FT/MIN)	-3000	-2500	-2200	-2000	-1900
20000	**PITCH ATT**	**-3.0**	**-2.0**	**-1.0**	**0.0**	**1.0**
	V/S (FT/MIN)	-2700	-2300	-2000	-1800	-1700
10000	**PITCH ATT**	**-3.0**	**-2.0**	**-1.0**	**0.0**	**1.0**
	V/S (FT/MIN)	-2400	-2000	-1800	-1600	-1500
SEA LEVEL	**PITCH ATT**	**-3.5**	**-2.0**	**-1.0**	**0.0**	**1.0**
	V/S (FT/MIN)	-2200	-1800	-1600	-1500	-1400

HOLDING (VREF40 + 70)
Flaps Up, %N1 for Level Flight

PRESSURE ALTITUDE (FT)		WEIGHT (1000 KG) 40	50	60	70	80
15000	**PITCH ATT**	**5.0**	**5.0**	**5.0**	**5.0**	**5.0**
	%N1	**55.8**	**61.5**	**65.8**	**69.7**	**73.1**
	KIAS	177	195	214	231	247
10000	**PITCH ATT**	**5.0**	**5.5**	**5.0**	**5.0**	**5.0**
	%N1	**52.2**	**57.2**	**61.9**	**65.8**	**69.0**
	KIAS	177	194	213	230	246
5000	**PITCH ATT**	**5.5**	**5.5**	**5.5**	**5.0**	**5.0**
	%N1	**48.6**	**53.6**	**57.8**	**61.7**	**65.4**
	KIAS	177	193	212	229	245

Flight With Unreliable Airspeed/Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

TERMINAL AREA (5000 FT)

%N1 for Level Flight

Airport Altitude = -2000 FT

FLAP POSITION (VREF + INCREMENT)		WEIGHT (1000 KG) 40	50	60	70	80
FLAPS UP (GEAR UP) VREF40+70	**PITCH ATT**	**5.0**	**5.5**	**6.0**	**6.5**	**6.5**
	%N1	**47.2**	**51.9**	**56.0**	**59.7**	**63.3**
	KIAS	177	190	202	212	222
FLAPS 1 (GEAR UP) VREF40+50	**PITCH ATT**	**5.0**	**5.5**	**6.0**	**6.0**	**6.5**
	%N1	**49.2**	**53.8**	**58.0**	**61.8**	**65.3**
	KIAS	157	170	182	192	202
FLAPS 5 (GEAR UP) VREF40+30	**PITCH ATT**	**5.5**	**6.0**	**6.5**	**6.5**	**7.0**
	%N1	**48.7**	**53.9**	**58.3**	**62.5**	**66.2**
	KIAS	137	150	162	172	182
FLAPS 10 (GEAR UP) VREF40+30	**PITCH ATT**	**5.0**	**5.5**	**6.0**	**6.0**	**6.5**
	%N1	**52.5**	**57.7**	**62.5**	**66.7**	**70.3**
	KIAS	137	150	162	172	182
FLAPS 15 (GEAR UP) VREF40+20	**PITCH ATT**	**5.5**	**6.0**	**6.5**	**6.5**	**7.0**
	%N1	**52.6**	**58.1**	**63.0**	**67.2**	**70.9**
	KIAS	127	140	152	162	172
FLAPS 25 (GEAR UP) VREF40+10	**PITCH ATT**	**7.0**	**7.0**	**7.5**	**7.5**	**7.5**
	%N1	**53.4**	**59.1**	**64.1**	**68.3**	**72.1**
	KIAS	117	130	142	152	162
FLAPS 15 (GEAR DOWN) VREF40+20	**PITCH ATT**	**6.0**	**6.0**	**6.5**	**6.5**	**7.0**
	%N1	**57.0**	**62.7**	**67.5**	**71.8**	**75.7**
	KIAS	127	140	152	162	172

Flight With Unreliable Airspeed/Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

TERMINAL AREA (5000 FT)

%N1 for Level Flight

Airport Altitude = -1000 FT

FLAP POSITION (VREF + INCREMENT)		WEIGHT (1000 KG) 40	50	60	70	80
FLAPS UP (GEAR UP)	**PITCH ATT**	**5.0**	**5.5**	**6.0**	**6.0**	**6.5**
	%N1	**47.9**	**52.6**	**56.8**	**60.5**	**64.2**
VREF40+70	KIAS	177	190	202	212	222
FLAPS 1 (GEAR UP)	**PITCH ATT**	**5.0**	**5.5**	**6.0**	**6.0**	**6.5**
	%N1	**49.9**	**54.6**	**58.7**	**62.6**	**66.1**
VREF40+50	KIAS	157	170	182	192	202
FLAPS 5 (GEAR UP)	**PITCH ATT**	**5.5**	**6.0**	**6.5**	**6.5**	**7.0**
	%N1	**49.4**	**54.6**	**59.1**	**63.4**	**67.0**
VREF40+30	KIAS	137	150	162	172	182
FLAPS 10 (GEAR UP)	**PITCH ATT**	**5.0**	**5.5**	**6.0**	**6.0**	**6.5**
	%N1	**53.2**	**58.5**	**63.3**	**67.4**	**71.1**
VREF40+30	KIAS	137	150	162	172	182
FLAPS 15 (GEAR UP)	**PITCH ATT**	**5.5**	**6.0**	**6.5**	**6.5**	**6.5**
	%N1	**53.3**	**58.9**	**63.8**	**68.0**	**71.8**
VREF40+20	KIAS	127	140	152	162	172
FLAPS 25 (GEAR UP)	**PITCH ATT**	**7.0**	**7.0**	**7.5**	**7.5**	**7.5**
	%N1	**54.1**	**59.9**	**64.9**	**69.1**	**73.0**
VREF40+10	KIAS	117	130	142	152	162
FLAPS 15 (GEAR DOWN)	**PITCH ATT**	**6.0**	**6.0**	**6.5**	**6.5**	**7.0**
	%N1	**57.7**	**63.5**	**68.3**	**72.7**	**76.5**
VREF40+20	KIAS	127	140	152	162	172

Flight With Unreliable Airspeed/Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

TERMINAL AREA (5000 FT)

%N1 for Level Flight

Airport Altitude = SEA LEVEL

FLAP POSITION (VREF + INCREMENT)		WEIGHT (1000 KG)				
		40	50	60	70	80
FLAPS UP (GEAR UP) VREF40+70	**PITCH ATT**	**5.0**	**5.5**	**6.0**	**6.0**	**6.5**
	%N1	**48.6**	**53.3**	**57.5**	**61.3**	**65.0**
	KIAS	177	190	202	213	222
FLAPS 1 (GEAR UP) VREF40+50	**PITCH ATT**	**5.0**	**5.5**	**6.0**	**6.0**	**6.5**
	%N1	**50.5**	**55.3**	**59.5**	**63.5**	**66.8**
	KIAS	157	170	182	193	202
FLAPS 5 (GEAR UP) VREF40+30	**PITCH ATT**	**5.5**	**6.0**	**6.5**	**6.5**	**7.0**
	%N1	**50.1**	**55.3**	**59.9**	**64.2**	**67.8**
	KIAS	137	150	162	173	182
FLAPS 10 (GEAR UP) VREF40+30	**PITCH ATT**	**5.0**	**5.5**	**6.0**	**6.0**	**6.5**
	%N1	**53.9**	**59.3**	**64.1**	**68.2**	**72.0**
	KIAS	137	150	162	173	182
FLAPS 15 (GEAR UP) VREF40+20	**PITCH ATT**	**5.5**	**6.0**	**6.5**	**6.5**	**6.5**
	%N1	**54.0**	**59.7**	**64.6**	**68.8**	**72.7**
	KIAS	127	140	152	163	172
FLAPS 25 (GEAR UP) VREF40+10	**PITCH ATT**	**7.0**	**7.0**	**7.0**	**7.5**	**7.5**
	%N1	**54.9**	**60.7**	**65.7**	**69.9**	**73.9**
	KIAS	117	130	142	153	162
FLAPS 15 (GEAR DOWN) VREF40+20	**PITCH ATT**	**6.0**	**6.0**	**6.5**	**6.5**	**7.0**
	%N1	**58.5**	**64.3**	**69.2**	**73.6**	**77.3**
	KIAS	127	140	152	163	172

Flight With Unreliable Airspeed/Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

TERMINAL AREA (5000 FT)
%N1 for Level Flight
Airport Altitude = 1000 FT

FLAP POSITION (VREF + INCREMENT)		WEIGHT (1000 KG)				
		40	50	60	70	80
FLAPS UP (GEAR UP) VREF40+70	**PITCH ATT**	**5.0**	**5.5**	**6.0**	**6.0**	**6.5**
	%N1	**49.4**	**54.0**	**58.2**	**62.1**	**65.7**
	KIAS	177	190	202	213	223
FLAPS 1 (GEAR UP) VREF40+50	**PITCH ATT**	**5.0**	**5.5**	**6.0**	**6.0**	**6.5**
	%N1	**51.2**	**56.1**	**60.3**	**64.3**	**67.6**
	KIAS	157	170	182	193	203
FLAPS 5 (GEAR UP) VREF40+30	**PITCH ATT**	**5.5**	**6.0**	**6.5**	**6.5**	**7.0**
	%N1	**50.8**	**56.0**	**60.7**	**65.0**	**68.6**
	KIAS	137	150	162	173	183
FLAPS 10 (GEAR UP) VREF40+30	**PITCH ATT**	**5.0**	**5.5**	**6.0**	**6.0**	**6.5**
	%N1	**54.6**	**60.1**	**64.9**	**69.1**	**72.9**
	KIAS	137	150	162	173	183
FLAPS 15 (GEAR UP) VREF40+20	**PITCH ATT**	**5.5**	**6.0**	**6.0**	**6.5**	**6.5**
	%N1	**54.8**	**60.5**	**65.4**	**69.6**	**73.6**
	KIAS	127	140	152	163	173
FLAPS 25 (GEAR UP) VREF40+10	**PITCH ATT**	**7.0**	**7.0**	**7.0**	**7.5**	**7.5**
	%N1	**55.6**	**61.5**	**66.4**	**70.8**	**74.7**
	KIAS	117	130	142	153	163
FLAPS 15 (GEAR DOWN) VREF40+20	**PITCH ATT**	**6.0**	**6.0**	**6.5**	**6.5**	**7.0**
	%N1	**59.3**	**65.2**	**70.0**	**74.5**	**78.2**
	KIAS	127	140	152	163	173

Flight With Unreliable Airspeed/Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

TERMINAL AREA (5000 FT)
%N1 for Level Flight
Airport Altitude = 2000 FT

FLAP POSITION (VREF + INCREMENT)		WEIGHT (1000 KG) 40	50	60	70	80
FLAPS UP (GEAR UP) VREF40+70	**PITCH ATT**	**5.0**	**5.5**	**6.0**	**6.0**	**6.5**
	%N1	**50.1**	**54.7**	**58.9**	**63.0**	**66.5**
	KIAS	177	190	202	213	223
FLAPS 1 (GEAR UP) VREF40+50	**PITCH ATT**	**5.0**	**5.5**	**6.0**	**6.0**	**6.5**
	%N1	**51.9**	**56.8**	**61.1**	**65.0**	**68.4**
	KIAS	157	170	182	193	203
FLAPS 5 (GEAR UP) VREF40+30	**PITCH ATT**	**5.5**	**6.0**	**6.5**	**6.5**	**7.0**
	%N1	**51.5**	**56.8**	**61.6**	**65.8**	**69.4**
	KIAS	137	150	162	173	183
FLAPS 10 (GEAR UP) VREF40+30	**PITCH ATT**	**5.0**	**5.5**	**6.0**	**6.0**	**6.5**
	%N1	**55.3**	**60.9**	**65.7**	**69.9**	**73.7**
	KIAS	137	150	162	173	183
FLAPS 15 (GEAR UP) VREF40+20	**PITCH ATT**	**5.5**	**6.0**	**6.0**	**6.5**	**6.5**
	%N1	**55.5**	**61.3**	**66.2**	**70.5**	**74.4**
	KIAS	127	140	152	163	173
FLAPS 25 (GEAR UP) VREF40+10	**PITCH ATT**	**7.0**	**7.0**	**7.0**	**7.5**	**7.5**
	%N1	**56.4**	**62.3**	**67.2**	**71.7**	**75.5**
	KIAS	117	130	142	153	163
FLAPS 15 (GEAR DOWN) VREF40+20	**PITCH ATT**	**6.0**	**6.0**	**6.5**	**6.5**	**7.0**
	%N1	**60.1**	**65.9**	**70.9**	**75.3**	**79.0**
	KIAS	127	140	152	163	173

Flight With Unreliable Airspeed/Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

TERMINAL AREA (5000 FT)
%N1 for Level Flight
Airport Altitude = 3000 FT

FLAP POSITION (VREF + INCREMENT)		WEIGHT (1000 KG)				
		40	50	60	70	80
FLAPS UP (GEAR UP)	**PITCH ATT**	**5.0**	**5.5**	**6.0**	**6.0**	**6.5**
	%N1	**50.7**	**55.4**	**59.7**	**63.8**	**67.2**
VREF40+70	KIAS	177	190	203	214	223
FLAPS 1 (GEAR UP)	**PITCH ATT**	**5.0**	**5.5**	**6.0**	**6.0**	**6.5**
	%N1	**52.7**	**57.5**	**62.0**	**65.8**	**69.2**
VREF40+50	KIAS	157	170	183	194	203
FLAPS 5 (GEAR UP)	**PITCH ATT**	**5.5**	**6.0**	**6.5**	**6.5**	**7.0**
	%N1	**52.3**	**57.5**	**62.4**	**66.6**	**70.2**
VREF40+30	KIAS	137	150	163	174	183
FLAPS 10 (GEAR UP)	**PITCH ATT**	**5.0**	**5.5**	**6.0**	**6.0**	**6.5**
	%N1	**56.1**	**61.7**	**66.5**	**70.8**	**74.5**
VREF40+30	KIAS	137	150	163	174	183
FLAPS 15 (GEAR UP)	**PITCH ATT**	**5.5**	**6.0**	**6.0**	**6.5**	**6.5**
	%N1	**56.2**	**62.1**	**67.0**	**71.4**	**75.3**
VREF40+20	KIAS	127	140	153	164	173
FLAPS 25 (GEAR UP)	**PITCH ATT**	**7.0**	**7.0**	**7.0**	**7.0**	**7.5**
	%N1	**57.2**	**63.1**	**68.0**	**72.5**	**76.3**
VREF40+10	KIAS	117	130	143	154	163
FLAPS 15 (GEAR DOWN)	**PITCH ATT**	**6.0**	**6.0**	**6.5**	**6.5**	**6.5**
	%N1	**60.9**	**66.7**	**71.8**	**76.1**	**79.9**
VREF40+20	KIAS	127	140	153	164	173

Flight With Unreliable Airspeed/Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

TERMINAL AREA (5000 FT)
%N1 for Level Flight
Airport Altitude = 4000 FT

FLAP POSITION (VREF + INCREMENT)		WEIGHT (1000 KG)				
		40	50	60	70	80
FLAPS UP (GEAR UP) VREF40+70	**PITCH ATT**	**5.0**	**5.5**	**6.0**	**6.0**	**6.5**
	%N1	**51.4**	**56.2**	**60.5**	**64.6**	**68.0**
	KIAS	177	190	203	214	224
FLAPS 1 (GEAR UP) VREF40+50	**PITCH ATT**	**5.0**	**5.5**	**6.0**	**6.0**	**6.5**
	%N1	**53.5**	**58.3**	**62.8**	**66.5**	**70.0**
	KIAS	157	170	183	194	204
FLAPS 5 (GEAR UP) VREF40+30	**PITCH ATT**	**5.5**	**6.0**	**6.5**	**6.5**	**7.0**
	%N1	**53.0**	**58.3**	**63.2**	**67.3**	**71.0**
	KIAS	137	150	163	174	184
FLAPS 10 (GEAR UP) VREF40+30	**PITCH ATT**	**5.0**	**5.5**	**6.0**	**6.0**	**6.5**
	%N1	**56.8**	**62.5**	**67.3**	**71.6**	**75.4**
	KIAS	137	150	163	174	184
FLAPS 15 (GEAR UP) VREF40+20	**PITCH ATT**	**5.5**	**6.0**	**6.0**	**6.5**	**6.5**
	%N1	**57.0**	**62.9**	**67.8**	**72.3**	**76.0**
	KIAS	127	140	153	164	174
FLAPS 25 (GEAR UP) VREF40+10	**PITCH ATT**	**7.0**	**7.0**	**7.0**	**7.0**	**7.5**
	%N1	**58.0**	**64.0**	**68.9**	**73.4**	**77.2**
	KIAS	117	130	143	154	164
FLAPS 15 (GEAR DOWN) VREF40+20	**PITCH ATT**	**6.0**	**6.0**	**6.5**	**6.5**	**6.5**
	%N1	**61.7**	**67.5**	**72.7**	**77.0**	**80.8**
	KIAS	127	140	153	164	174

Flight With Unreliable Airspeed/Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

TERMINAL AREA (5000 FT)
%N1 for Level Flight
Airport Altitude = 5000 FT

FLAP POSITION (VREF + INCREMENT)		WEIGHT (1000 KG) 40	50	60	70	80
FLAPS UP (GEAR UP) VREF40+70	**PITCH ATT**	**5.0**	**5.5**	**6.0**	**6.0**	**6.5**
	%N1	**52.1**	**56.9**	**61.4**	**65.4**	**68.7**
	KIAS	177	190	203	214	224
FLAPS 1 (GEAR UP) VREF40+50	**PITCH ATT**	**5.0**	**5.5**	**6.0**	**6.0**	**6.5**
	%N1	**54.2**	**59.1**	**63.7**	**67.3**	**70.9**
	KIAS	157	170	183	194	204
FLAPS 5 (GEAR UP) VREF40+30	**PITCH ATT**	**5.5**	**6.0**	**6.5**	**6.5**	**7.0**
	%N1	**53.7**	**59.2**	**64.0**	**68.1**	**71.9**
	KIAS	137	150	163	174	184
FLAPS 10 (GEAR UP) VREF40+30	**PITCH ATT**	**5.0**	**5.5**	**6.0**	**6.0**	**6.0**
	%N1	**57.6**	**63.4**	**68.2**	**72.5**	**76.1**
	KIAS	137	150	163	174	184
FLAPS 15 (GEAR UP) VREF40+20	**PITCH ATT**	**5.5**	**6.0**	**6.0**	**6.5**	**6.5**
	%N1	**57.8**	**63.7**	**68.7**	**73.1**	**76.8**
	KIAS	127	140	153	164	174
FLAPS 25 (GEAR UP) VREF40+10	**PITCH ATT**	**7.0**	**7.0**	**7.0**	**7.0**	**7.5**
	%N1	**58.8**	**64.8**	**69.7**	**74.2**	**78.0**
	KIAS	117	130	143	154	164
FLAPS 15 (GEAR DOWN) VREF40+20	**PITCH ATT**	**6.0**	**6.0**	**6.5**	**6.5**	**6.5**
	%N1	**62.5**	**68.3**	**73.6**	**77.8**	**81.7**
	KIAS	127	140	153	164	174

Flight With Unreliable Airspeed/Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

TERMINAL AREA (5000 FT)
%N1 for Level Flight
Airport Altitude = 6000 FT

FLAP POSITION (VREF + INCREMENT)		WEIGHT (1000 KG) 40	50	60	70	80
FLAPS UP (GEAR UP) VREF40+70	**PITCH ATT**	**5.0**	**5.5**	**6.0**	**6.0**	**6.5**
	%N1	**52.8**	**57.6**	**62.3**	**66.1**	**69.5**
	KIAS	177	191	203	215	225
FLAPS 1 (GEAR UP) VREF40+50	**PITCH ATT**	**5.0**	**5.5**	**5.5**	**6.0**	**6.5**
	%N1	**54.9**	**59.9**	**64.4**	**68.2**	**71.8**
	KIAS	157	171	183	195	205
FLAPS 5 (GEAR UP) VREF40+30	**PITCH ATT**	**5.5**	**6.0**	**6.5**	**6.5**	**7.0**
	%N1	**54.4**	**60.0**	**64.8**	**68.9**	**72.8**
	KIAS	137	151	163	175	185
FLAPS 10 (GEAR UP) VREF40+30	**PITCH ATT**	**5.0**	**5.5**	**5.5**	**6.0**	**6.0**
	%N1	**58.4**	**64.2**	**69.0**	**73.3**	**77.0**
	KIAS	137	151	163	175	185
FLAPS 15 (GEAR UP) VREF40+20	**PITCH ATT**	**5.5**	**6.0**	**6.0**	**6.5**	**6.5**
	%N1	**58.6**	**64.6**	**69.5**	**74.0**	**77.6**
	KIAS	127	141	153	165	175
FLAPS 25 (GEAR UP) VREF40+10	**PITCH ATT**	**7.0**	**7.0**	**7.0**	**7.0**	**7.0**
	%N1	**59.6**	**65.5**	**70.7**	**75.0**	**78.9**
	KIAS	117	131	143	155	165
FLAPS 15 (GEAR DOWN) VREF40+20	**PITCH ATT**	**6.0**	**6.0**	**6.0**	**6.5**	**6.5**
	%N1	**63.4**	**69.2**	**74.4**	**78.7**	**82.6**
	KIAS	127	141	153	165	175

Flight With Unreliable Airspeed/Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

TERMINAL AREA (5000 FT)
%N1 for Level Flight
Airport Altitude = 7000 FT

FLAP POSITION (VREF + INCREMENT)		WEIGHT (1000 KG) 40	50	60	70	80
FLAPS UP (GEAR UP) VREF40+70	**PITCH ATT**	**5.0**	**5.5**	**6.0**	**6.0**	**6.5**
	%N1	**53.5**	**58.4**	**63.1**	**66.8**	**70.3**
	KIAS	177	191	204	215	225
FLAPS 1 (GEAR UP) VREF40+50	**PITCH ATT**	**5.0**	**5.5**	**5.5**	**6.0**	**6.5**
	%N1	**55.7**	**60.8**	**65.2**	**69.0**	**72.7**
	KIAS	157	171	184	195	205
FLAPS 5 (GEAR UP) VREF40+30	**PITCH ATT**	**5.5**	**6.0**	**6.5**	**6.5**	**6.5**
	%N1	**55.2**	**60.9**	**65.6**	**69.8**	**73.6**
	KIAS	137	151	164	175	185
FLAPS 10 (GEAR UP) VREF40+30	**PITCH ATT**	**5.0**	**5.5**	**5.5**	**6.0**	**6.0**
	%N1	**59.3**	**65.0**	**69.9**	**74.2**	**77.8**
	KIAS	137	151	164	175	185
FLAPS 15 (GEAR UP) VREF40+20	**PITCH ATT**	**5.5**	**6.0**	**6.0**	**6.0**	**6.5**
	%N1	**59.5**	**65.4**	**70.5**	**74.8**	**78.5**
	KIAS	127	141	154	165	175
FLAPS 25 (GEAR UP) VREF40+10	**PITCH ATT**	**7.0**	**7.0**	**7.0**	**7.0**	**7.0**
	%N1	**60.4**	**66.3**	**71.5**	**75.9**	**79.8**
	KIAS	117	131	144	155	165
FLAPS 15 (GEAR DOWN) VREF40+20	**PITCH ATT**	**6.0**	**6.0**	**6.0**	**6.5**	**6.5**
	%N1	**64.2**	**70.2**	**75.2**	**79.6**	**83.5**
	KIAS	127	141	154	165	175

Flight With Unreliable Airspeed/Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

TERMINAL AREA (5000 FT)
%N1 for Level Flight
Airport Altitude = 8000 FT

FLAP POSITION (VREF + INCREMENT)		WEIGHT (1000 KG) 40	50	60	70	80
FLAPS UP (GEAR UP) VREF40+70	**PITCH ATT**	**5.0**	**5.5**	**6.0**	**6.0**	**6.5**
	%N1	**54.2**	**59.2**	**63.9**	**67.6**	**71.2**
	KIAS	177	191	204	215	225
FLAPS 1 (GEAR UP) VREF40+50	**PITCH ATT**	**5.0**	**5.5**	**5.5**	**6.0**	**6.5**
	%N1	**56.4**	**61.6**	**66.0**	**69.9**	**73.5**
	KIAS	157	171	184	195	205
FLAPS 5 (GEAR UP) VREF40+30	**PITCH ATT**	**5.5**	**6.0**	**6.0**	**6.5**	**6.5**
	%N1	**56.0**	**61.8**	**66.4**	**70.6**	**74.4**
	KIAS	137	151	164	175	185
FLAPS 10 (GEAR UP) VREF40+30	**PITCH ATT**	**5.0**	**5.5**	**5.5**	**6.0**	**6.0**
	%N1	**60.1**	**65.8**	**70.8**	**75.0**	**78.7**
	KIAS	137	151	164	175	185
FLAPS 15 (GEAR UP) VREF40+20	**PITCH ATT**	**5.5**	**6.0**	**6.0**	**6.0**	**6.5**
	%N1	**60.3**	**66.2**	**71.4**	**75.6**	**79.4**
	KIAS	127	141	154	165	175
FLAPS 25 (GEAR UP) VREF40+10	**PITCH ATT**	**7.0**	**7.0**	**7.0**	**7.0**	**7.0**
	%N1	**61.2**	**67.2**	**72.4**	**76.7**	**80.7**
	KIAS	117	131	144	155	165
FLAPS 15 (GEAR DOWN) VREF40+20	**PITCH ATT**	**6.0**	**6.0**	**6.0**	**6.5**	**6.5**
	%N1	**65.0**	**71.0**	**76.1**	**80.6**	**84.5**
	KIAS	127	141	154	165	175

Flight With Unreliable Airspeed/Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

TERMINAL AREA (5000 FT)
%N1 for Level Flight
Airport Altitude = 9000 FT

FLAP POSITION (VREF + INCREMENT)		WEIGHT (1000 KG) 40	50	60	70	80
FLAPS UP (GEAR UP) VREF40+70	**PITCH ATT**	**5.0**	**5.5**	**6.0**	**6.0**	**6.5**
	%N1	**55.0**	**60.1**	**64.7**	**68.4**	**72.0**
	KIAS	177	191	204	216	226
FLAPS 1 (GEAR UP) VREF40+50	**PITCH ATT**	**5.0**	**5.5**	**5.5**	**6.0**	**6.5**
	%N1	**57.2**	**62.5**	**66.8**	**70.8**	**74.3**
	KIAS	157	171	184	196	206
FLAPS 5 (GEAR UP) VREF40+30	**PITCH ATT**	**5.5**	**6.0**	**6.0**	**6.5**	**6.5**
	%N1	**56.8**	**62.6**	**67.2**	**71.5**	**75.2**
	KIAS	137	151	164	176	186
FLAPS 10 (GEAR UP) VREF40+30	**PITCH ATT**	**5.0**	**5.5**	**5.5**	**6.0**	**6.0**
	%N1	**61.0**	**66.7**	**71.7**	**75.8**	**79.6**
	KIAS	137	151	164	176	186
FLAPS 15 (GEAR UP) VREF40+20	**PITCH ATT**	**5.5**	**6.0**	**6.0**	**6.0**	**6.5**
	%N1	**61.1**	**67.0**	**72.2**	**76.4**	**80.3**
	KIAS	127	141	154	166	176
FLAPS 25 (GEAR UP) VREF40+10	**PITCH ATT**	**7.0**	**7.0**	**7.0**	**7.0**	**7.0**
	%N1	**62.1**	**68.0**	**73.3**	**77.6**	**81.6**
	KIAS	117	131	144	156	166
FLAPS 15 (GEAR DOWN) VREF40+20	**PITCH ATT**	**6.0**	**6.0**	**6.0**	**6.5**	**6.5**
	%N1	**65.8**	**71.9**	**77.0**	**81.5**	**85.4**
	KIAS	127	141	154	166	176

Flight With Unreliable Airspeed/Turbulent Air Penetration
Altitude and/or vertical speed indications may also be unreliable.

TERMINAL AREA (5000 FT)
%N1 for Level Flight
Airport Altitude = 10000 FT

FLAP POSITION (VREF + INCREMENT)		WEIGHT (1000 KG) 40	50	60	70	80
FLAPS UP (GEAR UP)	**PITCH ATT**	**5.0**	**5.5**	**5.5**	**6.0**	**6.5**
	%N1	**55.7**	**61.0**	**65.4**	**69.2**	**72.8**
VREF40+70	KIAS	178	192	204	216	226
FLAPS 1 (GEAR UP)	**PITCH ATT**	**5.0**	**5.5**	**5.5**	**6.0**	**6.5**
	%N1	**58.0**	**63.3**	**67.6**	**71.7**	**75.1**
VREF40+50	KIAS	158	172	184	196	206
FLAPS 5 (GEAR UP)	**PITCH ATT**	**5.5**	**6.0**	**6.0**	**6.5**	**6.5**
	%N1	**57.6**	**63.4**	**68.1**	**72.4**	**76.0**
VREF40+30	KIAS	138	152	164	176	186
FLAPS 10 (GEAR UP)	**PITCH ATT**	**5.0**	**5.5**	**5.5**	**6.0**	**6.0**
	%N1	**61.8**	**67.5**	**72.5**	**76.6**	**80.5**
VREF40+30	KIAS	138	152	164	176	186
FLAPS 15 (GEAR UP)	**PITCH ATT**	**5.5**	**6.0**	**6.0**	**6.0**	**6.5**
	%N1	**62.0**	**67.9**	**73.1**	**77.3**	**81.2**
VREF40+20	KIAS	128	142	154	166	176
FLAPS 25 (GEAR UP)	**PITCH ATT**	**7.0**	**7.0**	**7.0**	**7.0**	**7.0**
	%N1	**63.0**	**68.9**	**74.1**	**78.5**	**82.5**
VREF40+10	KIAS	118	132	144	156	166
FLAPS 15 (GEAR DOWN)	**PITCH ATT**	**6.0**	**6.0**	**6.0**	**6.0**	**6.5**
	%N1	**66.6**	**72.9**	**77.9**	**82.4**	**86.3**
VREF40+20	KIAS	128	142	154	166	176

Flight With Unreliable Airspeed/Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

TERMINAL AREA (5000 FT)
%N1 for Level Flight
Airport Altitude = 11000 FT

FLAP POSITION (VREF + INCREMENT)		WEIGHT (1000 KG) 40	50	60	70	80
FLAPS UP (GEAR UP) VREF40+70	**PITCH ATT**	**5.0**	**5.5**	**5.5**	**6.0**	**6.5**
	%N1	**56.5**	**61.9**	**66.1**	**70.0**	**73.6**
	KIAS	178	192	205	216	227
FLAPS 1 (GEAR UP) VREF40+50	**PITCH ATT**	**5.0**	**5.5**	**5.5**	**6.0**	**6.0**
	%N1	**59.0**	**64.1**	**68.6**	**72.6**	**75.9**
	KIAS	158	172	185	196	207
FLAPS 5 (GEAR UP) VREF40+30	**PITCH ATT**	**5.5**	**6.0**	**6.0**	**6.5**	**6.5**
	%N1	**58.7**	**64.3**	**69.1**	**73.2**	**76.9**
	KIAS	138	152	165	176	187
FLAPS 10 (GEAR UP) VREF40+30	**PITCH ATT**	**5.0**	**5.5**	**5.5**	**6.0**	**6.0**
	%N1	**62.8**	**68.6**	**73.4**	**77.6**	**81.5**
	KIAS	138	152	165	176	187
FLAPS 15 (GEAR UP) VREF40+20	**PITCH ATT**	**5.5**	**6.0**	**6.0**	**6.0**	**6.0**
	%N1	**63.0**	**69.0**	**74.0**	**78.3**	**82.2**
	KIAS	128	142	155	166	177
FLAPS 25 (GEAR UP) VREF40+10	**PITCH ATT**	**7.0**	**7.0**	**7.0**	**7.0**	**7.0**
	%N1	**64.0**	**70.1**	**75.1**	**79.5**	**83.5**
	KIAS	118	132	145	156	167
FLAPS 15 (GEAR DOWN) VREF40+20	**PITCH ATT**	**6.0**	**6.0**	**6.0**	**6.0**	**6.5**
	%N1	**67.8**	**73.8**	**79.0**	**83.4**	**87.4**
	KIAS	128	142	155	166	177

Flight With Unreliable Airspeed/Turbulent Air Penetration
Altitude and/or vertical speed indications may also be unreliable.

TERMINAL AREA (5000 FT)
%N1 for Level Flight
Airport Altitude = 12000 FT

FLAP POSITION (VREF + INCREMENT)		WEIGHT (1000 KG) 40	50	60	70	80
FLAPS UP (GEAR UP) VREF40+70	**PITCH ATT**	**5.0**	**5.5**	**5.5**	**6.0**	**6.5**
	%N1	**57.3**	**62.8**	**66.9**	**70.9**	**74.4**
	KIAS	178	192	205	217	227
FLAPS 1 (GEAR UP) VREF40+50	**PITCH ATT**	**5.0**	**5.5**	**5.5**	**6.0**	**6.0**
	%N1	**60.0**	**65.0**	**69.5**	**73.4**	**76.8**
	KIAS	158	172	185	197	207
FLAPS 5 (GEAR UP) VREF40+30	**PITCH ATT**	**5.5**	**6.0**	**6.0**	**6.5**	**6.5**
	%N1	**59.8**	**65.2**	**70.0**	**74.1**	**77.8**
	KIAS	138	152	165	177	187
FLAPS 10 (GEAR UP) VREF40+30	**PITCH ATT**	**5.0**	**5.5**	**5.5**	**6.0**	**6.0**
	%N1	**63.8**	**69.6**	**74.3**	**78.6**	**82.4**
	KIAS	138	152	165	177	187
FLAPS 15 (GEAR UP) VREF40+20	**PITCH ATT**	**5.5**	**6.0**	**6.0**	**6.0**	**6.0**
	%N1	**64.1**	**70.1**	**74.9**	**79.3**	**83.2**
	KIAS	128	142	155	167	177
FLAPS 25 (GEAR UP) VREF40+10	**PITCH ATT**	**7.0**	**7.0**	**7.0**	**7.0**	**7.0**
	%N1	**65.1**	**71.2**	**76.1**	**80.6**	**84.4**
	KIAS	118	132	145	157	167
FLAPS 15 (GEAR DOWN) VREF40+20	**PITCH ATT**	**5.5**	**6.0**	**6.0**	**6.0**	**6.5**
	%N1	**69.0**	**74.8**	**80.0**	**84.4**	**88.5**
	KIAS	128	142	155	167	177

Flight With Unreliable Airspeed/Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

TERMINAL AREA (5000 FT)
%N1 for Level Flight
Airport Altitude = 13000 FT

FLAP POSITION (VREF + INCREMENT)		WEIGHT (1000 KG) 40	50	60	70	80
FLAPS UP (GEAR UP) VREF40+70	**PITCH ATT**	**5.0**	**5.5**	**5.5**	**6.0**	**6.5**
	%N1	**58.2**	**63.5**	**67.7**	**71.7**	**75.2**
	KIAS	178	192	206	217	228
FLAPS 1 (GEAR UP) VREF40+50	**PITCH ATT**	**5.0**	**5.5**	**5.5**	**6.0**	**6.0**
	%N1	**61.0**	**65.8**	**70.4**	**74.2**	**77.7**
	KIAS	158	172	185	197	208
FLAPS 5 (GEAR UP) VREF40+30	**PITCH ATT**	**5.5**	**6.0**	**6.0**	**6.5**	**6.5**
	%N1	**60.8**	**66.1**	**71.0**	**75.0**	**78.8**
	KIAS	138	152	165	177	188
FLAPS 10 (GEAR UP) VREF40+30	**PITCH ATT**	**5.0**	**5.5**	**5.5**	**5.5**	**6.0**
	%N1	**64.7**	**70.6**	**75.2**	**79.5**	**83.4**
	KIAS	138	152	165	177	188
FLAPS 15 (GEAR UP) VREF40+20	**PITCH ATT**	**5.5**	**6.0**	**6.0**	**6.0**	**6.0**
	%N1	**65.1**	**71.1**	**75.8**	**80.3**	**84.1**
	KIAS	128	142	155	167	178
FLAPS 25 (GEAR UP) VREF40+10	**PITCH ATT**	**7.0**	**7.0**	**6.5**	**6.5**	**7.0**
	%N1	**66.2**	**72.2**	**77.2**	**81.6**	**85.4**
	KIAS	118	132	145	157	168
FLAPS 15 (GEAR DOWN) VREF40+20	**PITCH ATT**	**5.5**	**6.0**	**6.0**	**6.0**	**6.5**
	%N1	**70.1**	**75.9**	**81.0**	**85.4**	**89.6**
	KIAS	128	142	155	167	178

Flight With Unreliable Airspeed/Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

TERMINAL AREA (5000 FT)
%N1 for Level Flight
Airport Altitude = 14000 FT

FLAP POSITION (VREF + INCREMENT)		WEIGHT (1000 KG) 40	50	60	70	80
FLAPS UP (GEAR UP) VREF40+70	**PITCH ATT**	**5.0**	**5.5**	**5.5**	**6.0**	**6.5**
	%N1	**59.0**	**64.2**	**68.5**	**72.5**	**76.0**
	KIAS	178	192	205	217	228
FLAPS 1 (GEAR UP) VREF40+50	**PITCH ATT**	**5.0**	**5.5**	**5.5**	**6.0**	**6.0**
	%N1	**61.8**	**66.7**	**71.2**	**75.0**	**78.5**
	KIAS	158	172	185	197	208
FLAPS 5 (GEAR UP) VREF40+30	**PITCH ATT**	**5.5**	**6.0**	**6.0**	**6.5**	**6.5**
	%N1	**61.7**	**67.1**	**71.9**	**75.8**	**79.7**
	KIAS	138	152	165	177	188
FLAPS 10 (GEAR UP) VREF40+30	**PITCH ATT**	**5.0**	**5.5**	**5.5**	**6.0**	**6.0**
	%N1	**65.7**	**71.5**	**76.1**	**80.5**	**84.2**
	KIAS	138	152	165	177	188
FLAPS 15 (GEAR UP) VREF40+20	**PITCH ATT**	**5.5**	**6.0**	**6.0**	**6.0**	**6.0**
	%N1	**66.1**	**72.0**	**76.8**	**81.2**	**85.0**
	KIAS	128	142	155	167	178
FLAPS 25 (GEAR UP) VREF40+10	**PITCH ATT**	**7.0**	**7.0**	**6.5**	**7.0**	**7.0**
	%N1	**67.4**	**73.1**	**78.2**	**82.5**	**86.5**
	KIAS	118	132	145	157	168
FLAPS 15 (GEAR DOWN) VREF40+20	**PITCH ATT**	**5.5**	**6.0**	**6.0**	**6.0**	**6.5**
	%N1	**71.1**	**76.9**	**82.0**	**86.5**	**90.7**
	KIAS	128	142	155	167	178

Flight With Unreliable Airspeed/Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

TERMINAL AREA (5000 FT)
%N1 for Level Flight
Airport Altitude = 14500 FT

FLAP POSITION (VREF + INCREMENT)		WEIGHT (1000 KG)				
		40	50	60	70	80
FLAPS UP (GEAR UP) VREF40+70	**PITCH ATT**	**5.0**	**5.5**	**5.5**	**6.0**	**6.5**
	%N1	**59.5**	**64.5**	**68.9**	**73.0**	**76.5**
	KIAS	178	192	206	217	228
FLAPS 1 (GEAR UP) VREF40+50	**PITCH ATT**	**5.0**	**5.5**	**5.5**	**6.0**	**6.0**
	%N1	**62.2**	**67.1**	**71.7**	**75.4**	**79.0**
	KIAS	158	172	186	197	208
FLAPS 5 (GEAR UP) VREF40+30	**PITCH ATT**	**5.5**	**6.0**	**6.0**	**6.5**	**6.5**
	%N1	**62.1**	**67.6**	**72.3**	**76.3**	**80.1**
	KIAS	138	152	166	177	188
FLAPS 10 (GEAR UP) VREF40+30	**PITCH ATT**	**5.0**	**5.5**	**5.5**	**5.5**	**6.0**
	%N1	**66.2**	**71.9**	**76.6**	**80.9**	**84.7**
	KIAS	138	152	166	177	188
FLAPS 15 (GEAR UP) VREF40+20	**PITCH ATT**	**5.5**	**6.0**	**6.0**	**6.0**	**6.0**
	%N1	**66.7**	**72.4**	**77.4**	**81.7**	**85.5**
	KIAS	128	142	156	167	178
FLAPS 25 (GEAR UP) VREF40+10	**PITCH ATT**	**7.0**	**7.0**	**6.5**	**6.5**	**7.0**
	%N1	**67.9**	**73.6**	**78.7**	**83.0**	**87.0**
	KIAS	118	132	146	157	168
FLAPS 15 (GEAR DOWN) VREF40+20	**PITCH ATT**	**5.5**	**6.0**	**6.0**	**6.0**	**6.5**
	%N1	**71.6**	**77.5**	**82.5**	**87.0**	**91.5**
	KIAS	128	142	156	167	178

Flight With Unreliable Airspeed/Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

FINAL APPROACH (1500 FT)

Gear Down, %N1 for 3° Glideslope

Airport Altitude = -2000 FT

FLAP POSITION (VREF + INCREMENT)		WEIGHT (1000 KG) 40	50	60	70	80
FLAPS 15 VREF15+10	**PITCH ATT**	**3.5**	**3.5**	**4.0**	**4.0**	**4.5**
	%N1	**40.6**	**44.8**	**48.7**	**52.0**	**55.1**
	KIAS	124	137	149	160	169
FLAPS 30 VREF30+10	**PITCH ATT**	**1.5**	**2.0**	**2.0**	**2.0**	**2.5**
	%N1	**44.6**	**49.3**	**53.4**	**57.0**	**60.2**
	KIAS	120	133	144	155	164
FLAPS 40 VREF40+10	**PITCH ATT**	**-0.5**	**0.0**	**0.0**	**0.5**	**0.5**
	%N1	**50.5**	**55.6**	**60.1**	**64.0**	**67.4**
	KIAS	117	130	141	151	160

Flap placard speed exceeded in shaded area.

Airport Altitude = -1000 FT

FLAP POSITION (VREF + INCREMENT)		WEIGHT (1000 KG) 40	50	60	70	80
FLAPS 15 VREF15+10	**PITCH ATT**	**3.5**	**3.5**	**4.0**	**4.0**	**4.0**
	%N1	**41.1**	**45.4**	**49.3**	**52.7**	**55.8**
	KIAS	124	137	149	160	169
FLAPS 30 VREF30+10	**PITCH ATT**	**1.5**	**2.0**	**2.0**	**2.0**	**2.5**
	%N1	**45.2**	**49.9**	**54.1**	**57.7**	**61.0**
	KIAS	120	133	144	155	164
FLAPS 40 VREF40+10	**PITCH ATT**	**-0.5**	**0.0**	**0.0**	**0.5**	**0.5**
	%N1	**51.2**	**56.4**	**60.9**	**64.8**	**68.2**
	KIAS	117	130	141	151	161

Flap placard speed exceeded in shaded area.

Flight With Unreliable Airspeed/Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

FINAL APPROACH (1500 FT)

Gear Down, %N1 for 3° Glideslope

Airport Altitude = SEA LEVEL

FLAP POSITION (VREF + INCREMENT)		WEIGHT (1000 KG) 40	50	60	70	80
FLAPS 15 VREF15+10	**PITCH ATT**	**3.5**	**3.5**	**4.0**	**4.0**	**4.0**
	%N1	**41.6**	**46.0**	**49.9**	**53.4**	**56.5**
	KIAS	124	137	149	160	170
FLAPS 30 VREF30+10	**PITCH ATT**	**1.5**	**2.0**	**2.0**	**2.0**	**2.5**
	%N1	**45.9**	**50.6**	**54.8**	**58.4**	**61.8**
	KIAS	120	133	144	155	164
FLAPS 40 VREF40+10	**PITCH ATT**	**-0.5**	**0.0**	**0.0**	**0.5**	**0.5**
	%N1	**51.9**	**57.1**	**61.7**	**65.7**	**69.0**
	KIAS	117	130	141	152	161

Flap placard speed exceeded in shaded area.

Airport Altitude = 1000 FT

FLAP POSITION (VREF + INCREMENT)		WEIGHT (1000 KG) 40	50	60	70	80
FLAPS 15 VREF15+10	**PITCH ATT**	**3.5**	**3.5**	**4.0**	**4.0**	**4.0**
	%N1	**42.2**	**46.7**	**50.5**	**54.1**	**57.2**
	KIAS	124	137	149	160	170
FLAPS 30 VREF30+10	**PITCH ATT**	**1.5**	**2.0**	**2.0**	**2.0**	**2.5**
	%N1	**46.5**	**51.3**	**55.5**	**59.2**	**62.6**
	KIAS	120	133	144	155	164
FLAPS 40 VREF40+10	**PITCH ATT**	**-0.5**	**0.0**	**0.0**	**0.5**	**0.5**
	%N1	**52.6**	**57.8**	**62.5**	**66.5**	**69.9**
	KIAS	117	130	141	152	161

Flap placard speed exceeded in shaded area.

Flight With Unreliable Airspeed/Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

FINAL APPROACH (1500 FT)

Gear Down, %N1 for 3° Glideslope

Airport Altitude = 2000 FT

FLAP POSITION (VREF + INCREMENT)		WEIGHT (1000 KG)				
		40	50	60	70	80
FLAPS 15 VREF15+10	**PITCH ATT**	**3.5**	**3.5**	**4.0**	**4.0**	**4.0**
	%N1	**42.7**	**47.4**	**51.2**	**54.8**	**57.9**
	KIAS	124	137	149	160	170
FLAPS 30 VREF30+10	**PITCH ATT**	**1.5**	**2.0**	**2.0**	**2.0**	**2.5**
	%N1	**47.1**	**52.0**	**56.2**	**60.0**	**63.4**
	KIAS	120	133	144	155	164
FLAPS 40 VREF40+10	**PITCH ATT**	**-0.5**	**0.0**	**0.0**	**0.5**	**0.5**
	%N1	**53.3**	**58.6**	**63.3**	**67.3**	**70.7**
	KIAS	117	130	142	152	162

Flap placard speed exceeded in shaded area.

Airport Altitude = 3000 FT

FLAP POSITION (VREF + INCREMENT)		WEIGHT (1000 KG)				
		40	50	60	70	80
FLAPS 15 VREF15+10	**PITCH ATT**	**3.5**	**3.5**	**4.0**	**4.0**	**4.0**
	%N1	**43.3**	**48.0**	**51.9**	**55.5**	**58.7**
	KIAS	124	137	149	160	170
FLAPS 30 VREF30+10	**PITCH ATT**	**1.5**	**2.0**	**2.0**	**2.0**	**2.5**
	%N1	**47.8**	**52.7**	**56.9**	**60.8**	**64.2**
	KIAS	120	133	144	155	164
FLAPS 40 VREF40+10	**PITCH ATT**	**-0.5**	**0.0**	**0.0**	**0.5**	**0.5**
	%N1	**54.0**	**59.4**	**64.1**	**68.1**	**71.6**
	KIAS	117	130	142	152	162

Flap placard speed exceeded in shaded area.

Flight With Unreliable Airspeed/Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

FINAL APPROACH (1500 FT)

Gear Down, %N1 for 3° Glideslope

Airport Altitude = 4000 FT

FLAP POSITION (VREF + INCREMENT)		WEIGHT (1000 KG) 40	50	60	70	80
FLAPS 15 VREF15+10	**PITCH ATT**	**3.5**	**3.5**	**4.0**	**4.0**	**4.0**
	%N1	**43.9**	**48.6**	**52.6**	**56.2**	**59.4**
	KIAS	124	137	149	161	170
FLAPS 30 VREF30+10	**PITCH ATT**	**1.5**	**2.0**	**2.0**	**2.0**	**2.5**
	%N1	**48.4**	**53.4**	**57.7**	**61.6**	**65.0**
	KIAS	120	133	145	155	165
FLAPS 40 VREF40+10	**PITCH ATT**	**-0.5**	**0.0**	**0.0**	**0.0**	**0.5**
	%N1	**54.7**	**60.2**	**64.9**	**68.9**	**72.5**
	KIAS	117	130	142	152	162

Flap placard speed exceeded in shaded area.

Airport Altitude = 5000 FT

FLAP POSITION (VREF + INCREMENT)		WEIGHT (1000 KG) 40	50	60	70	80
FLAPS 15 VREF15+10	**PITCH ATT**	**3.5**	**3.5**	**4.0**	**4.0**	**4.0**
	%N1	**44.6**	**49.2**	**53.4**	**56.9**	**60.2**
	KIAS	124	137	150	161	171
FLAPS 30 VREF30+10	**PITCH ATT**	**1.5**	**2.0**	**2.0**	**2.0**	**2.5**
	%N1	**49.1**	**54.1**	**58.4**	**62.4**	**65.8**
	KIAS	120	133	145	155	165
FLAPS 40 VREF40+10	**PITCH ATT**	**-0.5**	**0.0**	**0.0**	**0.0**	**0.5**
	%N1	**55.5**	**61.0**	**65.7**	**69.7**	**73.4**
	KIAS	117	130	142	153	162

Flap placard speed exceeded in shaded area.

Flight With Unreliable Airspeed/Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

FINAL APPROACH (1500 FT)

Gear Down, %N1 for 3° Glideslope

Airport Altitude = 6000 FT

FLAP POSITION (VREF + INCREMENT)		WEIGHT (1000 KG)				
		40	50	60	70	80
FLAPS 15 VREF15+10	**PITCH ATT**	**3.5**	**3.5**	**3.5**	**4.0**	**4.0**
	%N1	**45.2**	**49.9**	**54.0**	**57.7**	**61.0**
	KIAS	124	137	150	161	171
FLAPS 30 VREF30+10	**PITCH ATT**	**1.5**	**2.0**	**2.0**	**2.0**	**2.5**
	%N1	**49.7**	**54.8**	**59.2**	**63.2**	**66.6**
	KIAS	120	133	145	156	165
FLAPS 40 VREF40+10	**PITCH ATT**	**-0.5**	**0.0**	**0.0**	**0.0**	**0.5**
	%N1	**56.2**	**61.7**	**66.5**	**70.6**	**74.3**
	KIAS	117	130	142	153	163

Flap placard speed exceeded in shaded area.

Airport Altitude = 7000 FT

FLAP POSITION (VREF + INCREMENT)		WEIGHT (1000 KG)				
		40	50	60	70	80
FLAPS 15 VREF15+10	**PITCH ATT**	**3.5**	**3.5**	**3.5**	**4.0**	**4.0**
	%N1	**45.9**	**50.5**	**54.8**	**58.4**	**61.8**
	KIAS	124	137	150	161	171
FLAPS 30 VREF30+10	**PITCH ATT**	**1.5**	**2.0**	**2.0**	**2.0**	**2.5**
	%N1	**50.5**	**55.5**	**60.1**	**64.0**	**67.3**
	KIAS	120	133	145	156	165
FLAPS 40 VREF40+10	**PITCH ATT**	**-0.5**	**0.0**	**0.0**	**0.0**	**0.5**
	%N1	**57.0**	**62.5**	**67.3**	**71.6**	**75.2**
	KIAS	117	130	142	153	163

Flap placard speed exceeded in shaded area.

Flight With Unreliable Airspeed/Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

FINAL APPROACH (1500 FT)

Gear Down, %N1 for 3° Glideslope

Airport Altitude = 8000 FT

FLAP POSITION (VREF + INCREMENT)		WEIGHT (1000 KG) 40	50	60	70	80
FLAPS 15 VREF15+10	**PITCH ATT**	**3.5**	**3.5**	**3.5**	**4.0**	**4.0**
	%N1	**46.6**	**51.2**	**55.5**	**59.2**	**62.6**
	KIAS	124	137	150	161	171
FLAPS 30 VREF30+10	**PITCH ATT**	**1.5**	**2.0**	**2.0**	**2.0**	**2.5**
	%N1	**51.2**	**56.2**	**60.9**	**64.8**	**68.1**
	KIAS	120	133	145	156	165
FLAPS 40 VREF40+10	**PITCH ATT**	**-0.5**	**0.0**	**0.0**	**0.0**	**0.0**
	%N1	**57.8**	**63.4**	**68.2**	**72.4**	**76.0**
	KIAS	117	130	143	154	163

Flap placard speed exceeded in shaded area.

Airport Altitude = 9000 FT

FLAP POSITION (VREF + INCREMENT)		WEIGHT (1000 KG) 40	50	60	70	80
FLAPS 15 VREF15+10	**PITCH ATT**	**3.5**	**3.5**	**3.5**	**4.0**	**4.0**
	%N1	**47.2**	**52.0**	**56.2**	**60.0**	**63.4**
	KIAS	124	137	150	162	172
FLAPS 30 VREF30+10	**PITCH ATT**	**1.5**	**2.0**	**2.0**	**2.0**	**2.0**
	%N1	**51.9**	**57.0**	**61.7**	**65.6**	**69.0**
	KIAS	120	133	145	156	166
FLAPS 40 VREF40+10	**PITCH ATT**	**-0.5**	**0.0**	**0.0**	**0.0**	**0.0**
	%N1	**58.5**	**64.2**	**69.0**	**73.3**	**76.8**
	KIAS	117	130	143	154	164

Flap placard speed exceeded in shaded area.

Flight With Unreliable Airspeed/Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

FINAL APPROACH (1500 FT)

Gear Down, %N1 for 3° Glideslope

Airport Altitude = 10000 FT

FLAP POSITION (VREF + INCREMENT)		WEIGHT (1000 KG) 40	50	60	70	80
FLAPS 15 VREF15+10	**PITCH ATT**	**3.5**	**3.5**	**3.5**	**4.0**	**4.0**
	%N1	**47.8**	**52.7**	**57.0**	**60.8**	**64.1**
	KIAS	124	137	150	162	172
FLAPS 30 VREF30+10	**PITCH ATT**	**1.5**	**2.0**	**2.0**	**2.0**	**2.0**
	%N1	**52.6**	**57.8**	**62.5**	**66.4**	**69.8**
	KIAS	120	133	145	156	166
FLAPS 40 VREF40+10	**PITCH ATT**	**-0.5**	**0.0**	**0.0**	**0.0**	**0.0**
	%N1	**59.4**	**65.0**	**70.0**	**74.2**	**77.7**
	KIAS	117	130	143	154	164

Flap placard speed exceeded in shaded area.

Airport Altitude = 11000 FT

FLAP POSITION (VREF + INCREMENT)		WEIGHT (1000 KG) 40	50	60	70	80
FLAPS 15 VREF15+10	**PITCH ATT**	**3.5**	**3.5**	**3.5**	**4.0**	**4.0**
	%N1	**48.5**	**53.4**	**57.7**	**61.6**	**64.8**
	KIAS	124	138	151	162	172
FLAPS 30 VREF30+10	**PITCH ATT**	**1.5**	**2.0**	**2.0**	**2.0**	**2.0**
	%N1	**53.3**	**58.6**	**63.3**	**67.2**	**70.6**
	KIAS	120	133	146	157	166
FLAPS 40 VREF40+10	**PITCH ATT**	**-0.5**	**0.0**	**0.0**	**0.0**	**0.0**
	%N1	**60.2**	**65.8**	**70.9**	**75.1**	**78.6**
	KIAS	117	131	143	155	165

Flap placard speed exceeded in shaded area.

Flight With Unreliable Airspeed/Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

FINAL APPROACH (1500 FT)

Gear Down, %N1 for 3° Glideslope

Airport Altitude = 12000 FT

FLAP POSITION (VREF + INCREMENT)		WEIGHT (1000 KG)				
		40	50	60	70	80
FLAPS 15 VREF15+10	**PITCH ATT**	**3.5**	**3.5**	**3.5**	**3.5**	**4.0**
	%N1	**49.1**	**54.2**	**58.5**	**62.5**	**65.6**
	KIAS	124	138	151	162	172
FLAPS 30 VREF30+10	**PITCH ATT**	**1.5**	**2.0**	**2.0**	**2.0**	**2.0**
	%N1	**54.0**	**59.5**	**64.1**	**68.0**	**71.5**
	KIAS	120	133	146	157	166
FLAPS 40 VREF40+10	**PITCH ATT**	**-0.5**	**0.0**	**0.0**	**0.0**	**0.0**
	%N1	**61.0**	**66.7**	**71.8**	**75.9**	**79.5**
	KIAS	117	131	144	155	165

Flap placard speed exceeded in shaded area.

Airport Altitude = 13000 FT

FLAP POSITION (VREF + INCREMENT)		WEIGHT (1000 KG)				
		40	50	60	70	80
FLAPS 15 VREF15+10	**PITCH ATT**	**3.5**	**3.5**	**3.5**	**3.5**	**4.0**
	%N1	**49.9**	**54.9**	**59.4**	**63.2**	**66.3**
	KIAS	124	138	151	163	173
FLAPS 30 VREF30+10	**PITCH ATT**	**1.5**	**2.0**	**2.0**	**2.0**	**2.0**
	%N1	**54.8**	**60.3**	**65.0**	**68.8**	**72.3**
	KIAS	120	133	146	157	167
FLAPS 40 VREF40+10	**PITCH ATT**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**
	%N1	**61.8**	**67.6**	**72.7**	**76.8**	**80.5**
	KIAS	117	131	144	155	165

Flap placard speed exceeded in shaded area.

Flight With Unreliable Airspeed/Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

FINAL APPROACH (1500 FT)

Gear Down, %N1 for 3° Glideslope

Airport Altitude = 14000 FT

FLAP POSITION (VREF + INCREMENT)		WEIGHT (1000 KG) 40	50	60	70	80
FLAPS 15 VREF15+10	**PITCH ATT**	**3.5**	**3.5**	**3.5**	**3.5**	**4.0**
	%N1	**50.7**	**55.7**	**60.3**	**63.9**	**67.1**
	KIAS	124	138	151	163	173
FLAPS 30 VREF30+10	**PITCH ATT**	**1.5**	**1.5**	**2.0**	**2.0**	**2.0**
	%N1	**55.7**	**61.3**	**65.8**	**69.8**	**73.1**
	KIAS	120	134	146	157	167
FLAPS 40 VREF40+10	**PITCH ATT**	**-0.5**	**0.0**	**-0.5**	**0.0**	**0.0**
	%N1	**62.8**	**68.6**	**73.6**	**77.8**	**81.5**
	KIAS	117	131	144	156	166

Flap placard speed exceeded in shaded area.

Airport Altitude = 14500 FT

FLAP POSITION (VREF + INCREMENT)		WEIGHT (1000 KG) 40	50	60	70	80
FLAPS 15 VREF15+10	**PITCH ATT**	**3.5**	**3.5**	**3.5**	**3.5**	**4.0**
	%N1	**51.2**	**56.2**	**60.8**	**64.3**	**67.5**
	KIAS	124	138	151	163	173
FLAPS 30 VREF30+10	**PITCH ATT**	**1.5**	**1.5**	**2.0**	**2.0**	**2.0**
	%N1	**56.2**	**61.8**	**66.3**	**70.3**	**73.6**
	KIAS	120	134	146	157	167
FLAPS 40 VREF40+10	**PITCH ATT**	**-0.5**	**0.0**	**-0.5**	**0.0**	**0.0**
	%N1	**63.3**	**69.2**	**74.1**	**78.3**	**82.0**
	KIAS	118	131	144	156	166

Flap placard speed exceeded in shaded area.

Flight With Unreliable Airspeed/Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

GO-AROUND

Flaps 1, Gear Up, Set Go-Around Thrust

PRESSURE ALTITUDE (FT)		WEIGHT (1000 KG)				
		40	50	60	70	80
14000	**PITCH ATT**	**17.0**	**14.0**	**12.0**	**11.0**	**10.0**
	V/S (FT/MIN)	4200	3300	2600	2100	1700
	KIAS	157	171	184	196	206
10000	**PITCH ATT**	**19.5**	**16.0**	**14.0**	**12.5**	**11.5**
	V/S (FT/MIN)	4800	3800	3100	2500	2100
	KIAS	157	170	183	194	204
5000	**PITCH ATT**	**22.5**	**18.5**	**15.5**	**14.0**	**12.5**
	V/S (FT/MIN)	5200	4200	3400	2900	2400
	KIAS	157	170	182	193	202
SEA LEVEL	**PITCH ATT**	**25.0**	**20.5**	**17.5**	**15.5**	**14.0**
	V/S (FT/MIN)	5600	4500	3700	3100	2700
	KIAS	157	170	181	192	201
-2000	**PITCH ATT**	**25.5**	**20.5**	**17.5**	**15.5**	**14.0**
	V/S (FT/MIN)	5500	4400	3700	3100	2600
	KIAS	157	170	181	191	200

Flaps 5, Gear Up, Set Go-Around Thrust

PRESSURE ALTITUDE (FT)		WEIGHT (1000 KG)				
		40	50	60	70	80
14000	**PITCH ATT**	**18.0**	**15.0**	**13.0**	**11.5**	**10.5**
	V/S (FT/MIN)	3800	3000	2400	1900	1500
	KIAS	137	151	164	176	186
10000	**PITCH ATT**	**21.0**	**17.0**	**14.5**	**13.0**	**12.0**
	V/S (FT/MIN)	4300	3400	2800	2300	1900
	KIAS	137	150	163	174	184
5000	**PITCH ATT**	**23.5**	**19.0**	**16.5**	**14.5**	**13.0**
	V/S (FT/MIN)	4700	3800	3100	2600	2200
	KIAS	137	150	162	173	182
SEA LEVEL	**PITCH ATT**	**26.0**	**21.5**	**18.0**	**16.0**	**14.5**
	V/S (FT/MIN)	5000	4100	3400	2900	2400
	KIAS	137	150	161	172	181
-2000	**PITCH ATT**	**26.5**	**21.5**	**18.5**	**16.5**	**15.0**
	V/S (FT/MIN)	5000	4000	3400	2800	2400
	KIAS	137	150	161	171	180

Only authorized operators may use Flaps 5 for a Go-Around in conjunction with the Alternate Go-Around and Missed Approach Procedure.

Flight With Unreliable Airspeed/Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

GO-AROUND

Flaps 15, Gear Up, Set Go-Around Thrust

PRESSURE ALTITUDE (FT)		WEIGHT (1000 KG)				
		40	50	60	70	80
14000	**PITCH ATT**	**17.5**	**14.0**	**12.0**	**10.5**	**9.5**
	V/S (FT/MIN)	3300	2600	2000	1500	1200
	KIAS	127	141	154	166	176
10000	**PITCH ATT**	**20.0**	**16.5**	**13.5**	**12.0**	**10.5**
	V/S (FT/MIN)	3800	3000	2400	1900	1500
	KIAS	127	140	153	164	174
5000	**PITCH ATT**	**23.0**	**18.5**	**15.5**	**13.5**	**12.0**
	V/S (FT/MIN)	4200	3400	2700	2200	1800
	KIAS	127	140	152	163	172
SEA LEVEL	**PITCH ATT**	**25.5**	**20.5**	**17.5**	**15.0**	**13.5**
	V/S (FT/MIN)	4600	3700	3000	2500	2100
	KIAS	127	140	151	162	171
-2000	**PITCH ATT**	**26.0**	**21.0**	**17.5**	**15.5**	**14.0**
	V/S (FT/MIN)	4500	3600	3000	2500	2000
	KIAS	127	140	151	161	170

Long Range Cruise Maximum Operating Altitude

Max Cruise Thrust

ISA + 10°C and Below

WEIGHT (1000 KG)	OPTIMUM ALT (FT)	TAT (°C)	MARGIN TO INITIAL BUFFET 'G' (BANK ANGLE)				
			1.20 (33°)	1.25 (36°)	1.30 (39°)	1.40 (44°)	1.50 (48°)
85	31000	-8	34200*	33900	33000	31500	30000
80	32300	-10	35700*	35200	34300	32800	31400
75	33700	-14	37000*	36500	35700	34200	32700
70	35200	-17	38300*	37900	37100	35600	34200
65	36700	-19	39700*	39500	38600	37200	35800
60	38400	-19	41000	41000	40300	38800	37400
55	40200	-19	41000	41000	41000	40600	39200
50	41000	-19	41000	41000	41000	41000	41000
45	41000	-19	41000	41000	41000	41000	41000
40	41000	-19	41000	41000	41000	41000	41000

ISA + 15°C

WEIGHT (1000 KG)	OPTIMUM ALT (FT)	TAT (°C)	MARGIN TO INITIAL BUFFET 'G' (BANK ANGLE)				
			1.20 (33°)	1.25 (36°)	1.30 (39°)	1.40 (44°)	1.50 (48°)
85	31000	-2	32900*	32900*	32900*	31500	30000
80	32300	-5	34600*	34600*	34300	32800	31400
75	33700	-8	36100*	36100*	35700	34200	32700
70	35200	-11	37500*	37500*	37100	35600	34200
65	36700	-13	38900*	38900*	38600	37200	35800
60	38400	-13	40300*	40300*	40300	38800	37400
55	40200	-13	41000	41000	41000	40600	39200
50	41000	-13	41000	41000	41000	41000	41000
45	41000	-13	41000	41000	41000	41000	41000
40	41000	-13	41000	41000	41000	41000	41000

ISA + 20°C

WEIGHT (1000 KG)	OPTIMUM ALT (FT)	TAT (°C)	MARGIN TO INITIAL BUFFET 'G' (BANK ANGLE)				
			1.20 (33°)	1.25 (36°)	1.30 (39°)	1.40 (44°)	1.50 (48°)
85	31000	4	30400*	30400*	30400*	30400*	30000
80	32300	1	32900*	32900*	32900*	32800	31400
75	33700	-2	34800*	34800*	34800*	34200	32700
70	35200	-6	36300*	36300*	36300*	35600	34200
65	36700	-8	37800*	37800*	37800*	37200	35800
60	38400	-8	39200*	39200*	39200*	38800	37400
55	40200	-8	40700*	40700*	40700*	40600	39200
50	41000	-8	41000	41000	41000	41000	41000
45	41000	-8	41000	41000	41000	41000	41000
40	41000	-8	41000	41000	41000	41000	41000

***Denotes altitude thrust limited in level flight, 100 fpm residual rate of climb.**

Long Range Cruise Control

WEIGHT (1000 KG)		PRESSURE ALTITUDE (1000 FT) 25	27	29	31	33	35	37	39	41
85	%N1	84.8	85.9	87.1	88.5	90.5				
	MACH	.740	.756	.769	.781	.789				
	KIAS	310	305	297	290	280				
	FF/ENG	1521	1505	1488	1480	1503				
80	%N1	83.5	84.7	85.9	87.2	88.7	91.3			
	MACH	.725	.745	.760	.773	.785	.788			
	KIAS	304	300	294	286	279	267			
	FF/ENG	1440	1429	1412	1395	1395	1431			
75	%N1	82.1	83.4	84.6	85.9	87.1	88.9	92.9		
	MACH	.707	.731	.750	.764	.777	.787	.784		
	KIAS	295	294	289	283	275	267	254		
	FF/ENG	1354	1350	1338	1319	1304	1313	1371		
70	%N1	80.5	82.0	83.3	84.5	85.8	87.1	89.6		
	MACH	.685	.712	.736	.754	.767	.780	.789		
	KIAS	286	286	283	279	272	264	256		
	FF/ENG	1262	1266	1260	1246	1226	1216	1244		
65	%N1	78.8	80.3	81.8	83.1	84.3	85.6	87.4	90.7	
	MACH	.663	.690	.717	.740	.757	.770	.783	.789	
	KIAS	276	276	275	273	268	261	254	244	
	FF/ENG	1169	1176	1178	1170	1154	1135	1141	1179	
60	%N1	77.1	78.4	80.0	81.4	82.8	84.0	85.6	88.0	91.9
	MACH	.642	.665	.693	.720	.742	.759	.772	.785	.788
	KIAS	267	265	266	265	262	257	250	243	233
	FF/ENG	1083	1082	1089	1089	1079	1062	1055	1069	1111
55	%N1	75.3	76.6	78.0	79.5	81.0	82.3	84.0	86.0	88.5
	MACH	.621	.642	.666	.694	.721	.744	.760	.773	.786
	KIAS	257	256	255	255	254	251	245	239	232
	FF/ENG	1003	996	996	1000	999	989	980	979	994
50	%N1	73.3	74.6	76.0	77.4	78.9	80.5	82.1	84.2	86.2
	MACH	.598	.619	.641	.664	.693	.721	.744	.760	.773
	KIAS	248	246	244	243	243	243	240	234	228
	FF/ENG	930	916	910	908	911	909	905	903	902
45	%N1	71.1	72.5	73.8	75.2	76.6	78.1	80.1	82.2	84.3
	MACH	.571	.594	.615	.637	.661	.689	.718	.742	.759
	KIAS	236	235	234	232	231	231	231	228	223
	FF/ENG	851	843	832	824	821	822	833	836	834
40	%N1	68.4	70.0	71.4	72.8	74.1	75.6	77.5	79.8	82.0
	MACH	.541	.563	.587	.609	.631	.655	.682	.712	.737
	KIAS	223	223	223	222	220	219	218	218	216
	FF/ENG	785	779	771	759	749	743	746	754	757

Shaded area approximates optimum altitude.

Long Range Cruise Enroute Fuel and Time - Low Altitudes
Ground to Air Miles Conversions

AIR DISTANCE (NM)					GROUND DISTANCE (NM)	AIR DISTANCE (NM)				
HEADWIND COMPONENT (KTS)						TAILWIND COMPONENT (KTS)				
100	80	60	40	20		20	40	60	80	100
294	269	248	230	214	200	190	181	173	166	159
442	404	371	344	321	300	286	272	260	249	239
590	540	496	459	428	400	381	363	347	332	319
739	676	621	575	535	500	476	454	434	415	399
888	812	746	690	642	600	571	544	520	498	479
1038	949	871	806	750	700	667	636	607	582	559
1188	1086	996	921	857	800	762	727	694	665	638
1339	1224	1122	1037	965	900	857	817	781	747	718
1490	1361	1248	1153	1072	1000	952	908	867	830	797
1642	1499	1374	1269	1180	1100	1047	998	954	913	877
1794	1637	1500	1385	1287	1200	1142	1089	1040	996	956
1947	1776	1626	1501	1395	1300	1237	1180	1127	1079	1036
2101	1916	1753	1618	1502	1400	1332	1270	1213	1161	1115
2255	2055	1880	1734	1610	1500	1428	1361	1300	1244	1195
2409	2195	2007	1851	1718	1600	1523	1451	1386	1327	1274
2564	2335	2134	1968	1826	1700	1618	1542	1473	1410	1353
2720	2476	2262	2084	1934	1800	1713	1633	1559	1492	1432
2876	2617	2390	2201	2042	1900	1808	1723	1645	1574	1511
3033	2758	2518	2318	2150	2000	1903	1813	1731	1657	1590

Reference Fuel And Time Required at Check Point

AIR DIST (NM)	PRESSURE ALTITUDE (1000 FT)									
	10		14		20		24		28	
	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)
200	1.4	0:42	1.3	0:40	1.1	0:38	0.9	0:37	0.8	0:36
300	2.2	1:01	1.9	0:58	1.7	0:54	1.5	0:52	1.4	0:51
400	2.9	1:21	2.6	1:17	2.3	1:11	2.1	1:08	1.9	1:06
500	3.6	1:40	3.3	1:35	2.9	1:28	2.6	1:24	2.4	1:21
600	4.4	2:00	4.0	1:54	3.5	1:45	3.2	1:40	3.0	1:36
700	5.1	2:20	4.7	2:12	4.1	2:02	3.7	1:56	3.5	1:51
800	5.9	2:40	5.4	2:31	4.7	2:19	4.3	2:12	4.0	2:06
900	6.6	3:00	6.1	2:50	5.3	2:36	4.8	2:28	4.5	2:22
1000	7.3	3:21	6.7	3:09	5.9	2:53	5.4	2:45	5.0	2:37
1100	8.0	3:41	7.4	3:28	6.5	3:11	5.9	3:01	5.6	2:52
1200	8.7	4:02	8.1	3:47	7.1	3:28	6.5	3:17	6.1	3:08
1300	9.5	4:23	8.7	4:07	7.7	3:46	7.0	3:34	6.6	3:23
1400	10.2	4:44	9.4	4:26	8.3	4:03	7.6	3:50	7.1	3:39
1500	10.9	5:05	10.0	4:46	8.9	4:21	8.1	4:07	7.6	3:55
1600	11.6	5:26	10.7	5:06	9.5	4:39	8.7	4:23	8.1	4:10
1700	12.3	5:47	11.4	5:26	10.1	4:57	9.2	4:40	8.6	4:26
1800	13.0	6:09	12.0	5:46	10.7	5:15	9.7	4:57	9.1	4:42
1900	13.7	6:30	12.6	6:06	11.2	5:33	10.2	5:14	9.6	4:58
2000	14.3	6:52	13.3	6:26	11.8	5:51	10.8	5:31	10.1	5:14

Long Range Cruise Enroute Fuel and Time - Low Altitudes
Fuel Required Adjustments (1000 KG)

REFERENCE FUEL REQUIRED (1000 KG)	WEIGHT AT CHECK POINT (1000 KG)				
	40	50	60	70	80
1	-0.1	0.0	0.0	0.1	0.1
2	-0.2	-0.1	0.0	0.1	0.3
3	-0.4	-0.2	0.0	0.2	0.5
4	-0.5	-0.3	0.0	0.3	0.6
5	-0.7	-0.3	0.0	0.4	0.8
6	-0.8	-0.4	0.0	0.5	1.0
7	-0.9	-0.5	0.0	0.6	1.2
8	-1.0	-0.5	0.0	0.7	1.4
9	-1.2	-0.6	0.0	0.8	1.6
10	-1.3	-0.7	0.0	0.9	1.7
11	-1.4	-0.8	0.0	1.0	1.9
12	-1.6	-0.8	0.0	1.1	2.1
13	-1.7	-0.9	0.0	1.2	2.3
14	-1.8	-1.0	0.0	1.3	2.5
15	-1.9	-1.0	0.0	1.4	2.7

Based on .78/280/250 descent.

Long Range Cruise Enroute Fuel and Time - High Altitudes
Ground to Air Miles Conversions

AIR DISTANCE (NM)					GROUND DISTANCE (NM)	AIR DISTANCE (NM)				
HEADWIND COMPONENT (KTS)						TAILWIND COMPONENT (KTS)				
100	80	60	40	20		20	40	60	80	100
537	503	472	445	422	400	382	365	350	336	324
803	753	707	667	632	600	573	548	526	505	486
1070	1003	943	890	843	800	765	732	702	674	649
1337	1254	1179	1113	1054	1000	956	915	878	843	812
1605	1505	1415	1335	1264	1200	1147	1099	1054	1012	975
1874	1757	1651	1558	1475	1400	1339	1282	1230	1181	1138
2144	2009	1888	1781	1686	1600	1530	1465	1405	1350	1300
2413	2262	2125	2005	1898	1800	1721	1648	1581	1519	1463
2684	2515	2362	2228	2109	2000	1913	1831	1756	1688	1625
2956	2769	2600	2452	2320	2200	2104	2014	1932	1856	1787
3228	3023	2838	2676	2531	2400	2295	2198	2107	2024	1949
3502	3278	3076	2900	2743	2600	2486	2380	2283	2193	2111
3775	3534	3315	3124	2954	2800	2677	2563	2458	2361	2273
4050	3789	3554	3349	3166	3000	2868	2746	2633	2529	2435
4325	4046	3794	3573	3378	3200	3059	2928	2807	2697	2596
4602	4303	4034	3798	3590	3400	3250	3110	2982	2864	2757
4878	4561	4274	4024	3802	3600	3441	3293	3157	3032	2919
5156	4819	4515	4249	4014	3800	3632	3475	3331	3199	3079
5435	5078	4756	4475	4226	4000	3822	3658	3506	3366	3240
5715	5338	4997	4701	4438	4200	4013	3839	3679	3533	3400
5996	5598	5239	4927	4651	4400	4203	4021	3853	3699	3560
6278	5859	5482	5154	4864	4600	4394	4203	4027	3866	3720
6562	6122	5725	5381	5076	4800	4584	4384	4200	4032	3879
6846	6385	5969	5608	5289	5000	4775	4566	4374	4198	4038

Long Range Cruise Enroute Fuel and Time - High Altitudes

Reference Fuel And Time Required at Check Point

AIR DIST (NM)	PRESSURE ALTITUDE (1000 FT)									
	29		31		33		35		37	
	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)
400	1.9	1:05	1.8	1:03	1.7	1:02	1.7	1:02	1.6	1:01
600	2.9	1:35	2.8	1:32	2.7	1:30	2.6	1:29	2.6	1:29
800	3.9	2:05	3.8	2:01	3.7	1:59	3.6	1:57	3.5	1:56
1000	5.0	2:35	4.8	2:30	4.7	2:27	4.5	2:25	4.4	2:23
1200	6.0	3:05	5.8	3:00	5.6	2:56	5.4	2:53	5.3	2:51
1400	7.0	3:36	6.8	3:30	6.6	3:24	6.3	3:21	6.2	3:18
1600	8.0	4:07	7.7	4:00	7.5	3:53	7.3	3:49	7.1	3:46
1800	8.9	4:38	8.7	4:30	8.4	4:22	8.2	4:17	8.0	4:13
2000	9.9	5:09	9.6	5:00	9.3	4:52	9.1	4:46	8.8	4:41
2200	10.9	5:41	10.6	5:31	10.2	5:22	9.9	5:15	9.7	5:09
2400	11.8	6:13	11.5	6:02	11.2	5:51	10.8	5:43	10.5	5:37
2600	12.8	6:45	12.4	6:33	12.0	6:21	11.7	6:12	11.4	6:05
2800	13.7	7:18	13.3	7:05	12.9	6:52	12.5	6:42	12.2	6:34
3000	14.6	7:50	14.2	7:36	13.8	7:22	13.4	7:11	13.1	7:02
3200	15.5	8:23	15.1	8:08	14.7	7:53	14.2	7:41	13.9	7:31
3400	16.5	8:56	16.0	8:40	15.5	8:25	15.1	8:11	14.7	8:00
3600	17.4	9:30	16.9	9:13	16.4	8:56	15.9	8:41	15.5	8:29
3800	18.3	10:04	17.7	9:45	17.2	9:28	16.7	9:12	16.3	8:58
4000	19.2	10:37	18.6	10:18	18.1	9:59	17.6	9:42	17.1	9:28
4200	20.1	11:12	19.5	10:52	18.9	10:32	18.4	10:14	17.9	9:57
4400	20.9	11:46	20.3	11:25	19.7	11:04	19.2	10:45	18.7	10:27
4600	21.8	12:22	21.2	11:59	20.6	11:37	20.0	11:16	19.4	10:58
4800	22.7	12:57	22.0	12:33	21.4	12:10	20.8	11:48	20.2	11:28
5000	23.6	13:32	22.9	13:07	22.2	12:43	21.5	12:20	21.0	11:59

Fuel Required Adjustments (1000 KG)

REFERENCE FUEL REQUIRED (1000 KG)	WEIGHT AT CHECK POINT (1000 KG)				
	40	50	60	70	80
2	-0.3	-0.2	0.0	0.2	0.7
4	-0.6	-0.3	0.0	0.5	1.3
6	-0.9	-0.5	0.0	0.7	1.9
8	-1.2	-0.7	0.0	1.0	2.5
10	-1.5	-0.8	0.0	1.2	3.0
12	-1.8	-1.0	0.0	1.4	3.5
14	-2.1	-1.1	0.0	1.6	3.9
16	-2.5	-1.3	0.0	1.8	4.3
18	-2.8	-1.4	0.0	2.0	4.7
20	-3.1	-1.6	0.0	2.1	5.0
22	-3.5	-1.7	0.0	2.3	5.3
24	-3.8	-1.9	0.0	2.4	5.5

Based on .78/280/250 descent.

Long Range Cruise Wind-Altitude Trade

PRESSURE ALTITUDE (1000 FT)	CRUISE WEIGHT (1000 KG)								
	80	75	70	65	60	55	50	45	40
41				43	15	2	1	11	27
39			33	11	1	1	10	24	42
37	51	23	7	0	2	10	23	39	56
35	14	3	0	3	11	23	37	53	69
33	1	0	4	13	24	37	51	66	80
31	2	7	15	26	38	51	64	77	88
29	10	18	28	39	51	64	75	86	95
27	22	31	42	53	64	75	85	93	101
25	35	45	55	65	75	84	92	99	104

The above wind factor table is for calculation of wind required to maintain present range capability at new pressure altitude, i.e., break-even wind.

Method:

1. **Read wind factors for present and new altitudes from table.**
2. **Determine difference (new altitude wind factor minus present altitude wind factor); This difference may be negative or positive.**
3. **Break-even wind at new altitude is present altitude wind plus difference from step 2.**

Descent

.78/280/250

PRESSURE ALTITUDE (FT)	TIME (MIN)	FUEL (KG)	DISTANCE (NM)			
			LANDING WEIGHT (1000 KG)			
			40	50	60	70
41000	27	340	104	122	135	144
39000	26	340	99	116	130	138
37000	25	340	94	111	124	133
35000	25	330	90	106	118	127
33000	24	330	87	102	114	122
31000	23	320	82	96	107	115
29000	22	310	77	90	101	108
27000	21	310	73	85	94	101
25000	20	300	68	79	88	94
23000	19	290	63	73	81	87
21000	18	280	59	68	75	80
19000	17	270	54	62	69	73
17000	16	260	49	57	63	66
15000	14	240	45	51	56	59
10000	11	200	31	35	38	39
5000	7	150	18	20	21	21
1500	4	110	9	9	9	9

Allowances for a straight-in approach are included.

Holding

Flaps Up

WEIGHT (1000 KG)		PRESSURE ALTITUDE (FT)								
		1500	5000	10000	15000	20000	25000	30000	35000	41000
80	%N1	62.4	65.4	69.0	73.1	77.2	81.5	85.4		
	KIAS	244	245	246	247	249	251	254		
	FF/ENG	1410	1380	1370	1360	1330	1330	1360		
75	%N1	60.7	63.7	67.4	71.5	75.5	79.9	83.8	88.2	
	KIAS	236	237	238	239	241	243	245	249	
	FF/ENG	1330	1300	1290	1280	1250	1240	1270	1300	
70	%N1	58.9	61.7	65.8	69.7	73.8	78.2	82.2	86.4	
	KIAS	228	229	230	231	232	234	237	240	
	FF/ENG	1250	1220	1210	1200	1170	1160	1180	1200	
65	%N1	57.2	59.8	64.1	67.7	72.0	76.3	80.4	84.6	
	KIAS	220	220	222	223	224	225	227	230	
	FF/ENG	1170	1150	1130	1110	1100	1070	1090	1100	
60	%N1	55.3	57.8	61.9	65.8	70.0	74.2	78.5	82.6	
	KIAS	211	212	213	213	215	216	218	220	
	FF/ENG	1090	1070	1050	1030	1020	990	1000	1010	
55	%N1	53.2	55.8	59.6	63.8	67.7	72.1	76.4	80.5	87.8
	KIAS	202	203	203	204	205	206	208	210	214
	FF/ENG	1010	990	970	950	940	910	910	920	980
50	%N1	51.0	53.6	57.2	61.5	65.3	69.8	73.9	78.3	85.3
	KIAS	192	193	194	195	195	197	198	200	203
	FF/ENG	940	910	890	870	860	850	840	850	890
45	%N1	48.7	51.1	54.8	58.6	63.0	67.0	71.3	75.8	82.7
	KIAS	184	184	184	184	185	186	187	189	191
	FF/ENG	860	830	830	810	790	780	760	760	790
40	%N1	46.2	48.6	52.2	55.8	60.2	64.1	68.5	72.9	79.9
	KIAS	177	177	177	177	177	177	177	177	180
	FF/ENG	800	780	750	730	710	700	690	680	700

This table includes 5% additional fuel for holding in a racetrack pattern.

Intentionally
Blank

Performance Inflight — Chapter PI
Advisory Information — Section 32

ADVISORY INFORMATION

Normal Configuration Landing Distance
Flaps 30

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	60000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 60000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF30	ONE REV	NO REV

Dry Runway

MAX MANUAL	985	60/-50	15/30	-35/125	10/-10	15/-15	35	15	35
AUTOBRAKE MAX	1230	65/-70	30/35	-45/155	0/0	30/-30	60	0	0
AUTOBRAKE 3	1715	100/-110	45/65	-75/260	0/0	45/-45	100	0	0
AUTOBRAKE 2	2185	145/-155	65/90	-105/360	15/-35	65/-65	105	35	35
AUTOBRAKE 1	2425	180/-185	80/110	-125/425	60/-70	70/-70	100	190	225

Good Reported Braking Action

MAX MANUAL	1355	75/-80	35/45	-65/220	35/-30	30/-35	50	70	155
AUTOBRAKE MAX	1440	80/-85	35/50	-65/225	30/-25	35/-35	65	75	165
AUTOBRAKE 3	1715	105/-110	45/65	-75/265	5/0	45/-45	100	5	15
AUTOBRAKE 2	2185	145/-155	65/90	-105/360	15/-35	65/-65	105	35	35
AUTOBRAKE 1	2425	180/-185	80/110	-125/425	60/-70	70/-70	100	190	225

Medium Reported Braking Action

MAX MANUAL	1850	120/-125	50/75	-100/355	80/-65	45/-45	70	190	460
AUTOBRAKE MAX	1865	125/-125	60/80	-100/360	80/-60	45/-45	80	190	460
AUTOBRAKE 3	1920	125/-125	60/80	-105/370	70/-40	50/-50	100	160	445
AUTOBRAKE 2	2250	150/-160	65/90	-115/410	50/-50	65/-65	105	75	205
AUTOBRAKE 1	2445	180/-190	80/110	-125/445	80/-75	70/-70	100	205	295

Poor Reported Braking Action

MAX MANUAL	2405	180/-180	75/115	-150/570	200/-130	65/-70	80	410	1100
AUTOBRAKE MAX	2410	180/-180	75/115	-150/570	205/-130	65/-70	80	410	1105
AUTOBRAKE 3	2410	180/-180	75/115	-150/570	200/-125	65/-70	90	410	1105
AUTOBRAKE 2	2540	185/-185	80/115	-155/585	185/-120	65/-70	105	320	990
AUTOBRAKE 1	2655	195/-200	85/120	-160/605	190/-130	70/-75	100	380	925

Reference distance is based on sea level, standard day, no wind or slope, VREF30, two-engine detent No. 2 reverse thrust, and auto speedbrakes.
For max manual braking and manual speedbrakes, increase reference landing distance by 60 m.
For autobrake and manual speedbrakes, increase reference landing distance by 50 m.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
All reference distances and adjustments shown have been increased by 15%.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Normal Configuration Landing Distance

Flaps 40

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	60000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 60000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF40	ONE REV	NO REV

Dry Runway

MAX MANUAL	965	60/-45	15/30	-35/120	10/-10	15/-15	35	15	35
AUTOBRAKE MAX	1200	60/-65	30/40	-45/150	0/0	25/-30	60	0	0
AUTOBRAKE 3	1655	100/-105	45/65	-75/255	0/0	40/-40	100	0	0
AUTOBRAKE 2	2110	140/-150	65/90	-105/350	10/-35	60/-60	105	25	25
AUTOBRAKE 1	2350	175/-180	75/105	-120/420	50/-65	70/-65	100	165	200

Good Reported Braking Action

MAX MANUAL	1340	75/-80	35/50	-65/220	35/-30	30/-30	50	65	150
AUTOBRAKE MAX	1420	80/-85	35/50	-65/225	30/-25	35/-35	65	70	160
AUTOBRAKE 3	1660	100/-105	45/65	-75/260	10/-5	40/-40	100	5	15
AUTOBRAKE 2	2110	140/-150	65/90	-105/350	10/-35	60/-60	105	25	25
AUTOBRAKE 1	2350	175/-180	75/105	-120/420	50/-65	70/-65	100	165	200

Medium Reported Braking Action

MAX MANUAL	1810	120/-120	50/75	-100/355	80/-65	45/-45	70	180	430
AUTOBRAKE MAX	1830	120/-125	50/80	-100/355	80/-60	45/-45	80	180	425
AUTOBRAKE 3	1875	120/-125	60/80	-100/360	70/-45	45/-50	100	160	425
AUTOBRAKE 2	2180	145/-155	65/90	-115/405	50/-50	60/-60	105	70	200
AUTOBRAKE 1	2365	175/-180	75/110	-125/435	80/-75	65/-70	100	185	270

Poor Reported Braking Action

MAX MANUAL	2345	175/-175	75/110	-150/565	200/-125	60/-65	80	380	1005
AUTOBRAKE MAX	2350	175/-175	75/115	-150/565	200/-130	60/-65	80	380	1005
AUTOBRAKE 3	2360	180/-175	75/115	-150/565	200/-125	60/-65	90	380	1005
AUTOBRAKE 2	2475	180/-180	80/115	-150/575	180/-120	65/-70	100	300	915
AUTOBRAKE 1	2575	190/-195	80/120	-155/590	190/-130	70/-75	100	350	855

Reference distance is based on sea level, standard day, no wind or slope, VREF40, two-engine detent No. 2 reverse thrust, and auto speedbrakes.
For max manual braking and manual speedbrakes, increase reference landing distance by 60 m.
For autobrake and manual speedbrakes, increase reference landing distance by 50 m.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
All reference distances and adjustments shown have been increased by 15%.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance
Airspeed Unreliable (Flaps 15)
VREF15

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	60000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 60000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	945	65/-55	20/30	-35/115	10/-10	20/-20	N/A	20	45
AUTOBRAKE MAX	1230	60/-65	30/40	-45/145	0/0	30/-30	N/A	0	0
AUTOBRAKE 2	2195	150/-160	70/95	-100/340	30/-45	60/-60	N/A	105	105

Good Reported Braking Action

MAX MANUAL	1300	75/-75	35/45	-55/195	30/-25	30/-30	N/A	75	175
AUTOBRAKE MAX	1385	80/-80	35/50	-60/205	25/-20	35/-35	N/A	85	190
AUTOBRAKE 2	2195	150/-160	70/95	-100/340	30/-45	60/-60	N/A	105	105

Medium Reported Braking Action

MAX MANUAL	1775	120/-120	55/75	-90/325	75/-60	45/-45	N/A	210	525
AUTOBRAKE MAX	1800	120/-120	55/75	-90/325	70/-55	45/-50	N/A	210	525
AUTOBRAKE 3	1915	120/-125	55/80	-95/340	50/-35	50/-50	N/A	135	445

Poor Reported Braking Action

MAX MANUAL	2305	170/-170	75/110	-135/510	180/-120	60/-65	N/A	445	1250
AUTOBRAKE MAX	2305	170/-170	75/110	-135/510	180/-120	60/-65	N/A	440	1250
AUTOBRAKE 3	2320	170/-170	75/110	-135/510	175/-105	60/-65	N/A	440	1250

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Actual (unfactored) distances are shown.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance
Airspeed Unreliable (Flaps 30)
VREF30

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	60000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 60000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	915	55/-50	20/25	-35/115	10/-10	20/-20	N/A	20	40
AUTOBRAKE MAX	1175	55/-60	25/35	-45/145	0/0	25/-25	N/A	0	0
AUTOBRAKE 2	2065	135/-145	65/85	-95/325	35/-40	60/-60	N/A	100	100

Good Reported Braking Action

MAX MANUAL	1265	70/-75	35/45	-55/195	30/-25	30/-30	N/A	70	165
AUTOBRAKE MAX	1350	75/-80	35/50	-60/200	25/-25	30/-30	N/A	80	180
AUTOBRAKE 2	2065	135/-145	65/85	-95/325	35/-40	60/-60	N/A	100	100

Medium Reported Braking Action

MAX MANUAL	1705	110/-115	50/70	-85/320	70/-55	45/-45	N/A	190	465
AUTOBRAKE MAX	1735	115/-115	50/70	-90/320	65/-55	45/-45	N/A	190	470
AUTOBRAKE 3	1830	115/-115	55/75	-90/330	50/-35	50/-50	N/A	125	405

Poor Reported Braking Action

MAX MANUAL	2185	160/-155	70/100	-130/500	170/-115	55/-60	N/A	390	1070
AUTOBRAKE MAX	2190	160/-160	70/100	-130/500	175/-115	55/-60	N/A	390	1070
AUTOBRAKE 3	2210	160/-160	70/100	-130/500	165/-100	55/-60	N/A	390	1075

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Actual (unfactored) distances are shown.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

Airspeed Unreliable (Flaps 40)

VREF40

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	60000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 60000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	905	55/-45	20/25	-30/110	10/-10	20/-20	N/A	20	40
AUTOBRAKE MAX	1145	55/-60	25/35	-40/140	0/0	25/-25	N/A	0	0
AUTOBRAKE 2	1995	135/-140	60/85	-95/320	30/-40	55/-55	N/A	90	90

Good Reported Braking Action

MAX MANUAL	1250	70/-70	35/45	-55/195	30/-25	30/-30	N/A	70	155
AUTOBRAKE MAX	1335	75/-80	35/50	-60/200	25/-25	30/-30	N/A	75	170
AUTOBRAKE 2	1995	135/-140	60/85	-95/320	35/-40	55/-55	N/A	90	90

Medium Reported Braking Action

MAX MANUAL	1675	110/-110	50/70	-85/315	70/-60	40/-45	N/A	180	435
AUTOBRAKE MAX	1705	115/-115	50/75	-90/320	65/-55	45/-45	N/A	180	440
AUTOBRAKE 3	1785	110/-115	50/75	-90/330	50/-40	45/-50	N/A	125	390

Poor Reported Braking Action

MAX MANUAL	2140	155/-155	70/100	-130/495	170/-110	55/-60	N/A	365	975
AUTOBRAKE MAX	2145	155/-155	70/100	-130/495	170/-110	55/-60	N/A	360	975
AUTOBRAKE 3	2165	160/-155	70/100	-130/495	165/-105	55/-60	N/A	365	985

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Actual (unfactored) distances are shown.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

All Flaps Up Landing

VREF40 + 55

BRAKING CONFIGURATION	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
	60000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 60000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV
Dry Runway									
MAX MANUAL	1195	155/-70	30/70	-40/135	15/-15	30/-30	40	30	70
AUTOBRAKE MAX	1725	85/-80	45/60	-55/180	5/-5	45/-45	70	0	5
AUTOBRAKE 2	3130	195/-215	105/140	-125/405	70/-75	95/-95	95	250	285
Good Reported Braking Action									
MAX MANUAL	1645	85/-90	45/65	-65/220	35/-30	45/-45	45	100	230
AUTOBRAKE MAX	1865	90/-95	50/70	-70/235	25/-20	50/-50	70	80	210
AUTOBRAKE 2	3130	195/-215	105/140	-125/405	70/-75	95/-95	95	250	285
Medium Reported Braking Action									
MAX MANUAL	2330	145/-150	75/105	-105/365	95/-75	65/-65	60	285	710
AUTOBRAKE MAX	2405	150/-155	80/105	-105/370	90/-70	65/-70	70	295	730
AUTOBRAKE 3	2730	145/-160	85/115	-115/400	60/-50	80/-80	110	150	475
Poor Reported Braking Action									
MAX MANUAL	3100	220/-220	110/155	-155/575	225/-155	85/-90	80	630	1775
AUTOBRAKE MAX	3095	220/-220	110/155	-155/575	225/-145	85/-90	85	625	1760
AUTOBRAKE 3	3200	210/-215	110/155	-160/585	200/-130	90/-95	105	560	1715

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Actual (unfactored) distances are shown.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance
ANTISKID INOPERATIVE (Flaps 15)
VREF15

BRAKING CONFIGURATION	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
	60000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 60000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	1570	95/-100	40/60	-75/265	45/-40	35/-40	60	125	295
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Good Reported Braking Action

MAX MANUAL	1760	115/-115	50/70	-90/325	70/-55	40/-45	65	185	460
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Medium Reported Braking Action

MAX MANUAL	2250	165/-160	70/105	-135/505	170/-110	55/-60	75	400	1135
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Poor Reported Braking Action

MAX MANUAL	3015	240/-235	100/150	-220/935	1360/-260	65/-90	90	985	3725
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Actual (unfactored) distances are shown.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance
ANTISKID INOPERATIVE (Flaps 30)
VREF30

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	60000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 60000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	1510	90/-95	40/55	-75/260	45/-40	35/-35	60	110	265
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Good Reported Braking Action

MAX MANUAL	1685	105/-110	45/65	-85/320	65/-55	40/-40	65	165	405
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Medium Reported Braking Action

MAX MANUAL	2140	150/-150	65/95	-130/495	165/-105	50/-55	75	350	970
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Poor Reported Braking Action

MAX MANUAL	2845	225/-215	90/140	-215/915	1265/-245	60/-85	85	865	3105
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Actual (unfactored) distances are shown.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance
ANTISKID INOPERATIVE (Flaps 40)
VREF40

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	60000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 60000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	1480	90/-90	40/55	-75/260	45/-40	35/-35	60	105	250
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Good Reported Braking Action

MAX MANUAL	1650	105/-105	45/65	-85/315	65/-55	40/-40	65	155	375
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Medium Reported Braking Action

MAX MANUAL	2090	150/-145	65/95	-130/490	165/-105	50/-55	75	325	885
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Poor Reported Braking Action

MAX MANUAL	2765	215/-210	90/135	-210/905	1220/-240	60/-80	80	805	2815
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Actual (unfactored) distances are shown.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

Jammed or Restricted Flight Controls (Flaps 15)

VREF15

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	60000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 60000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	880	60/-50	20/25	-30/110	10/-10	15/-20	30	15	40
AUTOBRAKE MAX	1125	60/-60	25/35	-40/140	0/0	25/-25	55	0	0
AUTOBRAKE 2	2000	140/-150	60/85	-95/320	20/-30	55/-55	100	45	45

Good Reported Braking Action

MAX MANUAL	1210	70/-70	30/45	-55/190	25/-25	30/-30	45	70	155
AUTOBRAKE MAX	1280	75/-80	35/45	-55/195	25/-20	30/-30	50	75	170
AUTOBRAKE 2	2000	140/-150	60/85	-95/320	20/-30	55/-55	100	45	45

Medium Reported Braking Action

MAX MANUAL	1655	110/-110	50/70	-85/315	70/-55	40/-45	60	190	480
AUTOBRAKE MAX	1665	115/-115	50/70	-85/315	65/-50	40/-45	70	190	475
AUTOBRAKE 3	1735	115/-115	50/70	-90/325	55/-35	45/-45	90	145	440

Poor Reported Braking Action

MAX MANUAL	2155	165/-160	70/105	-130/500	175/-115	55/-60	75	415	1170
AUTOBRAKE MAX	2155	165/-160	70/105	-130/500	175/-115	55/-60	75	415	1170
AUTOBRAKE 3	2155	165/-160	70/105	-130/500	175/-110	55/-60	75	415	1170

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Actual (unfactored) distances are shown.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance
LEADING EDGE FLAPS TRANSIT (Flaps 15)
VREF15 + 15

BRAKING CONFIGURATION	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
	60000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 60000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	990	65/-55	20/30	-35/120	10/-10	20/-20	35	25	50
AUTOBRAKE MAX	1290	65/-70	30/40	-45/150	0/0	30/-30	60	0	0
AUTOBRAKE 2	2345	155/-170	75/100	-105/350	30/-45	70/-65	100	95	95

Good Reported Braking Action

MAX MANUAL	1385	80/-80	35/50	-60/205	30/-30	35/-35	50	90	205
AUTOBRAKE MAX	1465	85/-85	40/55	-60/210	30/-25	35/-35	55	95	220
AUTOBRAKE 2	2345	155/-170	75/100	-105/350	30/-45	70/-65	100	95	95

Medium Reported Braking Action

MAX MANUAL	1900	125/-130	60/85	-95/335	80/-65	50/-50	65	240	610
AUTOBRAKE MAX	1915	130/-130	60/85	-95/335	75/-60	50/-50	70	240	610
AUTOBRAKE 3	2025	125/-130	60/85	-95/350	55/-35	55/-55	95	165	540

Poor Reported Braking Action

MAX MANUAL	2470	185/-180	85/120	-140/525	195/-130	65/-70	75	510	1460
AUTOBRAKE MAX	2470	185/-180	85/120	-140/525	195/-130	65/-70	75	510	1460
AUTOBRAKE 3	2475	185/-180	85/125	-140/525	195/-115	65/-70	90	505	1460

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Actual (unfactored) distances are shown.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

LOSS OF SYSTEM A (Flaps 15)

VREF15

BRAKING CONFIGURATION	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
	60000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 60000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	965	65/-50	20/30	-35/120	15/-10	20/-20	40	25	40
AUTOBRAKE MAX	1125	55/-60	25/35	-40/140	0/0	25/-25	55	0	0
AUTOBRAKE 2	2050	135/-145	60/80	-95/325	0/-5	60/-60	125	0	0

Good Reported Braking Action

MAX MANUAL	1395	85/-85	40/55	-60/210	40/-35	35/-35	60	110	220
AUTOBRAKE MAX	1395	85/-90	40/55	-60/210	35/-25	35/-35	65	105	215
AUTOBRAKE 2	2050	135/-145	60/80	-95/325	0/-5	60/-60	125	0	0

Medium Reported Braking Action

MAX MANUAL	1920	135/-135	60/85	-95/345	95/-75	50/-50	80	295	705
AUTOBRAKE MAX	1905	135/-135	60/85	-95/345	100/-75	50/-50	80	290	695
AUTOBRAKE 3	1905	135/-135	60/85	-95/345	100/-75	50/-50	80	290	695

Poor Reported Braking Action

MAX MANUAL	2495	195/-190	85/125	-145/540	220/-145	65/-70	95	605	1765
AUTOBRAKE MAX	2490	195/-190	85/125	-145/540	225/-150	65/-70	95	605	1765
AUTOBRAKE 3	2490	195/-190	85/125	-145/540	225/-150	65/-70	95	605	1765

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Actual (unfactored) distances are shown.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

LOSS OF SYSTEM A (Flaps 30)

VREF30

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	60000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 60000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	935	60/-45	20/30	-35/115	15/-10	20/-20	45	25	35
AUTOBRAKE MAX	1070	55/-60	25/30	-40/135	0/0	25/-25	50	5	10
AUTOBRAKE 2	1930	125/-135	55/75	-95/315	0/0	55/-55	120	0	0

Good Reported Braking Action

MAX MANUAL	1350	80/-80	35/50	-60/210	40/-35	30/-35	65	100	200
AUTOBRAKE MAX	1350	80/-85	35/50	-60/210	30/-30	30/-35	65	100	195
AUTOBRAKE 2	1930	125/-135	55/75	-95/315	0/0	55/-55	120	0	0

Medium Reported Braking Action

MAX MANUAL	1830	125/-125	55/80	-95/340	90/-70	45/-50	80	260	615
AUTOBRAKE MAX	1820	125/-125	55/80	-95/340	95/-75	45/-50	80	260	610
AUTOBRAKE 3	1820	125/-125	55/80	-95/340	95/-75	45/-50	80	260	610

Poor Reported Braking Action

MAX MANUAL	2360	180/-175	80/115	-140/530	210/-135	60/-65	90	530	1475
AUTOBRAKE MAX	2355	180/-175	80/115	-140/530	215/-140	60/-65	90	530	1475
AUTOBRAKE 3	2360	180/-175	80/115	-140/530	215/-140	60/-65	90	530	1475

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Actual (unfactored) distances are shown.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance
LOSS OF SYSTEM A (Flaps 40)
VREF40

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	60000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 60000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	935	55/-45	20/30	-35/115	15/-10	20/-20	45	25	35
AUTOBRAKE MAX	1045	55/-55	25/35	-40/135	5/0	25/-25	50	10	20
AUTOBRAKE 2	1860	120/-130	55/75	-90/310	0/0	50/-50	115	0	0

Good Reported Braking Action

MAX MANUAL	1330	80/-80	35/50	-60/210	40/-35	30/-30	65	95	190
AUTOBRAKE MAX	1335	80/-85	35/55	-60/210	35/-30	30/-30	70	95	185
AUTOBRAKE 2	1860	120/-130	55/75	-90/310	0/0	50/-50	115	0	0

Medium Reported Braking Action

MAX MANUAL	1790	125/-120	55/80	-95/335	90/-70	45/-45	80	240	560
AUTOBRAKE MAX	1785	125/-120	55/80	-95/335	95/-75	45/-45	80	240	560
AUTOBRAKE 3	1785	125/-120	55/80	-95/335	95/-75	45/-45	80	240	560

Poor Reported Braking Action

MAX MANUAL	2285	175/-170	75/115	-140/525	205/-135	60/-65	90	480	1305
AUTOBRAKE MAX	2290	175/-170	75/115	-140/525	210/-140	60/-65	90	480	1305
AUTOBRAKE 3	2290	175/-170	75/115	-140/525	210/-140	60/-65	90	480	1305

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Actual (unfactored) distances are shown.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance
LOSS OF SYSTEM A AND SYSTEM B (Flaps 15)
VREF15

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	60000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 60000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	1420	75/-80	35/50	-60/195	35/-30	35/-35	75	-10	55
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Good Reported Braking Action

MAX MANUAL	1960	120/-120	55/75	-90/310	80/-65	50/-50	95	60	335
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Medium Reported Braking Action

MAX MANUAL	2605	180/-180	80/115	-135/480	180/-130	65/-70	110	275	1165
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Poor Reported Braking Action

MAX MANUAL	3250	250/-240	110/160	-190/725	405/-225	80/-90	125	665	2955
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Actual (unfactored) distances are shown.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

LOSS OF SYSTEM B (Flaps 15)

VREF15

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	60000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 60000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	1015	50/-55	25/30	-40/135	15/-15	20/-20	40	35	55
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Good Reported Braking Action

MAX MANUAL	1420	85/-90	40/55	-65/235	40/-35	35/-35	55	115	235
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Medium Reported Braking Action

MAX MANUAL	1920	135/-135	60/85	-105/380	105/-80	50/-50	70	290	705
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Poor Reported Braking Action

MAX MANUAL	2460	190/-185	80/120	-155/590	255/-150	60/-70	85	580	1675
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Actual (unfactored) distances are shown.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance
MANUAL REVERSION (Flaps 15)
VREF15

BRAKING CONFIGURATION	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
	60000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 60000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	1420	75/-80	35/50	-60/195	35/-30	35/-35	75	-10	55
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Good Reported Braking Action

MAX MANUAL	1960	120/-120	55/75	-90/310	80/-65	50/-50	95	60	335
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Medium Reported Braking Action

MAX MANUAL	2605	180/-180	80/115	-135/480	180/-130	65/-70	110	275	1165
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Poor Reported Braking Action

MAX MANUAL	3250	250/-240	110/160	-190/725	405/-225	80/-90	125	665	2955
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Actual (unfactored) distances are shown.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

One Engine Inoperative Landing (Flaps 15)

VREF15

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	60000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 60000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	890	60/-50	20/30	-35/110	10/-10	20/-20	35	0	20
AUTOBRAKE MAX	1125	60/-60	30/40	-40/140	0/0	25/-25	55	0	0
AUTOBRAKE 2	2045	135/-145	65/90	-95/325	0/-10	60/-60	120	0	0

Good Reported Braking Action

MAX MANUAL	1260	75/-75	35/50	-55/200	30/-30	30/-30	50	0	85
AUTOBRAKE MAX	1340	80/-85	40/50	-60/205	30/-25	30/-30	55	0	90
AUTOBRAKE 2	2045	135/-145	65/90	-95/325	0/-10	60/-60	120	0	0

Medium Reported Braking Action

MAX MANUAL	1800	120/-125	60/80	-95/340	90/-70	45/-50	70	0	270
AUTOBRAKE MAX	1815	125/-125	60/85	-95/345	85/-65	50/-50	80	0	270
AUTOBRAKE 3	1845	125/-130	60/85	-95/345	85/-55	50/-50	85	0	275

Poor Reported Braking Action

MAX MANUAL	2470	185/-185	90/125	-150/560	245/-155	65/-70	85	0	685
AUTOBRAKE MAX	2470	185/-185	90/125	-150/560	250/-160	70/-70	85	0	685
AUTOBRAKE 3	2475	190/-190	90/125	-150/560	250/-150	70/-70	95	0	685

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Actual (unfactored) distances are shown.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

One Engine Inoperative Landing (Flaps 30)

VREF30

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	60000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 60000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	860	55/-45	20/25	-30/110	10/-10	15/-15	35	0	15
AUTOBRAKE MAX	1070	55/-60	25/35	-40/135	0/0	25/-25	50	0	0
AUTOBRAKE 2	1920	125/-130	60/85	-95/315	5/-10	55/-55	115	0	0

Good Reported Braking Action

MAX MANUAL	1215	70/-75	35/45	-55/195	30/-25	30/-30	50	0	75
AUTOBRAKE MAX	1295	75/-80	35/50	-60/205	30/-25	30/-30	60	0	85
AUTOBRAKE 2	1920	125/-130	60/85	-95/315	5/-10	55/-55	115	0	0

Medium Reported Braking Action

MAX MANUAL	1710	115/-115	55/75	-90/335	90/-70	45/-45	65	0	235
AUTOBRAKE MAX	1730	115/-120	55/75	-95/335	80/-60	45/-45	75	0	235
AUTOBRAKE 3	1755	115/-120	55/80	-95/335	85/-55	45/-45	85	0	245

Poor Reported Braking Action

MAX MANUAL	2315	170/-170	80/115	-145/545	230/-145	65/-65	80	0	575
AUTOBRAKE MAX	2315	170/-170	80/115	-145/545	235/-150	65/-65	85	0	575
AUTOBRAKE 3	2330	175/-175	80/115	-145/545	230/-140	65/-65	90	0	580

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Actual (unfactored) distances are shown.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

Stabilizer Trim Inoperative (Flaps 15)

VREF15

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	60000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 60000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	880	60/-50	20/25	-30/110	10/-10	15/-20	30	15	40
AUTOBRAKE MAX	1125	60/-60	25/35	-40/140	0/0	25/-25	55	0	0
AUTOBRAKE 2	2000	140/-150	60/85	-95/320	20/-30	55/-55	100	45	45

Good Reported Braking Action

MAX MANUAL	1210	70/-70	30/45	-55/190	25/-25	30/-30	45	70	155
AUTOBRAKE MAX	1280	75/-80	35/45	-55/195	25/-20	30/-30	50	75	170
AUTOBRAKE 2	2000	140/-150	60/85	-95/320	20/-30	55/-55	100	45	45

Medium Reported Braking Action

MAX MANUAL	1655	110/-110	50/70	-85/315	70/-55	40/-45	60	190	480
AUTOBRAKE MAX	1665	115/-115	50/70	-85/315	65/-50	40/-45	70	190	475
AUTOBRAKE 3	1735	115/-115	50/70	-90/325	55/-35	45/-45	90	145	440

Poor Reported Braking Action

MAX MANUAL	2155	165/-160	70/105	-130/500	175/-115	55/-60	75	415	1170
AUTOBRAKE MAX	2155	165/-160	70/105	-130/500	175/-115	55/-60	75	415	1170
AUTOBRAKE 3	2155	165/-160	70/105	-130/500	175/-110	55/-60	75	415	1170

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Actual (unfactored) distances are shown.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance
Trailing Edge Flap Asymmetry (1 ≤ Flap Lever <15)
VREF40 + 30

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	60000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 60000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	1025	80/-60	25/35	-35/125	10/-10	20/-20	35	25	55
AUTOBRAKE MAX	1400	65/-70	35/50	-50/160	5/-5	35/-35	65	0	5
AUTOBRAKE 2	2495	160/-175	90/125	-110/360	45/-55	75/-70	95	155	160

Good Reported Braking Action

MAX MANUAL	1410	75/-80	40/60	-60/205	30/-25	35/-35	45	85	195
AUTOBRAKE MAX	1540	80/-85	45/65	-60/215	25/-20	40/-40	60	90	215
AUTOBRAKE 2	2500	160/-175	90/125	-110/360	45/-55	75/-70	95	155	160

Medium Reported Braking Action

MAX MANUAL	1955	125/-125	65/95	-95/335	80/-65	50/-55	60	235	590
AUTOBRAKE MAX	2000	125/-130	70/100	-95/340	75/-60	50/-55	70	240	600
AUTOBRAKE 3	2180	125/-130	70/105	-100/360	50/-35	60/-60	100	135	450

Poor Reported Braking Action

MAX MANUAL	2555	185/-185	95/140	-140/530	195/-130	70/-75	75	505	1425
AUTOBRAKE MAX	2555	185/-180	95/140	-140/530	195/-130	70/-75	75	500	1420
AUTOBRAKE 3	2595	180/-180	95/140	-140/535	180/-110	70/-75	95	485	1410

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Actual (unfactored) distances are shown.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

Trailing Edge Flap Asymmetry (Flap Lever 15 or 25)

VREF15

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	60000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 60000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	880	60/-50	20/30	-30/110	10/-10	15/-20	30	15	40
AUTOBRAKE MAX	1125	60/-60	30/40	-40/140	0/0	25/-25	55	0	0
AUTOBRAKE 2	2000	140/-150	70/90	-95/320	20/-30	55/-55	100	45	45

Good Reported Braking Action

MAX MANUAL	1210	70/-70	35/50	-55/190	25/-25	30/-30	45	70	155
AUTOBRAKE MAX	1280	75/-80	35/50	-55/195	25/-20	30/-30	50	75	170
AUTOBRAKE 2	2000	140/-150	70/90	-95/320	20/-30	55/-55	100	45	45

Medium Reported Braking Action

MAX MANUAL	1655	110/-110	55/75	-85/315	70/-55	40/-45	60	190	480
AUTOBRAKE MAX	1665	115/-115	55/80	-85/315	65/-50	40/-45	70	190	475
AUTOBRAKE 3	1735	115/-115	55/80	-90/325	55/-35	45/-45	90	145	440

Poor Reported Braking Action

MAX MANUAL	2155	165/-160	80/115	-130/500	175/-115	55/-60	75	415	1170
AUTOBRAKE MAX	2155	165/-160	80/115	-130/500	175/-115	55/-60	75	415	1170
AUTOBRAKE 3	2155	165/-160	80/115	-130/500	175/-110	55/-60	75	415	1170

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Actual (unfactored) distances are shown.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance
Trailing Edge Flap Asymmetry (Flap Lever 30)
VREF30

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	60000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 60000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	855	50/-45	20/25	-30/110	10/-10	15/-15	30	15	35
AUTOBRAKE MAX	1070	55/-60	25/35	-40/135	0/0	25/-25	50	0	0
AUTOBRAKE 2	1885	125/-135	60/85	-90/310	20/-30	50/-50	90	45	45

Good Reported Braking Action

MAX MANUAL	1175	65/-70	30/45	-55/185	25/-25	25/-25	45	65	145
AUTOBRAKE MAX	1240	70/-75	35/50	-55/195	25/-20	30/-30	55	70	155
AUTOBRAKE 2	1885	125/-135	60/85	-90/310	20/-30	50/-50	90	45	45

Medium Reported Braking Action

MAX MANUAL	1585	105/-105	50/70	-85/310	70/-55	40/-40	60	170	425
AUTOBRAKE MAX	1600	110/-110	50/75	-85/310	65/-50	40/-40	65	170	420
AUTOBRAKE 3	1655	105/-110	50/75	-85/315	55/-35	40/-45	85	135	400

Poor Reported Braking Action

MAX MANUAL	2045	150/-150	70/105	-125/485	165/-110	50/-55	70	365	1000
AUTOBRAKE MAX	2050	150/-150	70/105	-125/485	170/-110	50/-55	70	365	1000
AUTOBRAKE 3	2050	155/-150	75/105	-125/485	170/-100	50/-55	80	365	1005

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Actual (unfactored) distances are shown.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

Trailing Edge Flap Disagree (1 ≤ Indicated Flaps <15)

VREF40 + 30

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	60000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 60000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	1025	80/-60	25/35	-35/125	10/-10	20/-20	35	25	55
AUTOBRAKE MAX	1400	65/-70	35/50	-50/160	5/-5	35/-35	65	0	5
AUTOBRAKE 2	2495	160/-175	90/125	-110/360	45/-55	75/-70	95	155	160

Good Reported Braking Action

MAX MANUAL	1410	75/-80	40/60	-60/205	30/-25	35/-35	45	85	195
AUTOBRAKE MAX	1540	80/-85	45/65	-60/215	25/-20	40/-40	60	90	215
AUTOBRAKE 2	2500	160/-175	90/125	-110/360	45/-55	75/-70	95	155	160

Medium Reported Braking Action

MAX MANUAL	1955	125/-125	65/95	-95/335	80/-65	50/-55	60	235	590
AUTOBRAKE MAX	2000	125/-130	70/100	-95/340	75/-60	50/-55	70	240	600
AUTOBRAKE 3	2180	125/-130	70/105	-100/360	50/-35	60/-60	100	135	450

Poor Reported Braking Action

MAX MANUAL	2555	185/-185	95/140	-140/530	195/-130	70/-75	75	505	1425
AUTOBRAKE MAX	2555	185/-180	95/140	-140/530	195/-130	70/-75	75	500	1420
AUTOBRAKE 3	2595	180/-180	95/140	-140/535	180/-110	70/-75	95	485	1410

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Actual (unfactored) distances are shown.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

Trailing Edge Flap Disagree (15 ≤ Indicated Flaps <30)

VREF15

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	60000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 60000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	880	60/-50	20/30	-30/110	10/-10	15/-20	30	15	40
AUTOBRAKE MAX	1125	60/-60	30/40	-40/140	0/0	25/-25	55	0	0
AUTOBRAKE 2	2000	140/-150	70/90	-95/320	20/-30	55/-55	100	45	45

Good Reported Braking Action

MAX MANUAL	1210	70/-70	35/50	-55/190	25/-25	30/-30	45	70	155
AUTOBRAKE MAX	1280	75/-80	35/50	-55/195	25/-20	30/-30	50	75	170
AUTOBRAKE 2	2000	140/-150	70/90	-95/320	20/-30	55/-55	100	45	45

Medium Reported Braking Action

MAX MANUAL	1655	110/-110	55/75	-85/315	70/-55	40/-45	60	190	480
AUTOBRAKE MAX	1665	115/-115	55/80	-85/315	65/-50	40/-45	70	190	475
AUTOBRAKE 3	1735	115/-115	55/80	-90/325	55/-35	45/-45	90	145	440

Poor Reported Braking Action

MAX MANUAL	2155	165/-160	80/115	-130/500	175/-115	55/-60	75	415	1170
AUTOBRAKE MAX	2155	165/-160	80/115	-130/500	175/-115	55/-60	75	415	1170
AUTOBRAKE 3	2155	165/-160	80/115	-130/500	175/-110	55/-60	75	415	1170

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Actual (unfactored) distances are shown.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

Trailing Edge Flap Disagree (30 ≤ Indicated Flaps <40)

VREF30

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	60000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 60000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	855	50/-45	20/25	-30/110	10/-10	15/-15	30	15	35
AUTOBRAKE MAX	1070	55/-60	25/35	-40/135	0/0	25/-25	50	0	0
AUTOBRAKE 2	1885	125/-135	60/85	-90/310	20/-30	50/-50	90	45	45

Good Reported Braking Action

MAX MANUAL	1175	65/-70	30/45	-55/185	25/-25	25/-25	45	65	145
AUTOBRAKE MAX	1240	70/-75	35/50	-55/195	25/-20	30/-30	55	70	155
AUTOBRAKE 2	1885	125/-135	60/85	-90/310	20/-30	50/-50	90	45	45

Medium Reported Braking Action

MAX MANUAL	1585	105/-105	50/70	-85/310	70/-55	40/-40	60	170	425
AUTOBRAKE MAX	1600	110/-110	50/75	-85/310	65/-50	40/-40	65	170	420
AUTOBRAKE 3	1655	105/-110	50/75	-85/315	55/-35	40/-45	85	135	400

Poor Reported Braking Action

MAX MANUAL	2045	150/-150	70/105	-125/485	165/-110	50/-55	70	365	1000
AUTOBRAKE MAX	2050	150/-150	70/105	-125/485	170/-110	50/-55	70	365	1000
AUTOBRAKE 3	2050	155/-150	75/105	-125/485	170/-100	50/-55	80	365	1005

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Actual (unfactored) distances are shown.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

Trailing Edge Flaps Up Landing

VREF40 + 40

BRAKING CONFIGURATION	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
	60000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 60000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	1080	100/-65	25/35	-35/125	10/-10	25/-25	30	25	55
AUTOBRAKE MAX	1525	75/-75	40/50	-50/170	5/-5	40/-40	65	0	5
AUTOBRAKE 2	2725	175/-190	90/120	-115/380	55/-65	80/-80	90	195	220

Good Reported Braking Action

MAX MANUAL	1485	80/-85	40/55	-60/210	30/-30	35/-40	45	85	195
AUTOBRAKE MAX	1660	85/-90	45/60	-65/220	25/-20	40/-40	65	75	190
AUTOBRAKE 2	2725	175/-190	90/120	-115/380	55/-65	80/-80	90	195	220

Medium Reported Braking Action

MAX MANUAL	2075	130/-135	65/90	-95/345	85/-65	55/-55	60	240	595
AUTOBRAKE MAX	2145	135/-140	70/95	-100/350	80/-65	55/-60	70	245	610
AUTOBRAKE 3	2395	130/-140	70/100	-105/375	55/-45	65/-70	100	130	410

Poor Reported Braking Action

MAX MANUAL	2740	195/-195	95/135	-145/545	205/-135	75/-80	75	525	1455
AUTOBRAKE MAX	2740	195/-195	95/135	-145/545	200/-130	75/-80	80	520	1445
AUTOBRAKE 3	2815	190/-190	95/135	-150/555	185/-120	80/-85	100	480	1420

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Actual (unfactored) distances are shown.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Recommended Brake Cooling Schedule

Reference Brake Energy Per Brake (Millions of Foot Pounds)

		WIND CORRECTED BRAKES ON SPEED (KIAS)*																	
		80			100			120			140			160			180		
WEIGHT (1000 KG)	OAT (°C)	PRESSURE ALTITUDE (1000 FT)																	
		0	5	10	0	5	10	0	5	10	0	5	10	0	5	10	0	5	10
80	0	15.3	17.2	19.4	22.9	25.8	29.3	31.7	35.8	40.9	41.5	47.1	54.2	52.2	59.6	69.0	62.4	71.4	83.3
	10	15.8	17.7	20.0	23.6	26.6	30.2	32.7	37.0	42.2	42.8	48.7	55.9	53.9	61.5	71.2	64.4	73.7	86.0
	15	16.0	18.0	20.3	24.0	27.1	30.7	33.2	37.6	42.9	43.5	49.4	56.8	54.7	62.4	72.3	65.3	74.8	87.3
	20	16.3	18.3	20.6	24.4	27.5	31.1	33.7	38.1	43.5	44.1	50.1	57.6	55.6	63.4	73.4	66.3	75.9	88.6
	30	16.7	18.8	21.2	25.0	28.2	32.0	34.6	39.2	44.7	45.4	51.5	59.3	57.1	65.1	75.4	68.2	78.0	91.0
	40	16.8	18.9	21.3	25.2	28.5	32.3	35.0	39.6	45.3	46.0	52.3	60.2	58.0	66.3	77.0	69.5	79.7	93.3
	50	16.8	19.0	21.4	25.3	28.6	32.5	35.2	40.0	45.8	46.4	52.9	61.1	58.8	67.4	78.5	70.7	81.3	95.6
70	0	13.9	15.6	17.6	20.6	23.3	26.3	28.4	32.1	36.5	37.1	42.1	48.2	46.6	53.0	61.2	56.4	64.4	74.8
	10	14.4	16.2	18.2	21.3	24.0	27.2	29.3	33.1	37.7	38.3	43.4	49.7	48.1	54.7	63.1	58.2	66.5	77.2
	15	14.6	16.4	18.5	21.6	24.4	27.6	29.8	33.6	38.3	38.9	44.1	50.5	48.8	55.6	64.1	59.1	67.5	78.4
	20	14.8	16.7	18.8	22.0	24.8	28.0	30.2	34.2	38.9	39.5	44.7	51.3	49.5	56.4	65.1	60.0	68.5	79.6
	30	15.2	17.1	19.3	22.6	25.5	28.8	31.1	35.1	40.0	40.6	46.0	52.7	50.9	58.0	66.9	61.6	70.4	81.8
	40	15.3	17.2	19.4	22.7	25.6	29.1	31.3	35.5	40.4	41.0	46.6	53.5	51.7	58.9	68.1	62.7	71.8	83.6
	50	15.3	17.2	19.4	22.8	25.8	29.2	31.5	35.7	40.8	41.4	47.1	54.2	52.3	59.7	69.3	63.7	73.1	85.4
60	0	12.6	14.1	15.9	18.4	20.7	23.4	25.1	28.3	32.2	32.5	36.9	42.1	40.7	46.3	53.1	49.6	56.5	65.3
	10	13.0	14.6	16.4	19.0	21.4	24.2	25.9	29.2	33.2	33.6	38.0	43.4	42.0	47.7	54.9	51.2	58.3	67.4
	15	13.2	14.8	16.6	19.3	21.7	24.6	26.3	29.7	33.7	34.1	38.6	44.1	42.7	48.5	55.7	51.9	59.2	68.4
	20	13.4	15.0	16.9	19.6	22.1	24.9	26.7	30.1	34.2	34.6	39.2	44.8	43.3	49.2	56.5	52.7	60.1	69.5
	30	13.7	15.4	17.4	20.1	22.7	25.6	27.4	31.0	35.2	35.6	40.3	46.0	44.5	50.6	58.1	54.2	61.7	71.4
	40	13.8	15.5	17.5	20.3	22.8	25.8	27.7	31.3	35.6	36.0	40.8	46.6	45.1	51.3	59.0	55.0	62.8	72.8
	50	13.8	15.5	17.5	20.3	22.9	25.9	27.8	31.5	35.8	36.2	41.1	47.1	45.6	51.9	59.9	55.7	63.8	74.2
50	0	11.2	12.6	14.1	16.2	18.2	20.5	21.8	24.6	27.9	28.0	31.7	36.1	34.8	39.5	45.1	42.1	47.9	55.1
	10	11.6	13.0	14.6	16.7	18.8	21.2	22.5	25.4	28.8	28.9	32.7	37.2	35.9	40.7	46.6	43.5	49.4	56.8
	15	11.7	13.2	14.8	16.9	19.1	21.5	22.8	25.8	29.2	29.4	33.2	37.8	36.5	41.4	47.3	44.2	50.2	57.7
	20	11.9	13.4	15.1	17.2	19.4	21.9	23.2	26.2	29.6	29.8	33.7	38.4	37.0	42.0	48.0	44.8	50.9	58.6
	30	12.3	13.8	15.5	17.7	19.9	22.5	23.8	26.9	30.5	30.7	34.7	39.4	38.1	43.2	49.4	46.1	52.4	60.2
	40	12.3	13.8	15.6	17.8	20.0	22.6	24.0	27.1	30.7	30.9	35.0	39.9	38.5	43.7	50.0	46.7	53.1	61.2
	50	12.3	13.8	15.6	17.8	20.1	22.7	24.1	27.2	30.9	31.1	35.2	40.2	38.8	44.1	50.6	47.2	53.8	62.1
40	0	9.9	11.1	12.5	14.0	15.7	17.7	18.5	20.8	23.5	23.5	26.5	30.1	28.9	32.7	37.3	34.8	39.4	45.1
	10	10.2	11.5	12.9	14.4	16.2	18.2	19.1	21.5	24.3	24.3	27.4	31.1	29.9	33.8	38.5	35.9	40.7	46.5
	15	10.4	11.7	13.1	14.6	16.5	18.5	19.4	21.8	24.7	24.6	27.8	31.5	30.3	34.3	39.1	36.4	41.3	47.2
	20	10.6	11.9	13.3	14.9	16.7	18.8	19.7	22.2	25.1	25.0	28.2	32.0	30.8	34.8	39.7	37.0	41.9	47.9
	30	10.9	12.2	13.7	15.3	17.2	19.3	20.2	22.8	25.8	25.7	29.0	32.9	31.7	35.8	40.8	38.0	43.1	49.3
	40	10.9	12.2	13.7	15.3	17.3	19.5	20.4	22.9	26.0	25.9	29.3	33.2	31.9	36.2	41.2	38.4	43.6	50.0
	50	10.9	12.2	13.8	15.4	17.3	19.5	20.4	23.0	26.1	26.0	29.4	33.4	32.1	36.4	41.6	38.7	44.0	50.5

***To correct for wind, enter table with the brakes on speed minus one half the headwind or plus 1.5 times the tailwind. If ground speed is used for brakes on speed, ignore wind and enter table with sea level, 15°C.**

Adjusted Brake Energy Per Brake (Millions of Foot Pounds)
No Reverse Thrust

		REFERENCE BRAKE ENERGY PER BRAKE (MILLIONS OF FOOT POUNDS)								
EVENT		10	20	30	40	50	60	70	80	90
RTO MAX MAN		10	20	30	40	50	60	70	80	90
LANDING	MAX MAN	7.5	15.8	24.6	33.8	43.5	53.5	63.6	73.9	84.2
	MAX AUTO	7.3	15.0	23.2	31.9	41.2	51.0	61.3	72.2	83.7
	AUTOBRAKE 3	7.0	14.2	21.8	29.7	38.1	47.1	56.7	67.1	78.3
	AUTOBRAKE 2	6.6	13.3	20.2	27.3	34.7	42.6	51.0	59.9	69.6
	AUTOBRAKE 1	6.3	12.4	18.6	24.9	31.6	38.6	46.2	54.4	63.5

ADVISORY INFORMATION

Recommended Brake Cooling Schedule

Adjusted Brake Energy Per Brake (Millions of Foot Pounds)
Two Engine Detent Reverse Thrust

		REFERENCE BRAKE ENERGY PER BRAKE (MILLIONS OF FOOT POUNDS)								
EVENT		10	20	30	40	50	60	70	80	90
RTO MAX MAN		10	20	30	40	50	60	70	80	90
LANDING	MAX MAN	6.9	14.5	22.7	31.4	40.4	49.7	59.3	68.9	78.5
	MAX AUTO	6.0	12.6	19.8	27.6	36.0	45.1	54.8	65.3	76.5
	AUTOBRAKE 3	4.5	9.5	15.1	21.3	28.1	35.6	43.7	52.5	62.0
	AUTOBRAKE 2	2.6	5.9	9.7	14.1	19.1	24.7	31.0	37.9	45.4
	AUTOBRAKE 1	1.8	3.8	6.3	9.1	12.5	16.4	21.0	26.3	32.5

Cooling Time (Minutes) - Category F Steel Brakes

	EVENT ADJUSTED BRAKE ENERGY (MILLIONS OF FOOT POUNDS)								
	16 & BELOW	17	20	23	25	28	32	33 TO 48	49 & ABOVE
	BRAKE TEMPERATURE MONITOR SYSTEM INDICATION ON CDS								
	UP TO 2.4	2.6	3.1	3.5	3.9	4.4	4.9	5.0 TO 7.5	7.5 & ABOVE
INFLIGHT GEAR DOWN	NO SPECIAL PROCEDURE REQUIRED	1	2	3	4	5	6	CAUTION	FUSE PLUG MELT ZONE
GROUND		10	20	30	40	50	60		

Cooling Time (Minutes) - Category M Carbon Brakes

	EVENT ADJUSTED BRAKE ENERGY (MILLIONS OF FOOT POUNDS)								
	16 & BELOW	17	19	20.9	23.5	26.9	29.4	30 TO 41	41 & ABOVE
	BRAKE TEMPERATURE MONITOR SYSTEM INDICATION ON CDS								
	UP TO 2.5	2.6	3	3.3	3.8	4.5	4.9	5.0 TO 7.1	7.1 & ABOVE
INFLIGHT GEAR DOWN	NO SPECIAL PROCEDURE REQUIRED	1	4	5	6	7	7.6	CAUTION	FUSE PLUG MELT ZONE
GROUND		6.7	16.0	24.1	34.2	45.9	53.3		

Observe maximum quick turnaround limit.
Table shows energy per brake added by a single stop with all brakes operating. Energy is assumed to be equally distributed among the operating brakes. Total energy is the sum of residual energy plus energy added.
Add 1.0 million foot pounds per brake for each taxi mile.

When in caution zone, wheel fuse plugs may melt. Delay takeoff and inspect after one hour. If overheat occurs after takeoff, extend gear soon for at least 7 minutes.

When in fuse plug melt zone, clear runway immediately. Unless required, do not set parking brake. Do not approach gear or attempt to taxi for one hour. Tire, wheel and brake replacement may be required. If overheat occurs after takeoff, extend gear soon for at least 12 minutes.

Brake temperature monitor system (BTMS) indication on CDS systems page may be used 10 to 15 minutes after airplane has come to a complete stop or inflight with gear retracted to determine recommended cooling schedule.

Intentionally
Blank

Performance Inflight — Chapter PI
Engine Inoperative — Section 33

ENGINE INOP

Initial Max Continuous %N1
Based on .79M, A/C high and anti-ice off

TAT (°C)	PRESSURE ALTITUDE (1000 FT)								
	25	27	29	31	33	35	37	39	41
20	96.1	95.9	95.6	95.5	95.2	94.8	94.3	94.0	93.2
15	96.7	96.5	96.2	96.1	96.0	95.5	95.1	94.8	94.1
10	97.3	97.2	96.8	96.7	96.7	96.2	95.8	95.6	95.0
5	97.5	97.9	97.6	97.4	97.4	97.0	96.6	96.4	95.9
0	96.8	98.1	98.5	98.3	98.2	97.8	97.5	97.2	96.8
-5	96.0	97.3	98.5	99.2	99.1	98.6	98.3	98.1	97.8
-10	95.2	96.5	97.7	99.0	99.9	99.5	99.2	99.0	98.7
-15	94.4	95.8	96.9	98.2	99.5	100.4	100.1	99.9	99.7
-20	93.6	95.0	96.2	97.4	98.7	99.8	100.4	100.2	100.0
-25	92.8	94.2	95.4	96.6	97.9	99.0	99.6	99.4	99.2
-30	91.9	93.4	94.6	95.8	97.0	98.2	98.7	98.5	98.3
-35	91.1	92.6	93.7	94.9	96.2	97.3	97.9	97.7	97.5
-40	90.3	91.8	92.9	94.1	95.3	96.5	97.0	96.8	96.6

%N1 Adjustments for Engine Bleeds

BLEED CONFIGURATION	PRESSURE ALTITUDE (1000 FT)								
	25	27	29	31	33	35	37	39	41
ENGINE ANTI-ICE	-1.2	-1.1	-1.0	-0.9	-0.8	-0.8	-0.8	-0.8	-0.8
ENGINE & WING ANTI-ICE	-4.2	-4.4	-4.5	-4.7	-5.0	-4.8	-4.8	-4.8	-4.8

ENGINE INOP

Max Continuous %N1

37000 FT to 29000 FT Pressure Altitudes

37000 FT PRESS ALT		TAT (°C)											
KIAS	M	-55	-50	-45	-40	-35	-30	-25	-20	-15	-10	-5	0
160	.51	96.0	97.0	97.9	98.7	99.6	98.9	98.1	96.9	95.6	94.0	92.5	91.1
200	.63	95.4	96.3	97.2	98.1	98.9	99.8	99.5	98.7	97.8	96.8	95.6	94.5
240	.74	94.4	95.3	96.2	97.1	98.0	98.8	99.7	100.1	99.3	98.5	97.7	96.7
280	.86	93.7	94.6	95.5	96.4	97.2	98.1	98.9	99.7	100.5	100.2	99.3	98.5
35000 FT PRESS ALT		TAT (°C)											
KIAS	M	-55	-50	-45	-40	-35	-30	-25	-20	-15	-10	-5	0
160	.49	95.9	96.8	97.7	98.6	99.5	99.2	98.4	97.3	96.1	94.7	93.3	92.0
200	.60	95.5	96.4	97.3	98.2	99.1	100.0	99.9	98.9	98.0	97.0	95.8	94.7
240	.71	94.4	95.3	96.2	97.1	98.0	98.8	99.6	100.2	99.5	98.9	98.0	97.0
280	.82	93.2	94.0	94.9	95.8	96.6	97.5	98.3	99.1	99.9	99.7	98.9	98.1
33000 FT PRESS ALT		TAT (°C)											
KIAS	M	-50	-45	-40	-35	-30	-25	-20	-15	-10	-5	0	5
160	.47	96.8	97.7	98.5	99.4	100.2	99.3	98.5	97.3	96.0	94.6	93.2	92.0
200	.58	96.4	97.3	98.2	99.1	99.9	100.8	99.9	99.0	98.0	96.8	95.6	94.5
240	.68	95.3	96.2	97.1	97.9	98.8	99.6	100.4	100.2	99.6	98.7	97.7	96.7
280	.79	93.6	94.5	95.4	96.2	97.1	97.9	98.7	99.5	99.9	99.1	98.2	97.4
320	.89	93.0	93.9	94.7	95.6	96.4	97.2	98.1	98.9	99.7	100.4	100.0	99.2
31000 FT PRESS ALT		TAT (°C)											
KIAS	M	-50	-45	-40	-35	-30	-25	-20	-15	-10	-5	0	5
160	.45	96.7	97.6	98.5	99.4	100.3	100.4	99.5	98.5	97.3	95.9	94.5	93.2
200	.55	96.5	97.3	98.2	99.1	100.0	100.8	101.0	100.1	99.1	98.0	96.7	95.5
240	.66	95.0	95.9	96.8	97.6	98.5	99.3	100.2	100.7	99.9	99.1	98.1	97.1
280	.76	93.2	94.0	94.9	95.7	96.6	97.4	98.2	99.0	99.8	99.1	98.2	97.3
320	.85	91.8	92.6	93.5	94.3	95.1	95.9	96.7	97.5	98.3	99.1	99.3	98.4
29000 FT PRESS ALT		TAT (°C)											
KIAS	M	-45	-40	-35	-30	-25	-20	-15	-10	-5	0	5	10
160	.43	97.5	98.4	99.3	100.1	101.0	100.5	99.6	98.5	97.2	95.7	94.4	93.1
200	.53	96.9	97.8	98.7	99.5	100.4	101.2	100.7	99.7	98.7	97.5	96.2	95.1
240	.63	95.7	96.5	97.4	98.2	99.1	99.9	100.7	100.4	99.5	98.6	97.5	96.6
280	.73	93.6	94.4	95.2	96.1	96.9	97.7	98.5	99.3	99.4	98.5	97.5	96.8
320	.82	91.4	92.3	93.1	93.9	94.7	95.5	96.3	97.0	97.8	98.6	97.8	97.0
360	.91	91.4	92.3	93.1	93.9	94.7	95.5	96.3	97.0	97.8	98.6	99.3	99.4

%N1 Adjustments for Engine Bleeds

BLEED CONFIGURATION	PRESSURE ALTITUDE (1000 FT)				
	29	31	33	35	37
ENGINE ANTI-ICE ON	-0.9	-0.9	-0.8	-0.8	-0.8
ENGINE & WING ANTI-ICE ON	-4.1	-4.3	-4.5	-4.7	-4.7

ENGINE INOP

Max Continuous %N1
27000 FT to 20000 FT Pressure Altitudes

270000 FT PRESS ALT		TAT (°C)											
KIAS	M	-45	-40	-35	-30	-25	-20	-15	-10	-5	0	5	10
160	.41	97.3	98.2	99.1	100.0	100.8	101.5	100.6	99.6	98.4	97.0	95.7	94.4
200	.51	96.3	97.2	98.1	98.9	99.8	100.6	101.1	100.2	99.2	98.1	96.9	95.7
240	.60	95.0	95.9	96.7	97.6	98.4	99.2	100.1	100.7	99.7	98.7	97.7	96.8
280	.70	93.0	93.8	94.6	95.5	96.3	97.1	97.9	98.7	99.4	98.7	97.7	96.9
320	.79	90.9	91.7	92.6	93.4	94.2	95.0	95.7	96.5	97.3	98.0	97.9	97.2
360	.88	90.2	91.0	91.8	92.7	93.5	94.3	95.1	95.9	96.6	97.4	98.2	98.7
25000 FT PRESS ALT		TAT (°C)											
KIAS	M	-40	-35	-30	-25	-20	-15	-10	-5	0	5	10	15
160	.39	98.2	99.0	99.9	100.7	101.6	101.7	100.7	99.6	98.4	97.0	95.8	94.5
200	.49	96.8	97.7	98.5	99.4	100.2	101.0	100.9	99.9	98.9	97.7	96.6	95.5
240	.58	95.1	95.9	96.8	97.6	98.4	99.2	100.0	99.8	98.9	97.9	96.9	96.0
280	.67	93.2	94.1	94.9	95.7	96.5	97.3	98.1	98.8	98.9	97.9	96.9	96.2
320	.76	90.9	91.8	92.6	93.4	94.2	95.0	95.8	96.6	97.3	97.9	97.2	96.5
360	.85	89.6	90.5	91.3	92.1	93.0	93.8	94.6	95.4	96.2	97.0	97.7	97.5
24000 FT PRESS ALT		TAT (°C)											
KIAS	M	-40	-35	-30	-25	-20	-15	-10	-5	0	5	10	15
160	.38	97.7	98.5	99.4	100.3	101.1	101.9	100.8	99.7	98.5	97.2	96.0	94.7
200	.48	96.4	97.2	98.1	98.9	99.7	100.6	101.0	99.9	98.9	97.8	96.7	95.6
240	.57	94.7	95.6	96.4	97.2	98.0	98.8	99.6	99.9	99.0	97.9	97.0	96.1
280	.66	93.0	93.8	94.6	95.4	96.2	97.0	97.8	98.6	99.1	98.0	97.0	96.3
320	.75	90.6	91.4	92.3	93.1	93.9	94.7	95.5	96.3	97.1	97.8	97.2	96.5
360	.83	89.0	89.8	90.7	91.5	92.4	93.2	94.0	94.8	95.6	96.4	97.2	97.2
22000 FT PRESS ALT		TAT (°C)											
KIAS	M	-35	-30	-25	-20	-15	-10	-5	0	5	10	15	20
160	.37	97.5	98.4	99.2	100.1	100.9	101.0	99.9	98.7	97.5	96.3	95.2	94.0
200	.46	96.3	97.1	98.0	98.8	99.6	100.4	100.1	98.9	97.8	96.8	95.8	94.8
240	.55	94.8	95.6	96.4	97.2	98.0	98.8	99.6	99.1	98.1	97.1	96.2	95.4
280	.63	93.2	94.0	94.8	95.6	96.4	97.1	97.9	98.7	98.4	97.4	96.6	95.8
320	.72	90.9	91.8	92.6	93.4	94.2	95.0	95.8	96.6	97.4	97.5	96.8	96.1
360	.80	89.0	89.9	90.7	91.6	92.4	93.2	94.0	94.8	95.6	96.4	97.0	96.4
20000 FT PRESS ALT		TAT (°C)											
KIAS	M	-35	-30	-25	-20	-15	-10	-5	0	5	10	15	20
160	.35	96.5	97.4	98.2	99.0	99.8	100.6	100.2	98.9	97.7	96.6	95.5	94.4
200	.44	95.4	96.2	97.0	97.9	98.7	99.4	100.2	99.1	97.8	96.8	95.8	94.9
240	.53	93.9	94.7	95.5	96.3	97.1	97.9	98.7	99.3	98.2	97.1	96.2	95.4
280	.61	92.4	93.3	94.1	94.8	95.6	96.4	97.2	97.9	98.5	97.6	96.7	95.9
320	.69	90.3	91.1	92.0	92.8	93.6	94.4	95.2	96.0	96.8	97.6	96.9	96.2
360	.77	88.5	89.3	90.2	91.0	91.8	92.6	93.5	94.3	95.1	95.8	96.6	96.4

%N1 Adjustments for Engine Bleeds

BLEED CONFIGURATION	PRESSURE ALTITUDE (1000 FT)				
	20	22	24	25	27
ENGINE ANTI-ICE ON	-0.9	-0.9	-1.0	-1.0	-1.0
ENGINE & WING ANTI-ICE ON	-3.6	-3.8	-3.8	-3.9	-4.0

ENGINE INOP

Max Continuous %N1

18000 FT to 12000 FT Pressure Altitudes

18000 FT PRESS ALT		TAT (°C)											
KIAS	M	-30	-25	-20	-15	-10	-5	0	5	10	15	20	25
160	.34	96.0	96.8	97.6	98.4	99.2	100.0	98.9	97.5	96.5	95.5	94.5	93.5
200	.42	95.1	95.9	96.7	97.5	98.2	99.0	99.3	98.0	96.7	95.9	95.0	94.1
240	.51	93.7	94.5	95.2	96.0	96.8	97.6	98.3	98.2	97.1	96.2	95.4	94.6
280	.59	92.0	92.9	93.7	94.5	95.3	96.1	96.8	97.6	97.5	96.6	95.8	95.1
320	.67	90.3	91.1	92.0	92.8	93.6	94.4	95.2	96.0	96.8	96.9	96.2	95.5
360	.75	88.7	89.5	90.4	91.2	92.0	92.8	93.6	94.4	95.2	96.0	96.4	95.8
16000 FT PRESS ALT		TAT (°C)											
KIAS	M	-30	-25	-20	-15	-10	-5	0	5	10	15	20	25
160	.33	95.0	95.8	96.6	97.4	98.2	99.0	99.4	98.2	97.0	96.1	95.2	94.2
200	.41	93.9	94.7	95.5	96.3	97.1	97.8	98.6	98.2	97.0	96.0	95.2	94.4
240	.49	92.5	93.3	94.1	94.9	95.7	96.5	97.2	98.0	97.3	96.3	95.5	94.7
280	.57	91.0	91.8	92.6	93.5	94.3	95.1	95.9	96.6	97.4	96.7	95.8	95.1
320	.64	89.4	90.3	91.1	91.9	92.8	93.6	94.4	95.2	95.9	96.7	96.1	95.5
360	.72	88.0	88.9	89.7	90.6	91.4	92.2	93.0	93.8	94.6	95.4	96.2	95.8
14000 FT PRESS ALT		TAT (°C)											
KIAS	M	-25	-20	-15	-10	-5	0	5	10	15	20	25	30
160	.31	94.9	95.7	96.5	97.3	98.0	98.8	99.2	98.2	97.3	96.4	95.5	94.6
200	.39	93.6	94.4	95.2	96.0	96.7	97.5	98.3	97.5	96.5	95.7	94.9	94.1
240	.47	92.1	92.9	93.8	94.6	95.4	96.2	96.9	97.4	96.5	95.6	94.8	94.1
280	.54	90.9	91.7	92.5	93.4	94.2	95.0	95.8	96.5	96.8	96.0	95.2	94.5
320	.62	89.6	90.4	91.2	92.1	92.9	93.7	94.5	95.3	96.1	96.2	95.5	94.8
360	.69	88.3	89.1	89.9	90.7	91.6	92.4	93.2	94.0	94.8	95.5	95.8	95.2
12000 FT PRESS ALT		TAT (°C)											
KIAS	M	-20	-15	-10	-5	0	5	10	15	20	25	30	35
160	.30	94.8	95.6	96.4	97.1	97.9	98.6	97.9	96.8	95.9	95.2	94.4	93.5
200	.38	92.7	93.5	94.3	95.1	95.9	96.7	97.1	96.1	95.1	94.4	93.6	92.8
240	.45	91.6	92.5	93.3	94.1	94.9	95.7	96.4	96.4	95.5	94.7	94.0	93.2
280	.52	90.6	91.4	92.2	93.0	93.8	94.6	95.4	96.2	95.9	95.1	94.4	93.7
320	.60	89.5	90.3	91.2	92.0	92.8	93.6	94.4	95.2	96.0	95.5	94.8	94.1
360	.67	88.3	89.1	90.0	90.8	91.6	92.4	93.2	93.9	94.7	95.5	95.1	94.4

%N1 Adjustments for Engine Bleeds

BLEED CONFIGURATION	PRESSURE ALTITUDE (1000 FT)			
	12	14	16	18
ENGINE ANTI-ICE ON	-0.9	-0.9	-0.9	-0.9
ENGINE & WING ANTI-ICE ON	-3.2	-3.4	-3.4	-3.5

ENGINE INOP

Max Continuous %N1
10000 FT to 1000 FT Pressure Altitudes

10000 FT PRESS ALT		TAT (°C)											
KIAS	M	-20	-15	-10	-5	0	5	10	15	20	25	30	35
160	.29	92.7	93.5	94.4	95.2	95.9	96.7	97.5	96.5	95.6	94.9	94.2	93.4
200	.36	91.3	92.1	93.0	93.8	94.6	95.4	96.1	96.1	95.2	94.4	93.7	92.9
240	.43	90.3	91.1	92.0	92.8	93.6	94.4	95.2	95.9	95.4	94.6	93.8	93.1
280	.51	89.5	90.3	91.1	91.9	92.7	93.5	94.3	95.1	95.7	95.0	94.2	93.5
320	.58	88.6	89.4	90.2	91.0	91.8	92.6	93.4	94.2	95.0	95.4	94.7	93.9
360	.65	87.5	88.3	89.2	90.0	90.8	91.6	92.3	93.1	93.9	94.7	95.0	94.3
5000 FT PRESS ALT		TAT (°C)											
KIAS	M	-10	-5	0	5	10	15	20	25	30	35	40	45
160	.26	90.5	91.4	92.2	93.0	93.8	94.5	95.1	94.4	93.6	92.9	92.2	91.4
200	.33	90.0	90.8	91.6	92.4	93.2	93.9	94.7	94.4	93.7	93.0	92.3	91.5
240	.40	89.2	90.0	90.8	91.6	92.4	93.2	93.9	94.4	93.7	92.9	92.2	91.5
280	.46	88.5	89.3	90.1	90.9	91.7	92.5	93.3	94.0	94.0	93.2	92.5	91.8
320	.53	87.8	88.6	89.4	90.2	90.9	91.7	92.5	93.2	94.0	93.6	92.9	92.2
360	.59	86.9	87.7	88.5	89.3	90.1	90.8	91.6	92.3	93.1	93.8	93.3	92.6
3000 FT PRESS ALT		TAT (°C)											
KIAS	M	-5	0	5	10	15	20	25	30	35	40	45	50
160	.26	90.5	91.3	92.1	92.8	93.6	94.4	94.6	93.9	93.2	92.4	91.6	90.7
200	.32	89.9	90.7	91.5	92.3	93.1	93.8	94.6	94.0	93.3	92.5	91.8	91.0
240	.38	88.8	89.6	90.4	91.2	92.0	92.7	93.5	93.5	92.8	92.0	91.3	90.6
280	.45	88.3	89.1	89.9	90.6	91.4	92.2	92.9	93.7	93.1	92.4	91.7	91.0
320	.51	87.6	88.4	89.2	90.0	90.7	91.5	92.2	93.0	93.5	92.8	92.0	91.3
360	.57	86.8	87.6	88.4	89.1	89.9	90.6	91.4	92.1	92.8	93.1	92.4	91.7
1000 FT PRESS ALT		TAT (°C)											
KIAS	M	-5	0	5	10	15	20	25	30	35	40	45	50
160	.25	89.0	89.8	90.6	91.4	92.2	92.9	93.7	93.4	92.7	91.9	91.2	90.3
200	.31	88.7	89.5	90.3	91.0	91.8	92.6	93.3	93.7	93.0	92.2	91.5	90.7
240	.37	87.8	88.6	89.4	90.2	90.9	91.7	92.5	93.2	92.8	92.0	91.3	90.6
280	.43	87.3	88.1	88.8	89.6	90.4	91.1	91.9	92.6	93.1	92.3	91.6	90.9
320	.49	86.7	87.5	88.2	89.0	89.8	90.5	91.3	92.0	92.7	92.7	91.9	91.2
360	.55	85.9	86.7	87.5	88.2	89.0	89.7	90.5	91.2	91.9	92.6	92.3	91.6

%N1 Adjustments for Engine Bleeds

BLEED CONFIGURATION	PRESSURE ALTITUDE (1000 FT)			
	1	3	5	10
ENGINE ANTI-ICE ON	-0.6	-0.8	-0.8	-0.8
ENGINE & WING ANTI-ICE ON	-2.9	-3.0	-3.1	-3.2

ENGINE INOP

MAX CONTINUOUS THRUST

Driftdown Speed/Level Off Altitude

100 ft/min residual rate of climb

WEIGHT (1000 KG)		OPTIMUM DRIFTDOWN SPEED (KIAS)	LEVEL OFF ALTITUDE (FT)		
START DRIFTDOWN	LEVEL OFF		ISA + 10°C & BELOW	ISA + 15°C	ISA + 20°C
85	81	270	16500	14800	12400
80	76	262	18500	17000	15000
75	72	254	20600	19100	17400
70	67	246	22600	21400	19800
65	62	238	24800	23600	22300
60	57	229	27000	25900	24800
55	53	219	29200	28300	27100
50	48	209	31300	30500	29500
45	43	199	33400	32700	31800
40	38	187	35800	35100	34200

Includes APU fuel burn.

ENGINE INOP

MAX CONTINUOUS THRUST

Driftdown/LRC Cruise Range Capability

Ground to Air Miles Conversion

AIR DISTANCE (NM)					GROUND DISTANCE (NM)	AIR DISTANCE (NM)				
HEADWIND COMPONENT (KTS)						TAILWIND COMPONENT (KTS)				
100	80	60	40	20		20	40	60	80	100
138	128	120	112	106	100	95	90	86	82	78
276	256	240	225	212	200	190	180	172	164	157
414	385	359	337	317	300	284	270	257	246	235
552	513	479	449	423	400	379	360	343	328	314
690	641	599	562	529	500	474	450	429	410	392
828	770	719	674	635	600	569	540	515	492	470
966	898	839	787	741	700	663	630	601	573	549
1105	1027	959	899	847	800	758	720	686	655	627
1243	1155	1079	1012	953	900	853	811	772	737	705
1382	1284	1199	1124	1058	1000	948	901	858	819	784
1520	1412	1319	1237	1164	1100	1042	990	944	901	862
1659	1541	1439	1349	1270	1200	1137	1080	1029	983	940
1797	1670	1559	1462	1376	1300	1232	1170	1115	1064	1018
1936	1798	1679	1574	1482	1400	1327	1260	1201	1146	1096
2075	1927	1799	1687	1588	1500	1421	1350	1286	1228	1175
2214	2056	1919	1800	1694	1600	1516	1440	1372	1309	1253
2353	2185	2040	1912	1800	1700	1611	1530	1457	1391	1331
2492	2314	2160	2025	1906	1800	1705	1620	1543	1473	1409

Driftdown/Cruise Fuel and Time

AIR DIST (NM)	FUEL REQUIRED (1000 KG)										TIME (HR:MIN)
	WEIGHT AT START OF DRIFTDOWN (1000 KG)										
	40	45	50	55	60	65	70	75	80	85	
100	0.4	0.4	0.4	0.4	0.4	0.5	0.5	0.5	0.5	0.5	0:16
200	0.8	0.8	0.9	0.9	1.0	1.0	1.1	1.2	1.2	1.2	0:33
300	1.2	1.3	1.4	1.5	1.6	1.7	1.8	1.9	1.9	2.0	0:50
400	1.6	1.8	1.9	2.1	2.2	2.3	2.5	2.6	2.7	2.8	1:06
500	2.0	2.2	2.4	2.6	2.7	2.9	3.1	3.3	3.5	3.7	1:23
600	2.4	2.6	2.8	3.1	3.3	3.5	3.8	4.0	4.2	4.4	1:39
700	2.8	3.1	3.3	3.6	3.8	4.1	4.4	4.7	4.9	5.2	1:56
800	3.2	3.5	3.8	4.1	4.4	4.7	5.0	5.3	5.6	6.0	2:12
900	3.5	3.9	4.2	4.6	4.9	5.3	5.6	6.0	6.3	6.7	2:29
1000	3.9	4.3	4.7	5.1	5.5	5.9	6.2	6.6	7.0	7.5	2:46
1100	4.3	4.7	5.2	5.6	6.0	6.4	6.9	7.3	7.7	8.2	3:02
1200	4.7	5.1	5.6	6.1	6.5	7.0	7.5	7.9	8.4	8.9	3:19
1300	5.0	5.5	6.0	6.6	7.0	7.5	8.1	8.6	9.1	9.7	3:36
1400	5.4	5.9	6.5	7.0	7.6	8.1	8.7	9.2	9.8	10.4	3:53
1500	5.8	6.3	6.9	7.5	8.1	8.7	9.2	9.9	10.5	11.1	4:09
1600	6.1	6.7	7.4	8.0	8.6	9.2	9.8	10.5	11.1	11.8	4:26
1700	6.5	7.1	7.8	8.4	9.1	9.7	10.4	11.1	11.8	12.6	4:43
1800	6.8	7.5	8.2	8.9	9.6	10.3	11.0	11.7	12.5	13.3	4:60

Includes APU fuel burn.
Driftdown at optimum driftdown speed and cruise at Long Range Cruise speed.

ENGINE INOP

MAX CONTINUOUS THRUST

Long Range Cruise Altitude Capability

100 ft/min residual rate of climb

WEIGHT (1000 KG)	PRESSURE ALTITUDE (FT)		
	ISA + 10°C & BELOW	ISA + 15°C	ISA + 20°C
85	11200	7800	4400
80	14500	11100	7800
75	17100	14500	11200
70	19700	17500	14700
65	22200	20400	17700
60	24700	23100	20900
55	27200	25800	24000
50	29800	28700	27100
45	32100	31300	30100
40	34500	33700	32600

With engine anti-ice on, decrease altitude capability by 2300 ft.
With engine and wing anti-ice on, decrease altitude capability by 7400 ft .

ENGINE INOP

Long Range Cruise Control

WEIGHT (1000 KG)		PRESSURE ALTITUDE (1000 FT)								
		10	15	17	19	21	25	27	29	31
85	%N1	90.9								
	MACH	.557								
	KIAS	309								
	FF/ENG	2970								
80	%N1	89.3	93.0	94.8						
	MACH	.542	.585	.600						
	KIAS	301	296	292						
	FF/ENG	2794	2768	2755						
75	%N1	87.7	91.5	93.0	95.1					
	MACH	.527	.573	.588	.604					
	KIAS	292	290	286	283					
	FF/ENG	2618	2608	2581	2576					
70	%N1	85.9	89.8	91.4	92.9	95.2				
	MACH	.510	.557	.576	.590	.607				
	KIAS	282	281	280	276	273				
	FF/ENG	2442	2435	2423	2395	2402				
65	%N1	83.9	87.9	89.5	91.1	92.8				
	MACH	.492	.540	.559	.577	.592				
	KIAS	272	272	272	270	266				
	FF/ENG	2265	2261	2251	2237	2215				
60	%N1	81.9	85.9	87.5	89.1	90.7	95.1			
	MACH	.473	.520	.540	.560	.578	.610			
	KIAS	262	262	262	261	260	253			
	FF/ENG	2088	2086	2077	2067	2055	2066			
55	%N1	79.6	83.6	85.3	86.9	88.6	92.2	94.9	98.4	
	MACH	.455	.499	.519	.539	.559	.593	.610	.631	
	KIAS	251	251	252	251	251	245	242	241	
	FF/ENG	1917	1910	1903	1894	1886	1868	1897	1972	
50	%N1	77.2	81.2	82.8	84.5	86.2	89.5	91.5	94.3	97.9
	MACH	.435	.477	.496	.516	.536	.576	.592	.609	.630
	KIAS	241	240	240	240	240	238	234	232	230
	FF/ENG	1754	1733	1728	1721	1714	1703	1700	1725	1795
45	%N1	74.8	78.5	80.1	81.8	83.5	86.9	88.5	90.5	93.5
	MACH	.416	.454	.471	.490	.511	.552	.572	.589	.606
	KIAS	230	228	228	228	228	228	226	223	220
	FF/ENG	1596	1564	1554	1546	1542	1533	1535	1533	1551
40	%N1	72.1	75.6	77.2	78.8	80.5	83.9	85.6	87.2	89.2
	MACH	.395	.431	.447	.464	.482	.524	.545	.566	.584
	KIAS	218	216	216	215	215	215	215	214	212
	FF/ENG	1442	1402	1388	1376	1367	1364	1366	1368	1366

ENGINE INOP

MAX CONTINUOUS THRUST

Long Range Cruise Diversion Fuel and Time

Ground to Air Miles Conversion

AIR DISTANCE (NM)					GROUND DISTANCE (NM)	AIR DISTANCE (NM)				
HEADWIND COMPONENT (KTS)						TAILWIND COMPONENT (KTS)				
100	80	60	40	20		20	40	60	80	100
297	272	249	230	214	200	190	180	172	164	157
599	546	500	461	429	400	379	361	344	328	315
902	822	751	693	644	600	569	541	516	492	472
1206	1099	1004	926	859	800	759	722	687	656	629
1513	1377	1257	1158	1074	1000	949	902	859	820	786
1821	1656	1511	1391	1290	1200	1138	1081	1030	983	942
2132	1937	1766	1625	1506	1400	1328	1262	1202	1147	1098
2444	2219	2022	1859	1722	1600	1517	1441	1372	1310	1254
2759	2502	2278	2093	1938	1800	1707	1621	1543	1473	1410

Reference Fuel and Time Required at Check Point

AIR DIST (NM)	PRESSURE ALTITUDE (1000 FT)									
	10		14		18		22		26	
	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)
200	1.3	0:43	1.2	0:41	1.0	0:39	0.9	0:38	0.9	0:37
400	2.8	1:23	2.5	1:19	2.3	1:15	2.1	1:12	2.0	1:09
600	4.2	2:04	3.8	1:57	3.5	1:51	3.3	1:46	3.1	1:42
800	5.5	2:45	5.1	2:36	4.7	2:27	4.4	2:20	4.2	2:15
1000	6.9	3:27	6.4	3:15	6.0	3:04	5.5	2:55	5.3	2:48
1200	8.3	4:09	7.7	3:54	7.1	3:41	6.7	3:29	6.4	3:22
1400	9.6	4:52	9.0	4:35	8.3	4:18	7.8	4:05	7.4	3:55
1600	10.9	5:35	10.2	5:15	9.5	4:56	8.8	4:40	8.5	4:29
1800	12.3	6:19	11.4	5:56	10.6	5:34	9.9	5:16	9.5	5:03

Fuel Required Adjustments (1000 KG)

REFERENCE FUEL REQUIRED (1000 KG)	WEIGHT AT CHECK POINT (1000 KG)				
	40	50	60	70	80
1	-0.1	-0.1	0.0	0.1	0.3
2	-0.3	-0.1	0.0	0.3	0.6
3	-0.4	-0.2	0.0	0.5	1.0
4	-0.6	-0.3	0.0	0.6	1.4
5	-0.7	-0.4	0.0	0.8	1.7
6	-0.9	-0.4	0.0	1.0	2.1
7	-1.0	-0.5	0.0	1.1	2.4
8	-1.2	-0.6	0.0	1.2	2.7
9	-1.4	-0.7	0.0	1.4	3.0
10	-1.5	-0.8	0.0	1.5	3.3
11	-1.7	-0.8	0.0	1.6	3.6
12	-1.8	-0.9	0.0	1.8	3.9
13	-2.0	-1.0	0.0	1.9	4.2

Includes APU fuel burn

ENGINE INOP

MAX CONTINUOUS THRUST

Holding

Flaps Up

WEIGHT (1000 KG)		PRESSURE ALTITUDE (FT)							
		1500	5000	10000	15000	20000	25000	30000	35000
80	%N1	79.3	82.2	86.4	90.9				
	KIAS	244	245	246	247				
	FF/ENG	2560	2550	2560	2600				
75	%N1	77.6	80.3	84.6	89.0	94.8			
	KIAS	236	237	238	239	241			
	FF/ENG	2400	2390	2390	2420	2480			
70	%N1	75.7	78.4	82.7	87.0	92.0			
	KIAS	228	229	230	231	232			
	FF/ENG	2240	2230	2220	2240	2270			
65	%N1	73.6	76.5	80.6	84.9	89.5	97.4		
	KIAS	220	220	222	223	224	225		
	FF/ENG	2080	2070	2060	2060	2080	2220		
60	%N1	71.3	74.3	78.3	82.7	87.2	93.4		
	KIAS	211	212	213	213	215	216		
	FF/ENG	1920	1910	1900	1900	1900	1960		
55	%N1	69.0	71.9	76.0	80.3	84.7	89.8		
	KIAS	202	203	203	204	205	206		
	FF/ENG	1770	1750	1740	1730	1720	1750		
50	%N1	66.5	69.2	73.5	77.6	82.1	86.8	94.6	
	KIAS	192	193	194	195	195	197	198	
	FF/ENG	1620	1600	1580	1570	1560	1570	1670	
45	%N1	63.8	66.5	70.6	74.8	79.3	83.8	89.4	
	KIAS	184	184	184	184	185	186	187	
	FF/ENG	1480	1450	1430	1410	1390	1400	1440	
40	%N1	60.6	63.5	67.5	71.8	76.0	80.6	85.3	93.9
	KIAS	177	177	177	177	177	177	177	177
	FF/ENG	1330	1310	1280	1260	1240	1230	1260	1350

This table includes 5% additional fuel for holding in a racetrack pattern.

ENGINE INOP

ADVISORY INFORMATION

Gear Down Landing Rate of Climb Available

Flaps 15

TAT (°C)	RATE OF CLIMB (FT/MIN)						
	PRESSURE ALTITUDE (FT)						
	-2000	0	2000	4000	6000	8000	10000
52	-160	-220					
50	-130	-200	-300				
48	-110	-170	-270				
46	-80	-150	-250	-350			
44	-50	-120	-220	-330			
42	-30	-90	-200	-300	-410		
40	0	-70	-170	-280	-390		
38	30	-40	-150	-260	-360	-470	
36	50	-10	-120	-230	-340	-450	
34	50	20	-100	-210	-320	-430	-540
32	50	30	-70	-180	-290	-410	-520
30	50	40	-40	-150	-270	-380	-500
20	60	40	-20	-90	-160	-260	-380
10	70	50	-20	-80	-160	-230	-320
0	70	60	-10	-80	-150	-230	-320
-20	80	60	-10	-80	-160	-240	-330
-40	90	70	0	-80	-160	-250	-340

Rate of climb capability shown is valid for 60000 kg, gear down at VREF15+5.
Decrease rate of climb 110 ft/min per 5000 kg greater than 60000 kg.
Increase rate of climb 150 ft/min per 5000 kg less than 60000 kg.

Flaps 30

TAT (°C)	RATE OF CLIMB (FT/MIN)						
	PRESSURE ALTITUDE (FT)						
	-2000	0	2000	4000	6000	8000	10000
52	-310	-380					
50	-290	-360	-460				
48	-270	-330	-440				
46	-240	-310	-410	-520			
44	-220	-280	-390	-500			
42	-190	-260	-370	-470	-580		
40	-170	-230	-340	-450	-560		
38	-140	-210	-320	-430	-540	-650	
36	-120	-180	-290	-410	-520	-630	
34	-120	-160	-270	-380	-490	-610	-720
32	-120	-140	-240	-360	-470	-580	-700
30	-110	-140	-220	-330	-450	-560	-680
20	-110	-130	-200	-270	-340	-450	-570
10	-110	-130	-200	-270	-340	-420	-510
0	-100	-120	-200	-270	-340	-430	-510
-20	-100	-120	-200	-270	-350	-440	-530
-40	-100	-130	-200	-280	-360	-450	-550

Rate of climb capability shown is valid for 60000 kg, gear down at VREF30+5.
Decrease rate of climb 110 ft/min per 5000 kg greater than 60000 kg.
Increase rate of climb 160 ft/min per 5000 kg less than 60000 kg.

Performance Inflight — Chapter PI
Alternate Mode EEC — Section 34

ALTERNATE MODE EEC

Alternate Mode EEC Limit Weight

PERFORMANCE LIMIT	NORMAL MODE PERFORMANCE LIMIT WEIGHT (1000 KG)										
	40	44	48	52	56	60	64	68	72	76	80
FIELD	37.1	40.6	44.2	47.7	51.3	54.9	58.4	62.0	65.6	69.1	72.6
CLIMB	35.5	39.0	42.5	46.0	49.5	53.0	56.5	60.0	63.6	67.1	70.6
OBSTACLE	35.6	39.1	42.6	46.1	49.6	53.2	56.7	60.2	63.7	67.2	70.8

Alternate Mode EEC Takeoff Speed Adjustment

TAKEOFF SPEEDS	TAKEOFF SPEED ADJUSTMENT (KTS)
V1	+3
VR	+2
V2	0

Alternate Mode EEC Max Takeoff %N1
Based on engine bleeds for packs on, engine and wing anti-ice on or off

OAT (°C)	AIRPORT PRESSURE ALTITUDE (FT)												
	-2000	-1000	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
60	92.6	93.2	93.6	93.7	93.8	93.9	94.0	94.1	94.0	93.7	93.6	93.5	93.5
55	93.2	93.8	94.3	94.4	94.5	94.6	94.7	94.9	94.7	94.4	94.1	93.5	92.8
50	93.8	94.4	94.9	95.1	95.2	95.4	95.5	95.6	95.5	95.2	94.9	94.4	93.9
45	94.6	95.2	95.6	95.8	95.9	96.1	96.2	96.3	96.2	95.9	95.6	95.3	94.9
40	95.2	95.9	96.4	96.5	96.6	96.7	96.8	97.0	96.9	96.6	96.3	96.2	95.9
35	95.8	96.5	97.2	97.3	97.4	97.5	97.6	97.7	97.6	97.3	97.0	96.9	96.8
30	95.4	96.6	98.1	98.1	98.2	98.2	98.3	98.3	98.2	98.1	97.8	97.7	97.7
25	94.6	95.9	97.3	97.9	98.5	98.6	98.5	98.5	98.5	98.5	98.4	98.4	98.5
20	93.8	95.1	96.6	97.1	97.7	98.0	98.3	98.6	98.6	98.7	98.6	98.6	98.6
15	93.0	94.3	95.8	96.4	97.0	97.3	97.6	97.9	98.3	98.7	98.9	98.9	98.9
10	92.3	93.6	95.0	95.6	96.2	96.5	96.8	97.2	97.5	97.9	98.3	98.8	99.3
5	91.5	92.8	94.2	94.8	95.4	95.8	96.1	96.4	96.8	97.2	97.6	98.1	98.5
0	90.7	92.0	93.4	94.1	94.7	95.0	95.3	95.7	96.0	96.4	96.8	97.3	97.8
-5	89.8	91.2	92.6	93.3	93.9	94.2	94.5	94.9	95.3	95.7	96.1	96.5	97.0
-10	89.0	90.4	91.8	92.5	93.1	93.4	93.8	94.1	94.5	94.9	95.3	95.8	96.2
-15	88.2	89.5	91.0	91.7	92.3	92.6	93.0	93.4	93.7	94.1	94.5	95.0	95.4
-20	87.4	88.7	90.2	90.8	91.5	91.8	92.2	92.6	93.0	93.4	93.7	94.2	94.6
-25	86.5	87.9	89.4	90.0	90.7	91.0	91.4	91.8	92.2	92.6	93.0	93.4	93.8
-30	85.7	87.0	88.5	89.2	89.8	90.2	90.6	91.0	91.4	91.8	92.1	92.6	93.0
-35	84.8	86.2	87.7	88.3	89.0	89.4	89.7	90.2	90.6	90.9	91.3	91.8	92.2
-40	83.9	85.3	86.8	87.5	88.1	88.5	88.9	89.3	89.7	90.1	90.5	90.9	91.4
-45	83.1	84.4	86.0	86.6	87.3	87.7	88.1	88.5	88.9	89.3	89.7	90.1	90.5
-50	82.2	83.5	85.1	85.7	86.4	86.8	87.2	87.7	88.1	88.4	88.8	89.3	89.7

%N1 Adjustments for Engine Bleed

BLEED CONFIGURATION	AIRPORT PRESSURE ALTITUDE (FT)											
	-2000	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
PACKS OFF	0.7	0.8	0.9	0.9	0.9	1.0	1.0	1.0	1.0	1.0	1.0	1.0

Intentionally
Blank

Performance Inflight — Chapter PI

Gear Down — Section 35

GEAR DOWN

Long Range Cruise Altitude Capability

Max Cruise Thrust, 100 ft/min residual rate of climb

WEIGHT (1000 KG)	PRESSURE ALTITUDE (FT)		
	ISA + 10°C & BELOW	ISA + 15°C	ISA + 20°C
85	15600	12500	9400
80	18500	15600	12700
75	21200	18500	15700
70	23700	21500	18600
65	26200	24500	21900
60	28700	27200	25400
55	30900	29700	28200
50	33000	32000	30800
45	35200	34200	33100
40	37600	36600	35500

GEAR DOWN

Long Range Cruise Control

WEIGHT (1000 KG)		PRESSURE ALTITUDE (1000 FT) 10	21	23	25	27	29	31	33	35	37
85	%N1	85.9									
	MACH	.482									
	KIAS	267									
	FF/ENG	2417									
80	%N1	84.2									
	MACH	.468									
	KIAS	259									
	FF/ENG	2266									
75	%N1	82.5	91.7								
	MACH	.454	.554								
	KIAS	251	248								
	FF/ENG	2116	2095								
70	%N1	80.5	89.8	91.7	94.3						
	MACH	.440	.541	.557	.575						
	KIAS	243	242	240	238						
	FF/ENG	1969	1955	1943	1965						
65	%N1	78.5	87.8	89.5	91.5	94.4					
	MACH	.425	.524	.543	.560	.578					
	KIAS	235	234	233	231	229					
	FF/ENG	1826	1807	1800	1797	1826					
60	%N1	76.4	85.6	87.4	89.1	91.2	94.4				
	MACH	.409	.504	.525	.544	.562	.580				
	KIAS	226	225	225	224	222	220				
	FF/ENG	1686	1656	1655	1652	1656	1686				
55	%N1	74.2	83.3	85.0	86.8	88.5	90.8	94.0			
	MACH	.393	.484	.504	.525	.545	.562	.581			
	KIAS	217	216	216	216	215	213	211			
	FF/ENG	1548	1509	1506	1509	1511	1515	1545			
50	%N1	71.7	80.7	82.4	84.2	86.0	87.7	90.0	93.3		
	MACH	.376	.463	.482	.502	.523	.544	.561	.580		
	KIAS	207	206	206	206	206	205	203	201		
	FF/ENG	1412	1364	1361	1362	1368	1371	1373	1401		
45	%N1	68.9	77.9	79.6	81.4	83.1	84.9	86.7	89.0	92.3	
	MACH	.358	.441	.458	.477	.498	.520	.541	.559	.578	
	KIAS	197	196	196	196	196	196	195	193	191	
	FF/ENG	1281	1223	1217	1218	1224	1229	1231	1231	1255	
40	%N1	66.0	74.8	76.5	78.2	80.0	81.7	83.6	85.4	87.5	91.3
	MACH	.340	.417	.434	.452	.471	.491	.513	.535	.554	.573
	KIAS	187	185	185	185	185	185	185	185	183	181
	FF/ENG	1156	1089	1077	1076	1082	1086	1088	1090	1090	1113

GEAR DOWN

Long Range Cruise Enroute Fuel and Time

Ground to Air Miles Conversion

AIR DISTANCE (NM)					GROUND DISTANCE (NM)	AIR DISTANCE (NM)				
HEADWIND COMPONENT (KTS)						TAILWIND COMPONENT (KTS)				
100	80	60	40	20		20	40	60	80	100
324	290	260	236	217	200	188	178	168	160	153
654	583	523	474	435	400	377	357	338	321	307
989	880	787	713	653	600	566	535	507	483	461
1329	1181	1054	953	871	800	754	713	676	643	614
1674	1484	1322	1194	1090	1000	943	891	844	803	766
2024	1791	1593	1436	1310	1200	1131	1069	1013	962	918
2380	2102	1865	1680	1530	1400	1320	1247	1181	1122	1070
2742	2417	2140	1924	1751	1600	1508	1424	1348	1280	1221
3111	2736	2418	2171	1972	1800	1695	1600	1514	1438	1371

Reference Fuel and Time Required at Check Point

AIR DIST (NM)	PRESSURE ALTITUDE (1000 FT)									
	10		14		20		24		28	
	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)
200	2.4	0:49	2.2	0:47	1.9	0:44	1.7	0:42	1.6	0:41
400	4.9	1:36	4.5	1:31	4.0	1:25	3.7	1:20	3.5	1:17
600	7.3	2:25	6.8	2:17	6.1	2:06	5.7	1:59	5.3	1:54
800	9.7	3:14	9.1	3:03	8.1	2:48	7.6	2:38	7.2	2:31
1000	12.1	4:04	11.2	3:50	10.1	3:31	9.4	3:18	8.9	3:08
1200	14.3	4:56	13.4	4:39	12.0	4:14	11.3	3:59	10.7	3:46
1400	16.6	5:49	15.5	5:28	13.9	4:58	13.1	4:40	12.4	4:24
1600	18.8	6:43	17.5	6:18	15.8	5:44	14.8	5:22	14.0	5:03
1800	20.9	7:38	19.6	7:10	17.6	6:30	16.5	6:05	15.7	5:43

Fuel Required Adjustments (1000 KG)

REFERENCE FUEL REQUIRED (1000 KG)	WEIGHT AT CHECK POINT (1000 KG)				
	40	50	60	70	80
2	-0.3	-0.2	0.0	0.3	0.7
4	-0.7	-0.3	0.0	0.6	1.4
6	-1.0	-0.5	0.0	0.9	2.0
8	-1.4	-0.7	0.0	1.2	2.6
10	-1.7	-0.9	0.0	1.4	3.2
12	-2.1	-1.0	0.0	1.6	3.7
14	-2.4	-1.2	0.0	1.8	4.2
16	-2.8	-1.4	0.0	2.0	4.6
18	-3.2	-1.6	0.0	2.2	5.0
20	-3.5	-1.7	0.0	2.4	5.3
22	-3.9	-1.9	0.0	2.5	5.6

GEAR DOWN

Descent

VREF40 + 70 KIAS

PRESSURE ALTITUDE (FT)	TIME (MIN)	FUEL (KG)	DISTANCE (NM)
41000	21	270	90
39000	21	270	86
37000	20	260	81
35000	19	260	77
33000	19	250	73
31000	18	250	68
29000	17	240	64
27000	16	240	60
25000	15	230	56
23000	15	220	52
21000	14	220	48
19000	13	210	44
17000	12	200	40
15000	11	190	36
10000	9	160	26
5000	6	130	16
1500	4	100	9

Allowances for a straight-in approach are included.

GEAR DOWN

Holding

Flaps Up

WEIGHT (1000 KG)		PRESSURE ALTITUDE (FT)							
		1500	5000	10000	15000	20000	25000	30000	35000
80	%N1	73.9	76.7	80.8	85.1	89.7			
	KIAS	224	224	224	224	224			
	FF/ENG	2090	2080	2070	2080	2090			
75	%N1	72.2	75.2	79.1	83.5	88.0	94.4		
	KIAS	219	219	219	219	219	219		
	FF/ENG	1980	1960	1950	1950	1950	2020		
70	%N1	70.4	73.4	77.4	81.7	86.2	91.5		
	KIAS	214	214	214	214	214	214		
	FF/ENG	1860	1840	1830	1820	1820	1850		
65	%N1	68.6	71.5	75.6	79.9	84.3	89.0		
	KIAS	209	209	209	209	209	209		
	FF/ENG	1750	1720	1710	1700	1690	1710		
60	%N1	66.7	69.5	73.7	77.8	82.2	86.8	93.9	
	KIAS	203	203	203	203	203	203	203	
	FF/ENG	1630	1610	1590	1580	1560	1570	1650	
55	%N1	64.7	67.4	71.6	75.6	80.0	84.6	90.1	
	KIAS	197	197	197	197	197	197	197	
	FF/ENG	1520	1490	1470	1460	1440	1440	1480	
50	%N1	62.3	65.2	69.2	73.4	77.7	82.2	86.9	
	KIAS	190	190	190	190	190	190	190	
	FF/ENG	1400	1380	1360	1340	1320	1310	1340	
45	%N1	59.9	62.8	66.8	71.1	75.2	79.7	84.3	91.1
	KIAS	184	184	184	184	184	184	184	184
	FF/ENG	1290	1270	1250	1230	1200	1190	1210	1250
40	%N1	57.5	60.2	64.3	68.4	72.7	77.0	81.5	86.5
	KIAS	177	177	177	177	177	177	177	177
	FF/ENG	1180	1160	1140	1120	1090	1070	1090	1100

This table includes 5% additional fuel for holding in a racetrack pattern.

Intentionally
Blank

Performance Inflight — Chapter PI
Gear Down, Engine Inop — Section 36

GEAR DOWN
ENGINE INOP

MAX CONTINUOUS THRUST

Driftdown Speed/Level Off Altitude

100 ft/min residual rate of climb

WEIGHT (1000 KG)		OPTIMUM DRIFTDOWN SPEED (KIAS)	LEVEL OFF ALTITUDE (FT)		
START DRIFTDOWN	LEVEL OFF		ISA + 10°C & BELOW	ISA + 15°C	ISA + 20°C
75	70	217	2000		
70	66	212	5300	2900	
65	61	206	8500	6500	4100
60	57	201	11500	9900	7700
55	52	195	14500	13400	11500
50	47	188	17300	16300	15200
45	43	182	20100	19000	17900
40	38	176	23000	22000	20900

Includes APU fuel burn.

Long Range Cruise Altitude Capability

100 ft/min residual rate of climb

WEIGHT (1000 KG)	PRESSURE ALTITUDE (FT)		
	ISA + 10°C & BELOW	ISA + 15°C	ISA + 20°C
65	1900		
60	6500	3500	
55	10700	8400	5600
50	14600	13200	10600
45	18100	17100	15800
40	21800	20600	19400

GEAR DOWN
ENGINE INOP
MAX CONTINUOUS THRUST

Long Range Cruise Control

WEIGHT (1000 KG)		PRESSURE ALTITUDE (1000 FT)									
		5	7	9	11	13	15	17	19	21	23
60	%N1	90.1	91.8								
	MACH	.364	.375								
	KIAS	220	219								
	FF/ENG	3180	3181								
55	%N1	87.6	89.2	90.9	92.7						
	MACH	.351	.362	.374	.387						
	KIAS	212	211	210	209						
	FF/ENG	2909	2898	2897	2904						
50	%N1	85.1	86.6	88.1	89.8	91.6	94.1				
	MACH	.338	.348	.359	.371	.384	.398				
	KIAS	204	203	202	201	200	199				
	FF/ENG	2652	2632	2618	2616	2624	2647				
45	%N1	82.4	83.8	85.3	86.8	88.5	90.3	92.6	96.4		
	MACH	.325	.334	.344	.355	.367	.380	.393	.408		
	KIAS	196	195	193	192	191	190	189	189		
	FF/ENG	2407	2379	2358	2344	2341	2343	2350	2406		
40	%N1	79.5	80.8	82.2	83.7	85.2	86.9	88.7	90.7	93.9	98.2
	MACH	.311	.320	.329	.339	.349	.361	.374	.387	.402	.417
	KIAS	188	186	184	183	182	181	180	179	179	178
	FF/ENG	2178	2141	2111	2090	2075	2066	2060	2057	2091	2183

GEAR DOWN

ENGINE INOP

MAX CONTINUOUS THRUST

Long Range Cruise Diversion Fuel and Time

Ground to Air Miles Conversion

AIR DISTANCE (NM)					GROUND DISTANCE (NM)	AIR DISTANCE (NM)				
HEADWIND COMPONENT (KTS)						TAILWIND COMPONENT (KTS)				
100	80	60	40	20		20	40	60	80	100
172	151	134	120	109	100	93	88	83	78	75
352	308	270	242	219	200	187	175	165	156	148
533	465	408	364	330	300	280	262	246	232	220
716	623	545	486	440	400	373	349	328	309	293
900	783	684	609	551	500	466	436	409	385	365
1086	943	823	733	661	600	559	523	490	462	438
1273	1105	964	856	772	700	652	610	572	538	510
1462	1267	1103	980	883	800	745	696	652	614	581
1652	1430	1244	1103	994	900	838	782	733	690	653
1844	1595	1385	1228	1105	1000	931	868	813	765	724

Reference Fuel and Time Required at Check Point

AIR DIST (NM)	PRESSURE ALTITUDE (1000 FT)					
	6		10		14	
	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)
100	1.2	0:27	1.1	0:26	1.0	0:26
200	2.6	0:53	2.4	0:50	2.3	0:48
300	3.9	1:18	3.6	1:15	3.5	1:11
400	5.2	1:44	4.9	1:39	4.8	1:35
500	6.5	2:10	6.1	2:04	5.9	1:58
600	7.8	2:37	7.3	2:29	7.1	2:22
700	9.0	3:03	8.5	2:55	8.3	2:46
800	10.3	3:30	9.7	3:20	9.4	3:10
900	11.5	3:58	10.8	3:46	10.5	3:35
1000	12.7	4:25	12.0	4:12	11.6	3:59

Fuel Required Adjustments (1000 KG)

REFERENCE FUEL REQUIRED (1000 KG)	WEIGHT AT CHECK POINT (1000 KG)				
	40	50	60	70	80
1	-0.2	-0.1	0.0	0.1	0.3
2	-0.3	-0.2	0.0	0.3	0.6
3	-0.5	-0.3	0.0	0.5	1.0
4	-0.7	-0.4	0.0	0.7	1.3
5	-0.9	-0.4	0.0	0.9	1.7
6	-1.0	-0.5	0.0	1.1	2.0
7	-1.2	-0.6	0.0	1.2	2.4
8	-1.4	-0.7	0.0	1.4	2.8
9	-1.5	-0.8	0.0	1.6	3.1
10	-1.7	-0.9	0.0	1.8	3.5
11	-1.9	-0.9	0.0	2.0	3.8
12	-2.0	-1.0	0.0	2.1	4.2
13	-2.2	-1.1	0.0	2.3	4.6
14	-2.4	-1.2	0.0	2.5	5.0

Includes APU fuel burn.

GEAR DOWN

ENGINE INOP

MAX CONTINUOUS THRUST

Holding

Flaps Up

WEIGHT (1000 KG)		PRESSURE ALTITUDE (FT)				
		1500	5000	10000	15000	20000
75	%N1	91.0				
	KIAS	219				
	FF/ENG	3820				
70	%N1	89.1	92.3			
	KIAS	214	214			
	FF/ENG	3560	3600			
65	%N1	87.1	90.1			
	KIAS	209	209			
	FF/ENG	3310	3330			
60	%N1	84.8	87.8	92.5		
	KIAS	203	203	203		
	FF/ENG	3060	3070	3110		
55	%N1	82.5	85.5	90.0		
	KIAS	197	197	197		
	FF/ENG	2820	2820	2840		
50	%N1	79.9	82.9	87.3	92.4	
	KIAS	190	190	190	190	
	FF/ENG	2580	2570	2580	2630	
45	%N1	77.4	80.2	84.6	89.3	97.3
	KIAS	184	184	184	184	184
	FF/ENG	2370	2350	2340	2370	2490
40	%N1	74.7	77.4	81.8	86.2	91.7
	KIAS	177	177	177	177	177
	FF/ENG	2150	2130	2110	2120	2140

This table includes 5% additional fuel for holding in a racetrack pattern.

Performance Inflight — Chapter PI
Text — Section 37

Introduction

This chapter contains information to supplement performance data from the Flight Management Computer (FMC). In addition, sufficient inflight data is provided to complete a flight with the FMC inoperative. In the event of conflict between data presented in this chapter and that contained in the approved Airplane Flight Manual, the Flight Manual shall always take precedence.

General

Takeoff Speeds

The speeds presented in the Takeoff Speeds table as well as FMC computed takeoff speeds can be used for all performance conditions except where adjustments must be made for anti-skid inoperative, thrust reversers inoperative, improved climb, contaminated runway situations, or brake energy limits.

V1 adjustments are not necessary for equal amounts of clearway and stopway. V1 for takeoff limit weights based on unequal clearway and stopway should be obtained from computerized takeoff speeds calculations for the specific takeoff conditions.

These speeds may be used for weights less than or equal to the performance limited weight subject to the restrictions noted above.

The FMC will protect for minimum control speeds by increasing V1, VR and V2 as required. However, the FMC will not compute takeoff speeds for weights where the required speed increase exceeds the maximum certified speed increase. This typically occurs at full rated thrust and light weights. In this case, the message "V SPEEDS UNAVAILABLE" will appear on the FMC scratchpad and the takeoff speed entries will be blank. In this situation, manually verify takeoff speeds using an approved source of takeoff performance information. Upon verifying the takeoff speeds, takeoff is permitted. When selected takeoff speeds cannot be verified, the options are to select a lower number flap setting, select derate thrust and/or increase airplane gross weight (e.g. add fuel). Selecting derate thrust is the preferred method as this will reduce the minimum control speeds. Note that the assumed temperature method will not help this condition as the minimum control speeds are determined at the actual temperature and therefore are not reduced by an assumed temperature selection.

Operations at -7B26 takeoff thrust may be limited at weights below 56699 kg in order to maintain airplane controllability during takeoff. Alternatively, lower minimum takeoff weights may be obtained, for the actual pressure altitude and outside air temperature, by using the Minimum Takeoff Weight table provided in the Performance Dispatch Takeoff Section. For takeoff at weights below the minimum takeoff weight, use of a lower thrust rating (certified derate) is required. Note that the assumed temperature method of reducing thrust may not be used as a means to comply with this restriction.

Normal takeoff speeds, V1, VR, and V2 are read from either the dry or wet table by entering with takeoff flap setting and brake release weight. Use the tables provided to adjust takeoff speeds for altitude and actual temperature or assumed temperature for reduced thrust takeoffs. Slope and wind adjustments to V1 are obtained by entering the Slope and Wind V1 Adjustment table.

V1(MCG)

Regulations prohibit scheduling takeoff with a V1 less than minimum V1 for control on the ground, V1(MCG). It is therefore necessary to compare the adjusted V1 to V1(MCG). The V1(MCG) presented in this manual is conservative for all weight and bleed configurations.

To find V1(MCG) enter the V1(MCG) table with the airport pressure altitude and actual OAT. If the adjusted V1 is less than V1(MCG), set V1 equal to V1(MCG). If the adjusted VR is less than V1(MCG), set VR equal to V1(MCG), and determine a new V2 by adding the difference between the normal VR and V1(MCG) to the normal V2. No takeoff weight adjustment is necessary provided that the actual field length exceeds the minimum field length shown in the Field and Climb Limit Weight table in chapter Performance Dispatch.

Stab Trim

To find takeoff stabilizer trim setting, enter Stab Trim Setting table with anticipated brake release weight and center of gravity (C.G. % MAC) and read required stabilizer trim units.

VREF

This table contains flaps 40, 30 and 15 reference speeds for a given weight.

Flap Maneuver Speeds

This table provides flap maneuver speeds for various flap settings. During flap retraction, selection of the next flap position is initiated when reaching the maneuver speed for the existing flap position. During flap retraction, at least adequate maneuver capability or 30° of bank (15° of bank and 15° overshoot) to stick shaker is provided at the flap retraction speed. Full maneuver capability or at least 40° of bank (25° of bank and 15° overshoot) is provided when the airplane has accelerated to the recommended maneuver speed for the selected flap position.

During flap extension, selection of the flaps to the next flap position should be made when approaching, and before decelerating below, the maneuver speed for the existing flap position. The flap extension speed schedule varies with airplane weight and provides full maneuver capability or at least 40° of bank (25° of bank and 15° overshoot) to stick shaker at all weights.

Slush/Standing Water Takeoff

Experience has shown that aircraft performance may deteriorate significantly on runways covered with snow, slush, standing water or ice. Therefore, reductions in field/obstacle limited takeoff weight and revised takeoff speeds are necessary. The tables are intended for guidance in accordance with advisory material and assume an engine failure at the critical point during the takeoff.

The entire runway is assumed to be completely covered by a contaminant of uniform thickness and density. Therefore this information is conservative when operating under typical cold weather conditions where patches of slush exist and some degree of sanding is common. Takeoffs in slush or standing water depths greater than 13 mm (0.5 inches) are not recommended because of possible airplane damage as a result of spray impingement on the airplane structure. The use of assumed temperature for reduced thrust is not allowed on contaminated runways. Interpolation for slush/standing water depths between the values shown is permitted.

Takeoff weight determination:

1. Enter the Weight Adjustment table with the dry field/obstacle limit weight to obtain the weight reduction for the slush/standing water depth and airport pressure altitude.
2. Adjust field length available for temperature by amount shown beneath V1(MCG) limit weight table.
3. Enter the V1(MCG) Limit Weight table with the adjusted field length and pressure altitude to obtain the slush/standing water limit weight with respect to minimum field length required for V1(MCG) speed.

4. The maximum allowable takeoff weight in slush/standing water is the lesser of the limit weights found in steps 1 and 3.

Takeoff speed determination:

1. Determine takeoff speeds V1, VR and V2 for actual brake release weight using the Dry Runway Takeoff Speeds table for the appropriate flap setting and thrust rating.
2. If V1(MCG) limited, set V1=V1(MCG). If not limited by V1(MCG) considerations, enter the V1 Adjustment table with actual brake release weight to determine the V1 reduction to apply to V1 speed. If the adjusted V1 is less than V1(MCG), set V1=V1(MCG).

Slippery Runway Takeoff

Airplane braking action is reported as good, medium or poor, depending on existing runway conditions. If braking action is reported as good, conditions should not be expected to be as good as on clean, dry runways. The value “good” is comparative and is intended to mean that airplanes should not experience braking or directional control difficulties when stopping. The performance level used to calculate the “good” data is consistent with wet runway testing done on early Boeing jets. The performance level used to calculate the “poor” data reflects a runway covered with wet ice. Performance is based on a 15 ft screen height at the end of the runway. The tables provided are used in the same manner as the Slush/Standing Water tables.

Anti-Skid Inoperative

When operating with anti-skid inoperative, the field limit weight and V1 must be reduced to account for the effect on accelerate-stop performance. Anti-skid inoperative is only allowed on a dry runway. A simplified method which conservatively accounts for the effects of anti-skid inoperative is to reduce the normal dry field/obstacle limited weight by 8000 kg and the V1 associated with the reduced weight by the amount shown in the table below.

ANTI-SKID INOPERATIVE V1 ADJUSTMENTS	
FIELD LENGTH (M)	V1 ADJUSTMENT (KIAS)
2000	-18
2500	-15
3000	-13
3500	-11
4000	-10

If the resulting V1 is less than V1(MCG), takeoff is permitted with V1 set equal to V1(MCG) provided the dry accelerate-stop distance adjusted for wind and slope exceeds approximately 2500 m.

Detailed analysis for the specific case from the Airplane Flight Manual may yield a less restrictive penalty.

Thrust Reverser Inoperative

When dispatching on a wet runway with both thrust reversers operative, an operative anti-skid system, and all brakes operating, regulations allow deceleration credit for one thrust reverser in the engine failure case and two thrust reversers in the all engine stop case.

When dispatching on a wet runway with one thrust reverser inoperative, the field/obstacle limited weight and V1 speed must be reduced to account for the effect on accelerate-stop performance. A simplified method, which conservatively accounts for this, is to reduce the normal wet runway/field/obstacle limited weight by 1000 kg and the V1 associated with the reduced weight by 2 knots.

If the resulting V1 is less than minimum V1, takeoff is permitted with V1 set equal to V1(MCG) provided the accelerate-stop distance available adjusted for wind and slope exceeds approximately 1900 m.

Detailed analysis for the specific case from the Airplane Flight Manual may yield a less restrictive penalty.

Takeoff %N1

To find Max Takeoff %N1 based on normal engine bleed for air conditioning packs on, enter Takeoff %N1 Table with airport pressure altitude and airport OAT and read %N1. Apply %N1 adjustments as provided when applicable.

Assumed Temperature Reduced Thrust

Regulations permit the use of up to 25% takeoff thrust reduction for operation with assumed temperature reduced thrust. Use of assumed temperature reduced thrust is not allowed with anti-skid inoperative or on runways contaminated with standing water, ice, slush, or snow. Use of assumed temperature reduced thrust is not recommended if potential windshear conditions exist.

To find the maximum allowable assumed temperature enter the Maximum Assumed Temperature table with airport pressure altitude and OAT. Compare this temperature to that at which the airplane is performance limited as determined from available takeoff performance data. Next, enter the Maximum Takeoff %N1 table with airport pressure altitude and the lower of the two temperatures previously determined, to obtain a maximum takeoff %N1. Do not use an assumed temperature less than the minimum assumed temperature shown. Enter the %N1 Adjustment table with OAT and the difference between the assumed and actual OAT to obtain a %N1 adjustment. Subtract the %N1 adjustment from the maximum takeoff %N1 found previously to determine the assumed temperature reduced thrust %N1.

Apply %N1 adjustments as provided when applicable.

Max Climb %N1

This table shows Max Climb %N1 for a 280/.78 climb speed schedule, normal engine bleed for packs on or off and anti-ice off. Enter the table with airport pressure altitude and TAT and read %N1. %N1 adjustments are shown for anti-ice operation.

Go-around %N1

To find Max Go-around %N1 based on normal engine bleed for packs on (AUTO) and anti-ice on or off, enter the Go-around %N1 table with airport pressure altitude and reported OAT or TAT and read %N1. For packs OFF or HIGH operation, apply the %N1 adjustment shown below the table.

Flight with Unreliable Airspeed / Turbulent Air Penetration

Pitch attitude and average %N1 information is provided for use in all phases of flight in the event of unreliable airspeed/Mach indications resulting from blocking or freezing of the pitot system. Loss of radome or turbulent air may also cause unreliable airspeed/Mach indications. The cruise table in this section may also be used for turbulent air penetration. The Flight with Unreliable Airspeed - FINAL APPROACH table includes a 10 knot margin for landing.

Pitch attitude is shown in bold type for emphasis since altitude and/or vertical speed indications may also be unreliable.

All Engines

Long Range Cruise Maximum Operating Altitude

These tables provide the maximum operating altitude in the same manner as the FMC. Maximum altitudes are shown for a given cruise weight and maneuver capability. This table considers both thrust and buffet limits, providing the more limiting of the two. Any data that is thrust limited is denoted by an asterisk and represents only a thrust limited condition in level flight with 100 ft/min residual rate of climb. Flying above these altitudes with sustained banks in excess of approximately 15° may cause the airplane to lose speed and/or altitude. The altitudes shown in the table are limited to the maximum certified altitude of 41000 ft.

Long Range Cruise Control

These tables provide target %N1, Long Range Cruise Mach number, IAS and standard day fuel flow per engine for the airplane weight and pressure altitude. As indicated by the shaded area, at optimum altitude .79M approximates the Long Range Cruise Mach schedule.

Long Range Cruise Enroute Fuel and Time

Long Range Cruise Enroute Fuel and Time tables are provided to determine remaining time and fuel required to destination. The data is based on Long Range Cruise and .78/280/250 descent. Tables are presented for low altitudes and high altitudes.

To determine remaining fuel and time required, first enter the Ground to Air Miles Conversion table to convert ground distance and enroute wind to an equivalent still air distance for use with the Reference Fuel and Time tables. Next, enter the Reference Fuel and Time table with air distance from the Ground to Air Miles Conversion table and the desired altitude and read Reference Fuel and Time Required. Lastly, enter the Fuel Required Adjustment table with the Reference Fuel and the actual weight at checkpoint to obtain fuel required to destination.

APU Operation During Flight

For APU operation during flight, increase fuel flow according to the table in the Engine Inoperative text section.

Long Range Cruise Wind-Altitude Trade

Wind is a factor which may justify operations considerably below optimum altitude. For example, a favorable wind component may have an effect on ground speed which more than compensates for the loss in air range.

Using this table, it is possible to determine the break-even wind (advantage necessary or disadvantage that can be tolerated) to maintain the same range at another altitude and long range cruise speed. The tables make no allowance for climb or descent time, fuel or distance, and are based on comparing ground fuel mileage.

Descent

Time, fuel, and distance for descent are shown for a .78/280/250 descent speed schedule. Enter the table with top of descent pressure altitude and read distance, time and fuel. Data is based on flight idle thrust descent in zero wind. Allowances are included for a straight-in approach with gear down and landing flaps at the outer marker.

Holding

Target %N1, indicated airspeed and fuel flow per engine information is tabulated for holding with flaps up based on the FMC optimum holding speed schedule. This is the higher of the maximum endurance speed and the maneuvering speed. Small variations in airspeed will not appreciably affect the overall endurance time. Enter the table with weight and pressure altitude to read %N1, IAS and fuel flow per engine.

Advisory Information

Normal Configuration Landing Distance

The normal configuration distance tables are provided as advisory information to help determine the actual landing distance performance of the airplane for different runway surface conditions and brake configurations.

If the surface is affected by water, snow or ice, and the braking action is reported as "good", conditions should not be expected to be as good as on clean, dry runways. The value "good" is comparative and is intended to mean that airplanes should not experience braking or directional control difficulties when landing. The performance level used to calculate the "good" data is consistent with wet runway testing done on early Boeing jets. The performance level used to calculate "poor" data reflects runways covered with wet ice.

Dry runway landing performance is shown for max manual braking configuration and autobrake settings max, 3, 2, and 1. The autobrake performance may be used to assist in the selection of the most desirable autobrake setting for a given field length. Selection of an autobrake setting results in a constant rate of deceleration. Maximum effort manual braking should achieve shorter landing distance than the max autobrake setting. The reference landing distance is a reference distance from 50 ft above the threshold to stop based on a reference landing weight and normal approach speed for the selected landing flap at sea level, zero wind, zero slope, and two engine detent reverse thrust. Subsequent columns provide adjustments for off-reference landing weight, altitude, wind, slope, temperature, speed, and reverse thrust. Each adjustment is independently added to the reference landing distance.

Flaps 30 and 40 landing distances and adjustments are provided for dry runways as well as runways with good, medium, and poor reported braking actions, which are commonly referred to as slippery runway conditions. All landing distances (reference distances plus adjustments) are 115% of the actual landing distance.

Non-normal Configuration Landing Distance

Advisory information is provided to support non-normal configurations that affect the landing performance of the airplane. Landing distances and adjustments are provided for dry runways and runways with good, medium, and poor reported braking action.

Enter the table with the applicable non-normal configuration and read the normal approach speed. The reference landing distance is a reference distance from 50 ft above the threshold to stop based on a reference landing weight and speed at sea level, zero wind, and zero slope. Subsequent columns provide adjustments for off-reference landing weight, altitude, wind, slope, and speed conditions. Each adjustment is independently added to the reference landing distance. Landing distance includes the effect of reverse thrust.

Recommended Brake Cooling Schedule

Advisory information is provided to assist in avoiding the problems associated with hot brakes. For normal operation, most landings are at weights below the AFM quick turnaround limit weight.

Use of the recommended cooling schedule will help avoid brake overheat and fuse plug problems that could result from repeated landings at short time intervals or a rejected takeoff.

Enter the Recommended Brake Cooling Schedule table with the airplane weight and brakes on speed, adjusted for wind at the appropriate temperature and altitude condition. Instructions for applying wind adjustments are included below the table. Linear interpolation may be used to obtain intermediate values. The resulting number is the reference brake energy per brake in millions of foot-pounds, and represents the amount of energy absorbed by each brake during a rejected takeoff. Notes providing adjustments for wind are included below the table.

To determine the energy per brake absorbed during landing, enter the appropriate Adjusted Brake Energy Per Brake table (No Reverse Thrust or 2 Engine Reverse) with the reference brake energy per brake and the type of braking used during landing (Max Manual, Max Auto, or Autobrake). The resulting number is the adjusted brake energy per brake and represents the energy absorbed in each brake during the landing.

The recommended cooling time is found in the appropriate (steel or carbon brakes) final table by entering with the adjusted brake energy per brake. Times are provided for ground cooling and inflight gear down cooling.

Brake Temperature Monitor System (BTMS) indications are also shown. If brake cooling is determined from the BTMS, use the hottest brake indication 10 to 15 minutes after the airplane has come to a complete stop, or inflight with gear retracted to determine recommended cooling schedule.

Engine Inoperative

Initial Max Continuous %N1

The Initial Max Continuous %N1 setting for use following an engine failure is shown. The table is based on the typical all engine cruise speed of .79M to provide a target %N1 setting at the start of driftdown. Once driftdown is established, the Max Continuous %N1 table should be used to determine %N1 for the given conditions.

Max Continuous %N1

Power setting is based on one engine operating with one A/C pack operating and all anti-ice bleeds off. Enter the table with pressure altitude, TAT, and IAS or Mach to read %N1.

It is desirable to maintain engine thrust level within the limits of the Max Cruise thrust rating. However, where thrust level in excess of Max Cruise rating is required, such as for meeting terrain clearance, ATC altitude assignments, or to attain maximum range capability, it is permissible to use the thrust needed up to the Max Continuous thrust rating. The Max Continuous thrust rating is intended primarily for emergency use at the discretion of the pilot and is the maximum thrust that may be used continuously.

Driftdown Speed/Level Off Altitude

The table shows optimum driftdown speed as a function of cruise weight at start of driftdown. Also shown are the approximate weight and pressure altitude at which the airplane will level off considering 100 ft/min residual rate of climb.

The level off altitude is dependent on air temperature (ISA deviation).

Driftdown/LRC Range Capability

This table shows the range capability from the start of driftdown. Driftdown is continued to level off altitude. As weight decreases due to fuel burn, the airplane is accelerated to Long Range Cruise speed. Cruise is continued at level off altitude and Long Range Cruise speed.

To determine fuel required, enter the Ground to Air Miles Conversion table with the desired ground distance and adjust for anticipated winds to obtain air distance to destination. Then enter the Driftdown/Cruise Fuel and Time table with air distance and weight at start of driftdown to determine fuel and time required. If altitudes other than the level off altitude is used, fuel and time required may be obtained by using the Engine Inoperative Long Range Cruise Enroute Fuel and Time table.

Long Range Cruise Altitude Capability

The table shows the maximum altitude that can be maintained at a given weight and air temperature (ISA deviation), based on Long Range Cruise speed, Max Continuous thrust, and 100 ft/min residual rate of climb.

Long Range Cruise Control

The table provides target %N1, engine inoperative Long Range Cruise Mach number, IAS and fuel flow for the airplane weight and pressure altitude. The fuel flow values in this table reflect single engine fuel burn.

APU Operation During Flight

For APU operation during flight, increase fuel flow according to the following table. These increments include the APU fuel flow and the effect of increased drag from the APU door.

PRESSURE ALTITUDE (1000 FT)	APU FUEL FLOW (KG/HR)
39	45
35	45
31	50
25	60
20	65
15	75
10	85
5	95

Long Range Cruise Diversion Fuel and Time

Tables are provided for crews to determine the fuel and time required to proceed to an alternate airfield with one engine inoperative. The data is based on single engine Long Range Cruise speed and .78/280/250 descent. Enter with Air Distance as determined from the Ground to Air Miles Conversion table and read Fuel and Time required at the cruise pressure altitude. Adjust the fuel obtained for deviation from the reference weight at checkpoint as required by entering the off reference fuel adjustments table with the fuel required for the reference weight and the actual weight at checkpoint. Read fuel required and time for the actual weight.

Holding

Single engine holding data is provided in the same format as the all engine holding data and is based on the same assumptions.

Gear Down Landing Rate of Climb Available

Rate of climb data is provided as guidance information in the event an engine inoperative landing (manual or autoland) is planned. The tables show gear down rate of climb available for Flaps 15 and Flaps 30. Enter the table with TAT and pressure altitude to read rate of climb available. Apply adjustments shown to correct for weight.

Alternate Mode EEC

Introduction

This section contains performance data for airplane operation with the Electronic Engine Control (EEC) in the alternate mode (ALTN EEC switch illuminated) for applicable thrust ratings. The data includes engine bleed effects for normal air conditioning operation i.e., two packs on at normal flow all engines operating.

Operation with derate and/or assumed temperature reduced thrust is not permitted with the EEC in alternate mode.

Limit Weight

A simplified method which conservatively accounts for the effects of EEC in alternate mode is to reduce the normal mode (ON EEC switch illuminated) performance limited weights. The Limit Weight table provides takeoff field, climb, and obstacle limit weights. To determine limit weights for operations with the EEC in alternate mode, enter the table with the limit weights for normal mode EEC operation and read the associated limit weight for each performance condition. The most limiting of the takeoff weights must be used. Analysis from the Airplane Flight Manual - Digital Performance Information may yield less restrictive limit weights.

Takeoff Speed Adjustment

Takeoff speeds for the reduced weight should be increased by the amount shown in the Takeoff Speeds Adjustment table. The adjusted V1 should not exceed the adjusted VR.

Note: The FMC does not incorporate alternate mode EEC performance in its takeoff speeds calculations.

Max Takeoff %N1

The alternate mode EEC thrust schedule provides equal or greater thrust than the normal mode thrust for the same thrust lever position. Thrust limit protection is not provided in alternate mode EEC and maximum rated thrust may be reached at thrust lever position less than full forward. As a result, thrust overboost may occur if the target alternate mode EEC Max Takeoff %N1 settings are not observed.

To find alternate mode EEC Max Takeoff %N1 based on normal engine bleed for air conditioning packs on, enter the Alternate Mode EEC Max Takeoff %N1 table with airport pressure altitude and airport OAT and read %N1. For packs off apply the %N1 adjustment provided below the table. No %N1 adjustment is required for engine or wing anti-ice.

Gear Down

This section contains performance for airplane operation with the landing gear extended. The data is based on engine bleeds for normal air conditioning.

Note: The Flight Management Computer System (FMCS) does not contain special provisions for operation with landing gear extended. As a result, the FMCS may generate inappropriate enroute speed schedules, display non-conservative predictions of fuel burn, estimated time of arrival (ETA), maximum altitude, and compute overly shallow descent path. An accurate estimated time of arrival (ETA) is available if current speed or Mach is entered into the VNAV cruise page.

Tables for gear down performance in this section are identical in format and used in the same manner as tables for the gear up configuration previously described.

Performance Inflight — Chapter PI

Table of Contents — Section 40

737-800 CFM56-7B26 C KG M FAA CATC/N

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Performance Inflight — Chapter PI
Pkg Model Identification — Section 40

General

The table below shows the airplanes that have been identified with the following performance package. Note, some airplanes may be identified with more than one performance package. This configuration table information reflects the Boeing delivered configuration updated for service bulletin incorporations in conformance with the policy stated in the introduction section of the FCOM. The performance data is prepared for the owner/operator named on the title page. The intent of this information is to assist flight crews and airlines in knowing which performance package is applicable to a given airplane. The performance package model identification information is based on Boeing's knowledge of the airline's fleet at a point in time approximately three months prior to the page date. Notice of Errata (NOE) will not be provided to airlines to identify airplanes that are moved between performance packages within this manual or airplanes added to the airline's fleet whose performance packages are already represented in this manual. These types of changes will be updated in the next block revision. Owners/operators are responsible for ensuring the operational documentation they are using is complete and matches the current configuration of their airplanes, and the accuracy and validity of all information furnished by the owner/operator or any other party. Owners/operators receiving active revision service are responsible to ensure that any modifications to the listed airplanes are properly reflected in this manual.

Serial and tabulation number are supplied by Boeing.

Registry Number	Serial Number	Tabulation Number
YX800	YX800	YX800

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Takeoff Speeds - Dry Runway
V1, VR, V2 for Max Takeoff Thrust

WEIGHT (1000 KG)	FLAPS 1			FLAPS 5			FLAPS 10			FLAPS 15			FLAPS 25		
	V1	VR	V2	V1	VR	V2	V1	VR	V2	V1	VR	V2	V1	VR	V2
90	169	171	175	161	163	168									
85	163	166	171	157	159	164	156	157	162						
80	158	160	167	152	154	160	151	152	158	148	149	155	145	146	153
75	153	155	162	147	148	156	146	147	154	142	144	151	140	141	149
70	147	149	158	141	143	152	140	141	150	137	138	147	135	136	145
65	141	143	153	135	137	147	134	136	146	131	133	143	129	130	140
60	135	136	148	129	131	143	128	129	141	125	126	138	123	124	136
55	128	129	143	123	124	137	122	123	136	119	120	133	117	118	131
50	121	122	137	116	117	132	115	116	130	112	113	128	110	111	126
45	113	114	131	109	110	126	108	108	125	105	106	122	103	104	120
40	105	106	125	101	102	120	100	101	119	98	99	117	96	97	115

Check V1(MCG).

V1, VR, V2 Adjustments*

TEMP		V1							VR							V2						
		PRESS ALT (1000 FT)							PRESS ALT (1000 FT)							PRESS ALT (1000 FT)						
°C	°F	-2	0	2	4	6	8	10	-2	0	2	4	6	8	10	-2	0	2	4	6	8	10
70	158	5	6						4	5						-3	-3					
60	140	4	5	6	7				3	4	5	6				-2	-3	-3	-4			
50	122	2	3	4	5	6	7	9	2	3	4	5	6	7	8	-2	-2	-3	-3	-4	-5	-6
40	104	1	1	3	4	5	6	7	1	1	3	4	5	6	7	-1	-1	-2	-2	-3	-4	-5
30	86	0	0	1	2	4	5	6	0	0	1	3	4	5	6	0	0	-1	-2	-2	-3	-4
20	68	0	0	1	2	3	4	5	0	0	1	2	3	4	5	0	0	-1	-1	-2	-3	-3
-60	-76	0	0	1	2	3	4	5	0	0	1	2	3	4	5	0	0	-1	-1	-2	-2	-3

Slope and Wind V1 Adjustments*

WEIGHT (1000 KG)	SLOPE (%)					WIND (KTS)							
	-2	-1	0	1	2	-15	-10	-5	0	10	20	30	40
90	-4	-2	0	1	1	-2	-2	-1	0	0	0	0	1
80	-3	-2	0	1	1	-2	-1	-1	0	0	0	1	1
70	-2	-1	0	1	1	-2	-1	-1	0	0	1	1	1
60	-2	-1	0	1	1	-2	-1	-1	0	0	1	1	1
50	-1	0	0	0	1	-2	-1	0	0	0	1	1	1
40	0	0	0	0	0	-2	-1	0	0	0	0	0	0

***V1 not to exceed VR.**

V1(MCG)
Max Takeoff Thrust

TEMP		PRESSURE ALTITUDE (FT)						
°C	°F	-2000	0	2000	4000	6000	8000	10000
70	158	95	93					
60	140	95	93	92	90			
50	122	97	95	92	90	88	86	83
40	104	101	99	96	93	89	86	83
30	86	104	103	100	96	92	88	85
20	68	104	104	101	98	94	90	87
-60	-76	106	105	102	99	95	92	89

Takeoff Speeds - Wet Runway

V1, VR, V2 for Max Takeoff Thrust

WEIGHT (1000 KG)	FLAPS 1			FLAPS 5			FLAPS 10			FLAPS 15			FLAPS 25		
	V1	VR	V2	V1	VR	V2	V1	VR	V2	V1	VR	V2	V1	VR	V2
90	164	171	175	156	164	168									
85	157	166	171	150	159	164	151	157	162						
80	151	160	167	145	154	160	145	152	158	141	149	155	140	146	153
75	145	155	162	139	148	156	139	147	154	136	144	151	134	141	149
70	139	149	158	133	143	152	133	141	150	130	138	147	128	136	145
65	133	143	153	127	137	148	127	136	146	124	133	143	122	130	140
60	126	136	148	121	131	143	120	129	141	117	126	138	115	124	136
55	119	129	143	114	124	137	113	123	136	111	120	133	109	118	131
50	111	122	137	107	117	132	106	116	130	104	113	128	102	111	126
45	104	114	131	99	110	126	99	108	125	96	106	122	95	104	120
40	96	106	125	92	102	120	91	101	119	89	99	117	87	97	115

Check V1(MCG).

V1, VR, V2 Adjustment*

TEMP		V1							VR							V2						
		PRESS ALT (1000 FT)							PRESS ALT (1000 FT)							PRESS ALT (1000 FT)						
°C	°F	-2	0	2	4	6	8	10	-2	0	2	4	6	8	10	-2	0	2	4	6	8	10
70	158	7	8						4	5						-3	-4					
60	140	5	6	7	9				3	4	5	6				-2	-3	-3	-4			
50	122	3	4	5	6	8	9	12	2	3	4	5	6	7	8	-2	-2	-3	-3	-4	-5	-6
40	104	1	2	3	4	6	7	9	1	1	3	4	5	6	7	-1	-1	-2	-2	-3	-4	-5
30	86	0	0	1	3	4	6	7	0	0	1	3	4	5	6	0	0	-1	-2	-2	-3	-4
20	68	0	0	1	2	4	5	6	0	0	1	2	3	4	5	0	0	-1	-1	-2	-2	-3
-60	-76	0	0	1	2	4	5	7	0	0	1	2	3	4	5	0	0	-1	-1	-2	-2	-3

Slope and Wind V1 Adjustment*

WEIGHT (1000 KG)	SLOPE (%)					WIND (KTS)							
	-2	-1	0	1	2	-15	-10	-5	0	10	20	30	40
90	-5	-3	0	3	6	-3	-2	-1	0	1	2	2	3
80	-5	-2	0	3	5	-4	-2	-1	0	1	2	2	3
70	-4	-2	0	2	4	-4	-2	-1	0	1	1	2	3
60	-3	-1	0	2	3	-4	-3	-1	0	1	2	2	3
50	-2	-1	0	1	3	-4	-3	-1	0	1	2	3	4
40	-1	0	0	1	2	-5	-3	-1	0	1	3	4	5

***V1 not to exceed VR.**

V1(MCG)
Max Takeoff Thrust

TEMP		PRESSURE ALTITUDE (FT)						
°C	°F	-2000	0	2000	4000	6000	8000	10000
70	158	95	93					
60	140	95	93	92	90			
50	122	97	95	92	90	88	86	83
40	104	101	99	96	93	89	86	83
30	86	104	103	100	96	92	88	85
20	68	104	104	101	98	94	90	87
-60	-76	106	105	102	99	95	92	89

Stab Trim Setting
Max Takeoff Thrust
Flaps 1 and 5

WEIGHT (1000 KG)	C.G. (%MAC)										
	6	8	9	11	16	21	26	30	32	34	36
85	8 1/2	8 1/2	8 1/2	8 1/4	7	6 1/4	5 1/2	4 3/4	4 1/2	4 1/4	3 3/4
80	8 1/2	8 1/2	8 1/4	7 3/4	6 3/4	6	5 1/4	4 1/2	4 1/4	4	3 1/2
75	8 1/4	8	7 3/4	7 1/2	6 1/2	5 3/4	5	4 1/2	4	3 3/4	3 1/2
70	8	7 3/4	7 1/2	7 1/4	6 1/4	5 1/2	4 3/4	4 1/4	3 3/4	3 1/2	3 1/4
65	7 3/4	7 1/4	7	6 3/4	6	5 1/4	4 1/2	4	3 3/4	3 1/4	3
60	7 1/4	7	6 3/4	6 1/2	5 3/4	5	4 1/4	3 3/4	3 1/2	3 1/4	2 3/4
55	6 3/4	6 1/2	6 1/2	6 1/4	5 1/2	4 3/4	4 1/4	3 1/2	3 1/4	3	2 3/4
50	6 1/2	6	6	5 3/4	5	4 1/2	3 3/4	3 1/4	3	2 3/4	2 1/4
45	6	5 3/4	5 1/2	5 1/2	4 3/4	4	3 1/2	3	2 1/2	2 1/2	2 1/4
40	6	5 3/4	5 1/2	5 1/2	4 3/4	4	3 1/2	3	2 1/2	2 1/2	2 1/4

Flaps 10, 15 and 25

WEIGHT (1000 KG)	C.G. (%MAC)										
	6	8	9	11	16	21	26	30	32	34	36
85	8 1/2	8 1/2	8 1/2	8 1/2	6 1/2	5 1/2	4 1/4	3 1/2	3	2 1/2	2 1/4
80	8 1/2	8 1/2	8 1/2	8 1/2	6	5	4	3 1/4	2 3/4	2 1/2	2 1/4
75	8 1/2	8 1/2	8 1/2	7 3/4	5 3/4	4 3/4	3 3/4	3	2 1/2	2 1/4	2 1/4
70	8 1/2	8 1/4	8 1/4	7 1/4	5 1/2	4 1/2	3 1/2	2 3/4	2 1/2	2 1/4	2 1/4
65	8 1/4	7 3/4	7 1/2	6 3/4	5 1/4	4 1/4	3 1/4	2 1/2	2 1/4	2 1/4	2 1/4
60	7 3/4	7	6 3/4	6 1/4	4 3/4	4	3	2 1/4	2 1/4	2 1/4	2 1/4
55	7	6 1/2	6 1/4	5 3/4	4 1/2	3 3/4	2 3/4	2 1/4	2 1/4	2 1/4	2 1/4
50	6	5 3/4	5 1/2	5	4	3 1/4	2 1/2	2 1/4	2 1/4	2 1/4	2 1/4
45	5	4 3/4	4 1/2	4 1/2	3 1/2	2 3/4	2 1/4	2 1/4	2 1/4	2 1/4	2 1/4
40	5	4 3/4	4 1/2	4 1/2	3 1/2	2 3/4	2 1/4	2 1/4	2 1/4	2 1/4	2 1/4

VREF

WEIGHT (1000 KG)	FLAPS		
	40	30	15
85	160	168	177
80	155	163	172
75	151	158	167
70	146	153	161
65	141	148	156
60	135	142	149
55	128	136	143
50	122	129	136
45	115	122	128
40	108	115	121

Flap Maneuver Speeds

FLAP POSITION	MANEUVER SPEED
UP	VREF40 + 70
1	VREF40 + 50
5	VREF40 + 30
10	VREF40 + 30
15	VREF40 + 20
25	VREF40 + 10
30	VREF30
40	VREF40

ADVISORY INFORMATION

Slush/Standing Water Takeoff

Maximum Reverse Thrust

Weight Adjustments (1000 KG)

DRY FIELD/OBSTACLE LIMIT WEIGHT (1000 KG)	SLUSH/STANDING WATER DEPTH								
	3 mm (0.12 INCHES)			6 mm(0.25 INCHES)			13 mm(0.50 INCHES)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
95	-12.7	-15.0	-17.3	-15.6	-17.8	-20.1	-21.5	-23.8	-26.0
90	-11.7	-14.0	-16.3	-14.2	-16.5	-18.7	-19.4	-21.7	-23.9
85	-10.7	-13.0	-15.3	-12.8	-15.1	-17.4	-17.3	-19.6	-21.8
80	-9.7	-12.0	-14.3	-11.5	-13.8	-16.0	-15.2	-17.5	-19.7
75	-8.8	-11.0	-13.3	-10.2	-12.5	-14.7	-13.2	-15.5	-17.8
70	-7.8	-10.1	-12.3	-9.0	-11.2	-13.5	-11.4	-13.6	-15.9
65	-6.9	-9.2	-11.4	-7.8	-10.0	-12.3	-9.7	-11.9	-14.2
60	-6.0	-8.3	-10.5	-6.7	-8.9	-11.2	-8.1	-10.4	-12.7
55	-5.2	-7.4	-9.7	-5.6	-7.9	-10.2	-6.7	-9.0	-11.2
50	-4.3	-6.6	-8.9	-4.7	-6.9	-9.2	-5.4	-7.7	-10.0
45	-3.5	-5.8	-8.1	-3.8	-6.0	-8.3	-4.3	-6.6	-8.8
40	-2.8	-5.0	-7.3	-2.9	-5.2	-7.5	-3.3	-5.5	-7.8

V1(MCG) Limit Weight (1000 KG)

ADJUSTED FIELD LENGTH (M)	SLUSH/STANDING WATER DEPTH								
	3 mm (0.12 INCHES)			6 mm (0.25 INCHES)			13 mm(0.50 INCHES)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
1200							33.4		
1400	41.8			45.4			51.5	36.3	
1600	61.5	44.9		65.2	48.5	32.8	71.1	54.6	39.2
1800	83.3	64.9	48.0	86.8	68.5	51.7	92.5	74.4	57.7
2000		87.1	68.4		90.5	72.0		96.1	77.8
2200			90.9			94.1			99.7

1. **Enter Weight Adjustment table with slush/standing water depth and dry field/obstacle limit weight to obtain slush/standing water weight adjustment.**
2. **Adjust field length available by -30 m/+30 m for every 5°C above/below 4°C.**
3. **Find V1(MCG) limit weight for adjusted field length and pressure altitude.**
4. **Max allowable slush/standing water limited weight is lesser of weights from 1 and 3.**

V1 Adjustment (KIAS)

WEIGHT (1000 KG)	SLUSH/STANDING WATER DEPTH								
	3 mm (0.12 INCHES)			6 mm (0.25 INCHES)			13 mm (0.50 INCHES)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
90	-15	-10	-5	-7	-2	0	0	0	0
85	-16	-11	-6	-10	-5	0	0	0	0
80	-18	-13	-8	-12	-7	-2	0	0	0
75	-19	-14	-9	-14	-9	-4	0	0	0
70	-20	-15	-10	-16	-11	-6	-4	0	0
65	-21	-16	-11	-17	-12	-7	-8	-3	0
60	-22	-17	-12	-19	-14	-9	-11	-6	-1
55	-23	-18	-13	-20	-15	-10	-14	-9	-4
50	-24	-19	-14	-22	-17	-12	-17	-12	-7
45	-25	-20	-15	-23	-18	-13	-19	-14	-9
40	-25	-20	-15	-24	-19	-14	-21	-16	-11

1. **Obtain V1, VR and V2 for the actual weight using the Dry Runway Takeoff Speeds table.**
2. **If V1(MCG) limited, set V1 = V1(MCG). If not V1(MCG) limited, enter V1 Adjustment table with the actual weight to obtain V1 speed adjustment. If adjusted V1 is less than V1(MCG), set V1 = V1(MCG). V1 not to exceed VR.**

ADVISORY INFORMATION

Slush/Standing Water Takeoff
No Reverse Thrust
Weight Adjustments (1000 KG)

DRY FIELD/OBSTACLE LIMIT WEIGHT (1000 KG)	SLUSH/STANDING WATER DEPTH								
	3 mm (0.12 INCHES)			6 mm(0.25 INCHES)			13 mm(0.50 INCHES)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
95	-14.6	-17.3	-20.1	-17.7	-20.4	-23.1	-23.9	-26.6	-29.3
90	-13.6	-16.3	-19.1	-16.3	-19.0	-21.7	-21.7	-24.4	-27.1
85	-12.6	-15.4	-18.1	-14.9	-17.6	-20.3	-19.4	-22.1	-24.9
80	-11.7	-14.4	-17.1	-13.5	-16.2	-18.9	-17.2	-19.9	-22.6
75	-10.6	-13.3	-16.0	-12.0	-14.8	-17.5	-15.0	-17.8	-20.5
70	-9.5	-12.2	-14.9	-10.6	-13.4	-16.1	-13.1	-15.8	-18.5
65	-8.4	-11.1	-13.8	-9.3	-12.0	-14.7	-11.2	-13.9	-16.7
60	-7.3	-10.0	-12.8	-8.0	-10.7	-13.4	-9.5	-12.2	-15.0
55	-6.3	-9.0	-11.7	-6.8	-9.5	-12.3	-8.0	-10.7	-13.4
50	-5.4	-8.1	-10.9	-5.8	-8.5	-11.2	-6.6	-9.3	-12.0
45	-4.7	-7.4	-10.1	-4.9	-7.6	-10.4	-5.4	-8.1	-10.8
40	-4.0	-6.7	-9.5	-4.1	-6.9	-9.6	-4.2	-6.9	-9.6

V1(MCG) Limit Weight (1000 KG)

ADJUSTED FIELD LENGTH (M)	SLUSH/STANDING WATER DEPTH								
	3 mm (0.12 INCHES)			6 mm (0.25 INCHES)			13 mm (0.50 INCHES)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
1600				32.3			47.4	31.6	
1800	46.7			56.0	37.9		69.3	52.5	36.5
2000	73.2	52.8	33.6	81.3	61.9	43.5	92.9	74.7	57.6
2200	101.8	79.9	59.0		87.6	67.9		98.6	80.3
2400			86.7			94.0			104.3

1. **Enter Weight Adjustment table with slush/standing water depth and dry field/obstacle limit weight to obtain slush/standing water weight adjustment.**
2. **Adjust field length available by -45 m/+45 m for every 5°C above/below 4°C.**
3. **Find V1(MCG) limit weight for adjusted field length and pressure altitude.**
4. **Max allowable slush/standing water limited weight is lesser of weights from 1 and 3.**

V1 Adjustment (KIAS)

WEIGHT (1000 KG)	SLUSH/STANDING WATER DEPTH								
	3 mm (0.12 INCHES)			6 mm (0.25 INCHES)			13 mm (0.50 INCHES)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
90	-20	-10	0	-11	-1	0	0	0	0
85	-22	-12	-2	-14	-4	0	0	0	0
80	-24	-14	-4	-16	-6	0	0	0	0
75	-25	-15	-5	-19	-9	0	0	0	0
70	-27	-17	-7	-21	-11	-1	-6	0	0
65	-28	-18	-8	-23	-13	-3	-11	-1	0
60	-29	-19	-9	-25	-15	-5	-15	-5	0
55	-30	-20	-10	-27	-17	-7	-19	-9	0
50	-31	-21	-11	-28	-18	-8	-22	-12	-2
45	-32	-22	-12	-30	-20	-10	-25	-15	-5
40	-32	-22	-12	-31	-21	-11	-27	-17	-7

1. **Obtain V1, VR and V2 for the actual weight using the Dry Runway Takeoff Speeds table.**
2. **If V1(MCG) limited, set V1 = V1(MCG). If not V1(MCG) limited, enter V1 Adjustment table with the actual weight to obtain V1 speed adjustment. If adjusted V1 is less than V1(MCG), set V1 = V1(MCG). V1 not to exceed VR.**

ADVISORY INFORMATION

Slippery Runway Takeoff

Maximum Reverse Thrust

Weight Adjustment (1000 KG)

DRY FIELD/OBSTACLE LIMIT WEIGHT (1000 KG)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
95	-0.8	-0.8	-0.8	-6.4	-6.4	-6.4	-11.5	-11.5	-11.5
90	-1.0	-1.0	-1.0	-6.4	-6.4	-6.4	-11.1	-11.1	-11.1
85	-1.3	-1.3	-1.3	-6.3	-6.3	-6.3	-10.6	-10.6	-10.6
80	-1.4	-1.4	-1.4	-6.1	-6.1	-6.1	-10.1	-10.1	-10.1
75	-1.5	-1.5	-1.5	-5.9	-5.9	-5.9	-9.6	-9.6	-9.6
70	-1.6	-1.6	-1.6	-5.7	-5.7	-5.7	-9.0	-9.0	-9.0
65	-1.5	-1.5	-1.5	-5.4	-5.4	-5.4	-8.4	-8.4	-8.4
60	-1.5	-1.5	-1.5	-5.0	-5.0	-5.0	-7.6	-7.6	-7.6
55	-1.3	-1.3	-1.3	-4.5	-4.5	-4.5	-6.9	-6.9	-6.9
50	-1.1	-1.1	-1.1	-4.0	-4.0	-4.0	-6.1	-6.1	-6.1
45	-0.8	-0.8	-0.8	-3.4	-3.4	-3.4	-5.2	-5.2	-5.2
40	-0.5	-0.5	-0.5	-2.8	-2.8	-2.8	-4.3	-4.3	-4.3

V1(MCG) Limit Weight (1000 KG)

ADJUSTED FIELD LENGTH (M)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
1000	39.6								
1200	72.0	57.3	42.4						
1400	103.9	89.4	74.8	46.2	31.3				
1600				69.6	53.3	38.1			
1800				95.6	77.5	60.6	41.6		
2000					104.1	85.6	55.7	40.7	
2200							71.2	54.7	39.8
2400							88.8	70.1	53.7
2600								87.5	69.0
2800									86.3

1. **Enter Weight Adjustment table with reported braking action and dry field/obstacle limit weight to obtain slippery runway weight adjustment.**
2. **Find V1(MCG) limit weight for available field length and pressure altitude.**
   Adjust “Good” field length available by -20 m/+20 m for every 5°C above/below 4°C.
   Adjust “Medium” field length available by -20 m/+20 m for every 5°C above/below 4°C.
   Adjust “Poor” field length available by -35 m/+35 m for every 5°C above/below 4°C.
3. **Max allowable slippery runway limited weight is lesser of weights from 1 and 3.**

ADVISORY INFORMATION

Slippery Runway Takeoff
Maximum Reverse Thrust
V1 Adjustment (KIAS)

WEIGHT (1000 KG)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
90	-5	-2	0	-13	-11	-8	-25	-23	-20
85	-6	-3	-1	-15	-13	-10	-27	-24	-22
80	-7	-4	-2	-17	-14	-12	-29	-26	-24
75	-8	-5	-3	-18	-16	-13	-31	-28	-26
70	-9	-6	-4	-20	-17	-15	-33	-30	-28
65	-9	-7	-4	-21	-19	-16	-35	-32	-30
60	-10	-8	-5	-22	-20	-17	-37	-34	-32
55	-11	-9	-6	-24	-21	-19	-38	-36	-33
50	-12	-9	-7	-25	-22	-20	-40	-37	-35
45	-13	-10	-8	-26	-24	-21	-41	-39	-36
40	-14	-11	-9	-27	-25	-22	-42	-40	-37

1. **Obtain V1, VR and V2 for the actual weight using the Dry Runway Takeoff Speeds table.**
2. **If V1(MCG) limited, set V1 = V1(MCG). If not V1(MCG) limited, enter V1 Adjustment table with the actual weight to obtain V1 speed adjustment. If adjusted V1 is less than V1(MCG), set V1 = V1(MCG).V1 not to exceed VR.**

ADVISORY INFORMATION

Slippery Runway Takeoff
No Reverse Thrust
Weight Adjustments (1000 KG)

DRY FIELD/OBSTACLE LIMIT WEIGHT (1000 KG)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
95	-2.1	-2.1	-2.1	-9.3	-9.3	-9.3	-15.9	-15.9	-15.9
90	-2.4	-2.4	-2.4	-9.2	-9.2	-9.2	-15.2	-15.2	-15.2
85	-2.7	-2.7	-2.7	-9.1	-9.1	-9.1	-14.5	-14.5	-14.5
80	-2.9	-2.9	-2.9	-9.0	-9.0	-9.0	-13.8	-13.8	-13.8
75	-3.1	-3.1	-3.1	-8.7	-8.7	-8.7	-13.0	-13.0	-13.0
70	-3.2	-3.2	-3.2	-8.4	-8.4	-8.4	-12.2	-12.2	-12.2
65	-3.2	-3.2	-3.2	-8.0	-8.0	-8.0	-11.3	-11.3	-11.3
60	-3.1	-3.1	-3.1	-7.5	-7.5	-7.5	-10.4	-10.4	-10.4
55	-3.0	-3.0	-3.0	-7.0	-7.0	-7.0	-9.4	-9.4	-9.4
50	-2.8	-2.8	-2.8	-6.3	-6.3	-6.3	-8.4	-8.4	-8.4
45	-2.5	-2.5	-2.5	-5.6	-5.6	-5.6	-7.3	-7.3	-7.3
40	-2.2	-2.2	-2.2	-4.8	-4.8	-4.8	-6.2	-6.2	-6.2

V1(MCG) Limit Weight (1000 KG)

ADJUSTED FIELD LENGTH (M)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
1200	38.0								
1400	86.5	67.4	43.5						
1600			89.8						
2000				72.9	33.7				
2200					86.8	53.8			
2400						100.0			
3200							75.7		
3400								70.0	
3600									63.9
3800									101.4

1. **Enter Weight Adjustment table with reported braking action and dry field/obstacle limit weight to obtain slippery runway weight adjustment.**
2. **Find V1(MCG) limit weight for available field length and pressure altitude.**
   Adjust "Good" field length available by -25 m/+25 m for every 5°C above/below 4°C.
   Adjust "Medium" field length available by -25 m/+25 m for every 5°C above/below 4°C.
   Adjust "Poor" field length available by -40 m/+40 m for every 5°C above/below 4°C.
3. **Max allowable slippery runway limited weight is lesser of weights from 1 and 3.**

ADVISORY INFORMATION

Slippery Runway Takeoff
No Reverse Thrust
V1 Adjustment (KIAS)

WEIGHT (1000 KG)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
90	-7	-2	0	-19	-14	-9	-39	-34	-29
85	-8	-3	0	-21	-16	-11	-42	-37	-32
80	-9	-4	0	-24	-19	-14	-45	-40	-35
75	-11	-6	-1	-26	-21	-16	-49	-44	-39
70	-12	-7	-2	-28	-23	-18	-52	-47	-42
65	-14	-9	-4	-31	-26	-21	-56	-51	-46
60	-15	-10	-5	-34	-29	-24	-59	-54	-49
55	-17	-12	-7	-37	-32	-27	-63	-58	-53
50	-18	-13	-8	-40	-35	-30	-66	-61	-56
45	-20	-15	-10	-43	-38	-33	-70	-65	-60
40	-22	-17	-12	-46	-41	-36	-74	-69	-64

1. **Obtain V1, VR and V2 for the actual weight using the Dry Runway Takeoff Speeds table.**
2. **If V1(MCG) limited, set V1 = V1(MCG). If not V1(MCG) limited, enter V1 Adjustment table with the actual weight to obtain V1 speed adjustment. If adjusted V1 is less than V1(MCG), set V1 = V1(MCG). V1 not to exceed VR.**

Takeoff %N1

Based on engine bleeds for packs on, engine and wing anti-ice on or off

OAT (°C)	AIRPORT PRESSURE ALTITUDE (FT)												
	-2000	-1000	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
60	94.8	95.4	95.8	95.9	96.0	96.1	96.2	96.3	96.2	95.9	95.8	95.7	95.7
55	95.4	96.0	96.5	96.6	96.7	96.8	96.9	97.1	96.9	96.6	96.3	95.7	95.0
50	96.0	96.6	97.1	97.3	97.4	97.6	97.7	97.8	97.7	97.4	97.1	96.6	96.1
45	96.8	97.4	97.8	98.0	98.1	98.3	98.4	98.5	98.4	98.1	97.8	97.5	97.1
40	97.4	98.1	98.6	98.7	98.8	98.9	99.0	99.2	99.1	98.8	98.5	98.4	98.1
35	98.0	98.7	99.4	99.5	99.6	99.7	99.8	99.9	99.8	99.5	99.2	99.1	99.0
30	97.6	98.8	100.3	100.3	100.4	100.4	100.5	100.5	100.4	100.3	100.0	99.9	99.9
25	96.8	98.1	99.5	100.1	100.7	100.8	100.7	100.7	100.7	100.7	100.6	100.6	100.7
20	96.0	97.3	98.8	99.3	99.9	100.2	100.5	100.8	100.8	100.9	100.8	100.8	100.8
15	95.2	96.5	98.0	98.6	99.2	99.5	99.8	100.1	100.5	100.9	101.1	101.1	101.1
10	94.5	95.8	97.2	97.8	98.4	98.7	99.0	99.4	99.7	100.1	100.5	101.0	101.5
5	93.7	95.0	96.4	97.0	97.6	98.0	98.3	98.6	99.0	99.4	99.8	100.3	100.7
0	92.9	94.2	95.6	96.3	96.9	97.2	97.5	97.9	98.2	98.6	99.0	99.5	100.0
-5	92.0	93.4	94.8	95.5	96.1	96.4	96.7	97.1	97.5	97.9	98.3	98.7	99.2
-10	91.2	92.6	94.0	94.7	95.3	95.6	96.0	96.3	96.7	97.1	97.5	98.0	98.4
-15	90.4	91.7	93.2	93.9	94.5	94.8	95.2	95.6	95.9	96.3	96.7	97.2	97.6
-20	89.6	90.9	92.4	93.0	93.7	94.0	94.4	94.8	95.2	95.6	95.9	96.4	96.8
-25	88.7	90.1	91.6	92.2	92.9	93.2	93.6	94.0	94.4	94.8	95.2	95.6	96.0
-30	87.9	89.2	90.7	91.4	92.0	92.4	92.8	93.2	93.6	94.0	94.3	94.8	95.2
-35	87.0	88.4	89.9	90.5	91.2	91.6	91.9	92.4	92.8	93.1	93.5	94.0	94.4
-40	86.1	87.5	89.0	89.7	90.3	90.7	91.1	91.5	91.9	92.3	92.7	93.1	93.6
-45	85.3	86.6	88.2	88.8	89.5	89.9	90.3	90.7	91.1	91.5	91.9	92.3	92.7
-50	84.4	85.7	87.3	87.9	88.6	89.0	89.4	89.9	90.3	90.6	91.0	91.5	91.9

%N1 Adjustments for Engine Bleeds

BLEED CONFIGURATION	AIRPORT PRESSURE ALTITUDE (FT)												
	-2000	-1000	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
PACKS OFF	0.7	0.7	0.7	0.7	0.7	0.7	0.8	0.8	0.8	0.8	0.8	0.9	1.0

Assumed Temperature Reduced Thrust

Maximum Assumed Temperature (Table 1 of 3)

Based on 25% Takeoff Thrust Reduction

OAT (°C)	AIRPORT PRESSURE ALTITUDE (FT)											
	-1000	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
55	73	71	69	67								
50	73	71	69	67	65	63						
45	73	71	69	67	65	63	61	59	57			
40	73	71	69	67	65	63	61	59	57	55		
35	71	71	69	67	65	63	61	59	57	55	53	
30	69	67	67	67	65	63	61	59	57	55	53	51
25	69	67	66	64	65	63	61	59	57	55	53	51
20	69	67	66	64	64	63	61	59	57	55	53	51
15	69	67	66	64	64	63	61	59	57	55	53	51
10 & BELOW	69	67	66	64	64	63	61	59	57	55	53	51

Takeoff %N1 (Table 2 of 3)

Based on engine bleed for packs on, engine and wing anti-ice on or off

ASSUMED TEMP (°C)	AIRPORT PRESSURE ALTITUDE (FT)											
	-1000	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
75	93.4	93.7	94.2	94.7	95.4	96.1	96.9	97.3	97.6	97.8	97.8	97.7
70	94.1	94.4	94.4	94.4	94.7	95.4	96.2	96.6	96.9	97.1	97.1	97.1
65	94.8	95.1	95.2	95.2	95.3	95.4	95.5	96.0	96.2	96.5	96.4	96.4
60	95.4	95.8	95.9	96.0	96.1	96.2	96.3	96.2	95.9	95.8	95.7	95.7
55	96.0	96.5	96.6	96.7	96.8	96.9	97.1	96.9	96.6	96.3	95.7	95.0
50	96.6	97.1	97.3	97.4	97.6	97.7	97.8	97.7	97.4	97.1	96.6	96.1
45	97.4	97.8	98.0	98.1	98.3	98.4	98.5	98.4	98.1	97.8	97.5	97.1
40	98.1	98.6	98.7	98.8	98.9	99.0	99.2	99.1	98.8	98.5	98.4	98.1
35	98.7	99.4	99.5	99.6	99.7	99.8	99.9	99.8	99.5	99.2	99.1	99.0
30	98.8	100.3	100.3	100.4	100.4	100.5	100.5	100.4	100.3	100.0	99.9	99.9
25	98.1	99.5	100.1	100.7	100.8	100.7	100.7	100.7	100.7	100.6	100.6	100.7
20	97.3	98.8	99.3	99.9	100.2	100.5	100.8	100.8	100.9	100.8	100.8	100.8
15	96.5	98.0	98.6	99.2	99.5	99.8	100.1	100.5	100.9	101.1	101.1	101.1
10	95.8	97.2	97.8	98.4	98.7	99.0	99.4	99.7	100.1	100.5	101.0	101.5
MINIMUM ASSUMED TEMP (°C)	32	30	28	26	24	22	20	18	16	15	12	10

With engine bleed for packs off, increase %N1 by 1.0.

Assumed Temperature Reduced Thrust

%N1 Adjustment for Temperature Difference (Table 3 of 3)

ASSUMED TEMP MINUS OAT (°C)	OUTSIDE AIR TEMPERATURE (°C)													
	-40	-20	0	5	10	15	20	25	30	35	40	45	50	55
110	14.9													
100	14.9	10.9												
90	14.0	11.7												
80	12.9	11.6	7.8											
70	11.2	10.7	8.6	7.8	6.3									
60	9.2	9.5	8.5	8.4	7.1	6.3	4.9							
50	7.8	7.8	7.5	7.1	6.9	7.0	5.6	4.9	3.4					
40		6.0	6.2	6.1	5.9	5.8	5.7	5.6	4.7	4.4	5.3			
30		4.6	4.6	4.6	4.6	4.5	4.4	4.3	4.3	4.2	4.1	4.0	3.9	
20			2.9	3.0	3.0	3.0	3.0	3.0	2.9	2.9	2.8	2.8	2.7	2.6
10			1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.4	1.4	1.4	1.4
0			0	0	0	0	0	0	0	0	0	0	0	0

1. **Determine Maximum Assumed Temperature allowed from Table 1.**
2. **Find Maximum %N1 from Table 2 using the desired assumed temperature (no greater than temperature from Table 1).**
3. **Use the difference between assumed temperature and OAT to determine the %N1 adjustment from Table 3.**
4. **Subtract %N1 adjustment from Maximum %N1 in Table 2.**

Takeoff Speeds - Dry Runway (24K Derate)

V1, VR, V2

WEIGHT (1000 KG)	FLAPS 1			FLAPS 5			FLAPS 10			FLAPS 15			FLAPS 25		
	V1	VR	V2	V1	VR	V2	V1	VR	V2	V1	VR	V2	V1	VR	V2
90	172	172	174												
85	166	167	170	159	160	163									
80	160	162	166	154	155	159									
75	155	156	161	149	150	155	148	148	153	145	145	150	142	142	148
70	149	150	157	143	144	151	142	143	149	139	140	146	137	137	144
65	143	144	152	137	138	147	136	137	145	133	134	142	131	131	139
60	137	138	147	131	132	142	130	131	140	127	128	137	125	125	135
55	130	131	142	124	125	136	123	124	135	121	121	132	118	119	130
50	122	123	136	118	118	131	116	117	129	114	115	127	112	112	125
45	115	116	130	110	111	125	109	110	124	107	107	121	105	105	119
40	107	108	124	103	103	119	102	102	118	99	100	116	97	98	114

Check V1(MCG).

V1, VR, V2 Adjustments*

TEMP		V1							VR							V2						
		PRESS ALT (1000 FT)							PRESS ALT (1000 FT)							PRESS ALT (1000 FT)						
°C	°F	-2	0	2	4	6	8	10	-2	0	2	4	6	8	10	-2	0	2	4	6	8	10
70	158	5	6						5	5						-3	-4					
60	140	4	5	5	6				3	4	5	6				-2	-3	-3	-4			
50	122	2	3	4	5	6	7	8	2	3	4	5	6	7	8	-2	-2	-3	-3	-4	-4	-5
40	104	1	2	3	4	5	6	7	1	2	3	4	5	6	7	-1	-1	-2	-2	-3	-4	-4
30	86	0	0	1	3	4	5	6	0	0	1	2	4	5	6	0	0	-1	-1	-2	-3	-4
20	68	0	0	1	1	2	4	5	0	0	1	1	2	4	5	0	0	0	-1	-1	-2	-3
-60	-76	0	0	1	1	2	3	4	0	0	1	1	2	3	4	0	0	0	-1	-1	-1	-2

Slope and Wind V1 Adjustments*

WEIGHT (1000 KG)	SLOPE (%)					WIND (KTS)							
	-2	-1	0	1	2	-15	-10	-5	0	10	20	30	40
84	-3	-2	0	1	1	-1	-1	0	0	0	1	1	1
76	-3	-1	0	1	1	-1	-1	0	0	0	1	1	1
68	-2	-1	0	1	1	-1	-1	0	0	0	1	1	1
60	-1	-1	0	1	1	-1	-1	0	0	0	1	1	1
52	-1	0	0	1	1	-1	-1	0	0	0	1	1	1
44	0	0	0	0	1	-2	-1	0	0	0	0	1	1

***V1 not to exceed VR.**

V1(MCG)

TEMP		PRESSURE ALTITUDE (FT)						
°C	°F	-2000	0	2000	4000	6000	8000	10000
70	158	90	88					
60	140	90	88	87	85			
50	122	92	90	87	85	83	81	79
40	104	97	95	91	88	84	81	79
30	86	100	99	95	92	88	85	81
20	68	100	99	97	95	92	88	85
-60	-76	101	101	98	96	94	91	89

Takeoff Speeds - Wet Runway (24K Derate)

V1, VR, V2

WEIGHT	FLAPS 1			FLAPS 5			FLAPS 10			FLAPS 15			FLAPS 25		
(1000 KG)	V1	VR	V2	V1	VR	V2	V1	VR	V2	V1	VR	V2	V1	VR	V2
90	167	172	174												
85	161	167	170	154	160	163									
80	155	162	166	148	155	159									
75	149	156	161	142	150	155	142	148	153	139	145	150	137	142	148
70	142	150	157	136	144	151	136	143	149	133	140	146	131	137	144
65	136	144	152	130	138	147	129	137	145	127	134	142	125	131	139
60	129	138	147	123	132	142	123	131	140	120	128	137	118	125	135
55	122	131	142	116	125	136	116	124	135	113	121	132	111	119	130
50	114	123	136	109	118	131	109	117	129	106	115	127	104	112	125
45	107	116	130	102	111	125	101	110	124	99	107	121	97	105	119
40	98	108	124	94	103	119	93	102	118	92	100	115	90	98	114

Check V1(MCG).

V1, VR, V2 Adjustment*

TEMP		V1							VR							V2						
		PRESS ALT (1000 FT)							PRESS ALT (1000 FT)							PRESS ALT (1000 FT)						
°C	°F	-2	0	2	4	6	8	10	-2	0	2	4	6	8	10	-2	0	2	4	6	8	10
70	158	8	8						5	5						-3	-4					
60	140	5	6	8	9				3	4	5	6				-2	-3	-3	-4			
50	122	3	4	5	7	8	10	11	2	3	4	5	6	7	8	-2	-2	-3	-3	-4	-4	-5
40	104	1	2	3	5	6	7	9	1	2	3	4	5	6	7	-1	-1	-2	-2	-3	-4	-4
30	86	0	0	1	3	4	6	7	0	0	1	3	4	5	6	0	0	-1	-1	-2	-3	-4
20	68	0	0	1	1	2	4	5	0	0	1	1	2	4	5	0	0	0	-1	-1	-2	-3
-60	-76	0	0	1	1	2	3	4	0	0	1	1	2	3	4	0	0	0	-1	-1	-1	-2

Slope and Wind V1 Adjustment*

WEIGHT	SLOPE (%)					WIND (KTS)							
(1000 KG)	-2	-1	0	1	2	-15	-10	-5	0	10	20	30	40
84	-5	-3	0	3	6	-3	-2	-1	0	1	1	2	2
76	-4	-2	0	2	5	-3	-2	-1	0	1	1	2	3
68	-4	-2	0	2	4	-3	-2	-1	0	1	1	2	3
60	-3	-1	0	2	3	-4	-2	-1	0	1	1	2	3
52	-2	-1	0	1	3	-4	-3	-1	0	1	2	3	3
44	-2	-1	0	1	2	-5	-3	-1	0	1	2	3	4

***V1 not to exceed VR.**

V1(MCG)

TEMP		PRESSURE ALTITUDE (FT)						
°C	°F	-2000	0	2000	4000	6000	8000	10000
70	158	90	88					
60	140	90	88	87	85			
50	122	92	90	87	85	83	81	79
40	104	97	95	91	88	84	81	79
30	86	100	99	95	92	88	85	81
20	68	100	99	97	95	92	88	85
-60	-76	101	101	98	96	94	91	89

Stab Trim Setting (24K Derate)

Flaps 1 and 5

WEIGHT (1000 KG)	C.G. (%MAC)									
	6	8	10	16	21	26	30	32	34	36
85	8 1/2	8 1/2	8 1/4	7 1/2	6 1/2	5 3/4	5	4 1/2	4 1/4	3 3/4
80	8 1/2	8 1/4	8	7	6 1/4	5 1/2	4 3/4	4 1/2	4	3 3/4
75	8 1/4	8	7 3/4	6 3/4	6	5 1/4	4 1/2	4 1/4	4	3 1/2
70	8	7 3/4	7 1/2	6 1/2	5 3/4	5	4 1/2	4	3 3/4	3 1/4
65	7 3/4	7 1/2	7 1/4	6 1/4	5 1/2	4 3/4	4 1/4	4	3 1/2	3 1/4
60	7 1/2	7 1/4	7	6	5 1/2	4 3/4	4	3 3/4	3 1/4	3
55	7 1/4	7	6 3/4	5 3/4	5 1/4	4 1/2	3 3/4	3 1/2	3 1/4	2 3/4
50	6 3/4	6 1/2	6 1/4	5 1/2	4 3/4	4	3 1/2	3 1/4	2 3/4	2 1/2
45	6 1/2	6 1/4	6	5	4 1/2	3 3/4	3	2 3/4	2 1/2	2 1/4
40	6 1/2	6 1/4	6	5	4 1/2	3 3/4	3	2 3/4	2 1/2	2 1/4

Flaps 10, 15 and 25

WEIGHT (1000 KG)	C.G. (%MAC)									
	6	8	10	16	21	26	30	32	34	36
85	8 1/2	8 1/2	8 1/2	6 3/4	5 1/2	4 1/2	3 3/4	3 1/4	2 3/4	2 1/2
80	8 1/2	8 1/2	8 1/2	6 1/2	5 1/2	4 1/2	3 1/2	3 1/4	2 3/4	2 1/4
75	8 1/2	8 1/2	8 1/4	6 1/4	5 1/4	4 1/4	3 1/2	3	2 1/2	2 1/4
70	8 1/2	8 1/4	7 3/4	6	5	4	3 1/4	2 3/4	2 1/4	2 1/4
65	8 1/4	7 3/4	7 1/4	5 1/2	4 3/4	3 3/4	3	2 1/2	2 1/4	2 1/4
60	7 3/4	7 1/4	6 3/4	5 1/4	4 1/4	3 1/2	2 3/4	2 1/4	2 1/4	2 1/4
55	7	6 3/4	6 1/4	5	4	3 1/4	2 1/2	2 1/4	2 1/4	2 1/4
50	6 1/2	6	5 3/4	4 1/2	3 3/4	3	2 1/4	2 1/4	2 1/4	2 1/4
45	5 3/4	5 1/2	5	4 1/4	3 1/2	2 3/4	2 1/4	2 1/4	2 1/4	2 1/4
40	5 3/4	5 1/2	5	4 1/4	3 1/2	2 3/4	2 1/4	2 1/4	2 1/4	2 1/4

ADVISORY INFORMATION

Slush/Standing Water Takeoff (24K Derate)

Maximum Reverse Thrust

Weight Adjustments (1000 KG)

24K DERATE DRY FIELD/OBSTACLE LIMIT WEIGHT (1000 KG)	SLUSH/STANDING WATER DEPTH								
	3 mm (0.12 INCHES)			6 mm (0.25 INCHES)			13 mm (0.50 INCHES)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
95	-12.8	-15.3	-17.8	-16.4	-18.9	-21.4	-25.3	-27.8	-30.3
90	-11.8	-14.3	-16.8	-14.8	-17.3	-19.8	-22.4	-24.9	-27.4
85	-10.9	-13.4	-15.9	-13.3	-15.8	-18.3	-19.5	-22.0	-24.5
80	-9.9	-12.4	-14.9	-11.9	-14.4	-16.9	-16.8	-19.3	-21.8
75	-9.0	-11.4	-13.9	-10.6	-13.1	-15.6	-14.4	-16.9	-19.4
70	-8.0	-10.5	-13.0	-9.3	-11.8	-14.3	-12.2	-14.7	-17.2
65	-7.1	-9.6	-12.1	-8.2	-10.6	-13.1	-10.2	-12.7	-15.2
60	-6.2	-8.7	-11.2	-7.1	-9.6	-12.0	-8.5	-11.0	-13.5
55	-5.4	-7.9	-10.4	-6.0	-8.5	-11.0	-7.1	-9.6	-12.1
50	-4.5	-7.0	-9.5	-4.9	-7.4	-9.9	-5.9	-8.4	-10.9
45	-3.6	-6.1	-8.6	-3.8	-6.3	-8.8	-4.9	-7.4	-9.9
40	-2.7	-5.2	-7.7	-2.7	-5.2	-7.7	-4.2	-6.7	-9.2

V1(MCG) Limit Weight (1000 KG)

ADJUSTED FIELD LENGTH (M)	SLUSH/STANDING WATER DEPTH								
	3 mm (0.12 INCHES)			6 mm (0.25 INCHES)			13 mm(0.50 INCHES)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
1200	30.2			33.6			39.3		
1400	50.4	34.9		53.6	38.2		58.9	43.8	
1600	72.3	55.4	39.7	75.3	58.6	42.9	80.6	63.8	48.4
1800	96.2	77.8	60.6	99.0	80.8	63.7	104.3	86.2	68.9
2000		102.0	83.4		104.7	86.4			91.8

1. **Enter Weight Adjustment table with slush/standing water depth and 24K Derate dry field/obstacle limit weight to obtain slush/standing water weight adjustment.**
2. **Adjust field length available by -30 m/+30 m for every 5°C above/below 4°C.**
3. **Find V1(MCG) limit weight for adjusted field length and pressure altitude.**
4. **Max allowable slush/standing water limited weight is lesser of weights from 1 and 3.**

ADVISORY INFORMATION

Slush/Standing Water Takeoff (24K Derate)
Maximum Reverse Thrust
V1 Adjustment (KIAS)

WEIGHT (1000 KG)	SLUSH/STANDING WATER DEPTH								
	3 mm (0.12 INCHES)			6 mm (0.25 INCHES)			13 mm (0.50 INCHES)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
90	-13	-11	-8	-7	-5	-2	0	0	0
85	-14	-12	-9	-8	-6	-3	0	0	0
80	-15	-13	-10	-9	-7	-4	0	0	0
75	-17	-14	-12	-11	-8	-6	0	0	0
70	-18	-15	-13	-12	-10	-7	0	0	0
65	-19	-16	-14	-14	-12	-9	-3	-1	0
60	-20	-18	-15	-16	-14	-11	-7	-5	-2
55	-22	-19	-17	-19	-16	-14	-11	-9	-6
50	-22	-20	-17	-20	-18	-15	-14	-12	-9
45	-23	-20	-18	-21	-18	-16	-17	-14	-12
40	-23	-20	-18	-21	-18	-16	-18	-15	-13

1. **Obtain V1, VR and V2 for the actual weight using the 24K Derate Dry Runway Takeoff Speeds table.**
2. **If V1(MCG) limited, set V1 = V1(MCG). If not V1(MCG) limited, enter V1 Adjustment table with the actual weight to obtain V1 speed adjustment. If adjusted V1 is less than V1(MCG), set V1 = V1(MCG). V1 not to exceed VR.**

ADVISORY INFORMATION

Slush/Standing Water Takeoff (24K Derate)

No Reverse Thrust

Weight Adjustments (1000 KG)

24K DERATE DRY FIELD/OBSTACLE LIMIT WEIGHT (1000 KG)	SLUSH/STANDING WATER DEPTH								
	3 mm (0.12 INCHES)			6 mm (0.25 INCHES)			13 mm (0.50 INCHES)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
95	-15.9	-19.1	-22.3	-19.6	-22.8	-25.9	-27.0	-30.1	-33.3
90	-14.6	-17.8	-21.0	-17.8	-20.9	-24.1	-24.1	-27.3	-30.5
85	-13.3	-16.5	-19.7	-15.9	-19.1	-22.3	-21.2	-24.4	-27.6
80	-12.1	-15.2	-18.4	-14.2	-17.4	-20.5	-18.5	-21.7	-24.9
75	-10.9	-14.0	-17.2	-12.5	-15.7	-18.9	-16.1	-19.3	-22.4
70	-9.7	-12.9	-16.1	-11.0	-14.2	-17.4	-13.8	-17.0	-20.2
65	-8.6	-11.8	-15.0	-9.6	-12.8	-16.0	-11.8	-15.0	-18.2
60	-7.6	-10.8	-13.9	-8.4	-11.5	-14.7	-10.1	-13.2	-16.4
55	-6.6	-9.8	-12.9	-7.2	-10.4	-13.5	-8.5	-11.7	-14.9
50	-5.7	-8.8	-12.0	-6.1	-9.3	-12.5	-7.1	-10.3	-13.5
45	-4.7	-7.9	-11.1	-5.1	-8.3	-11.4	-5.8	-9.0	-12.2
40	-3.8	-7.0	-10.1	-4.0	-7.2	-10.4	-4.5	-7.6	-10.8

V1(MCG) Limit Weight (1000 KG)

ADJUSTED FIELD LENGTH (M)	SLUSH/STANDING WATER DEPTH								
	3 mm (0.12 INCHES)			6 mm (0.25 INCHES)			13 mm (0.50 INCHES)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
1400							36.6		
1600	37.6			45.5			58.9	39.9	
1800	65.4	42.0		72.4	49.7		87.6	63.0	43.4
2000	93.9	70.0	46.5	102.0	77.0	53.9		93.0	67.3
2200		98.5	74.5			81.7			98.4
2400			103.1						

1. **Enter Weight Adjustment table with slush/standing water depth and 24K Derate dry field/obstacle limit weight to obtain slush/standing water weight adjustment.**
2. **Adjust field length available by -35 m/+30 m for every 5°C above/below 4°C.**
3. **Find V1(MCG) limit weight for available field length and pressure altitude.**
4. **Max allowable slush/standing water limited weight is lesser of weights from 1 and 3.**

ADVISORY INFORMATION

Slush/Standing Water Takeoff (24K Derate)
No Reverse Thrust
V1 Adjustment (KIAS)

WEIGHT (1000 KG)	SLUSH/STANDING WATER DEPTH								
	3 mm (0.12 INCHES)			6 mm (0.25 INCHES)			13 mm (0.50 INCHES)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
95	-14	-12	-9	-2	0	0	0	0	0
90	-16	-14	-11	-5	-3	0	0	0	0
85	-19	-16	-14	-9	-6	-4	0	0	0
80	-21	-18	-16	-12	-9	-7	0	0	0
75	-22	-20	-17	-15	-12	-10	0	0	0
70	-24	-22	-19	-17	-15	-12	0	0	0
65	-25	-23	-20	-20	-17	-15	-4	-2	0
60	-27	-24	-22	-22	-20	-17	-11	-8	-6
55	-28	-25	-23	-24	-21	-19	-15	-13	-10
50	-29	-26	-24	-26	-23	-21	-19	-17	-14
45	-29	-27	-24	-27	-25	-22	-22	-20	-17
40	-30	-27	-25	-28	-26	-23	-24	-21	-19

1. **Obtain V1, VR and V2 for the actual weight using the 24K Derate Dry Runway Takeoff Speeds table.**
2. **If V1(MCG) limited, set V1 = V1(MCG). If not V1(MCG) limited, enter V1 Adjustment table with the actual weight to obtain V1 speed adjustment. If adjusted V1 is less than V1(MCG), set V1 = V1(MCG). V1 not to exceed VR.**

ADVISORY INFORMATION

Slippery Runway Takeoff (24K Derate)
Maximum Reverse Thrust
Weight Adjustment (1000 KG)

24K DERATE DRY FIELD/OBSTACLE LIMIT WEIGHT (1000 KG)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
95	-0.3	-0.3	-0.3	-5.8	-5.8	-5.8	-10.7	-10.7	-10.7
90	-0.6	-0.6	-0.6	-5.8	-5.8	-5.8	-10.5	-10.5	-10.5
85	-1.0	-1.0	-1.0	-5.9	-5.9	-5.9	-10.2	-10.2	-10.2
80	-1.3	-1.3	-1.3	-5.9	-5.9	-5.9	-9.9	-9.9	-9.9
75	-1.4	-1.4	-1.4	-5.8	-5.8	-5.8	-9.5	-9.5	-9.5
70	-1.5	-1.5	-1.5	-5.6	-5.6	-5.6	-9.0	-9.0	-9.0
65	-1.6	-1.6	-1.6	-5.3	-5.3	-5.3	-8.4	-8.4	-8.4
60	-1.5	-1.5	-1.5	-5.0	-5.0	-5.0	-7.7	-7.7	-7.7
55	-1.4	-1.4	-1.4	-4.6	-4.6	-4.6	-7.0	-7.0	-7.0
50	-1.2	-1.2	-1.2	-4.1	-4.1	-4.1	-6.1	-6.1	-6.1
45	-0.9	-0.9	-0.9	-3.5	-3.5	-3.5	-5.2	-5.2	-5.2
40	-0.5	-0.5	-0.5	-2.9	-2.9	-2.9	-4.2	-4.2	-4.2

V1(MCG) Limit Weight (1000 KG)

ADJUSTED FIELD LENGTH (M)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
1000	47.2								
1200	79.8	62.7	45.0	31.1					
1400		94.3	77.7	53.9	34.7				
1600				78.8	57.8	38.3	33.8		
1800					83.1	61.8	47.5	30.8	
2000						87.4	62.7	44.4	
2200							79.9	59.3	41.3
2400							99.7	75.9	55.9
2600								95.3	72.1
2800									90.8

1. **Enter Weight Adjustment table with reported braking action and 24K Derate dry field/obstacle limit weight to obtain slippery runway weight adjustment.**
2. **Adjust “Good” field length available by -20 m/+20 m for every 5°C above/below 4°C.**
   Adjust “Medium” field length available by -20 m/+20 m for every 5°C above/below 4°C.
   Adjust “Poor” field length available by -35 m/+35 m for every 5°C above/below 4°C.
3. **Find V1(MCG) limit weight for adjusted field length and pressure altitude.**
4. **Max allowable slippery runway limited weight is lesser of weights from 1 and 3.**

ADVISORY INFORMATION

Slippery Runway Takeoff (24K Derate)
Maximum Reverse Thrust
V1 Adjustment (KIAS)

WEIGHT (1000 KG)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
90	-4	-3	-2	-13	-12	-10	-24	-23	-21
85	-5	-4	-3	-14	-12	-11	-25	-23	-22
80	-6	-5	-3	-15	-13	-12	-26	-25	-23
75	-7	-6	-4	-16	-15	-14	-28	-26	-25
70	-8	-6	-5	-18	-16	-15	-30	-28	-27
65	-9	-7	-6	-19	-18	-17	-32	-30	-29
60	-9	-8	-7	-21	-19	-18	-34	-33	-31
55	-10	-9	-8	-22	-21	-20	-36	-34	-33
50	-11	-10	-8	-23	-22	-21	-37	-36	-35
45	-12	-10	-9	-24	-23	-22	-39	-37	-36
40	-12	-11	-10	-25	-24	-22	-39	-38	-37

1. **Obtain V1, VR and V2 for the actual weight using the 24K Derate Dry Runway Takeoff Speeds table.**
2. **If V1(MCG) limited, set V1 = V1(MCG). If not V1(MCG) limited, enter V1 Adjustment table with the actual weight to obtain V1 speed adjustment. If adjusted V1 is less than V1(MCG), set V1 = V1(MCG). V1 not to exceed VR.**

ADVISORY INFORMATION

Slippery Runway Takeoff (24K Derate)

No Reverse Thrust

Weight Adjustments (1000 KG)

24K DERATE DRY FIELD/OBSTACLE LIMIT WEIGHT (1000 KG)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
95	-1.4	-1.4	-1.4	-8.0	-8.0	-8.0	-14.2	-14.2	-14.2
90	-1.7	-1.7	-1.7	-7.9	-7.9	-7.9	-13.6	-13.6	-13.6
85	-1.9	-1.9	-1.9	-7.8	-7.8	-7.8	-13.1	-13.1	-13.1
80	-2.2	-2.2	-2.2	-7.7	-7.7	-7.7	-12.4	-12.4	-12.4
75	-2.3	-2.3	-2.3	-7.5	-7.5	-7.5	-11.8	-11.8	-11.8
70	-2.4	-2.4	-2.4	-7.2	-7.2	-7.2	-11.0	-11.0	-11.0
65	-2.4	-2.4	-2.4	-6.8	-6.8	-6.8	-10.3	-10.3	-10.3
60	-2.3	-2.3	-2.3	-6.4	-6.4	-6.4	-9.4	-9.4	-9.4
55	-2.1	-2.1	-2.1	-5.9	-5.9	-5.9	-8.5	-8.5	-8.5
50	-1.9	-1.9	-1.9	-5.3	-5.3	-5.3	-7.6	-7.6	-7.6
45	-1.7	-1.7	-1.7	-4.6	-4.6	-4.6	-6.6	-6.6	-6.6
40	-1.3	-1.3	-1.3	-3.9	-3.9	-3.9	-5.5	-5.5	-5.5

V1(MCG) Limit Weight (1000 KG)

ADJUSTED FIELD LENGTH (M)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
1000	32.8								
1200	71.9	55.0	36.4						
1400		90.2	74.9						
1600				50.2					
1800				83.2	60.8	37.4			
2000					93.3	71.2			
2200						103.3			
2400							45.3		
2600							67.2	39.3	
2800							92.8	60.4	33.6
3000								84.8	53.9
3200									77.1
3400									103.8

1. **Enter Weight Adjustment table with reported braking action and 24K Derate dry field/obstacle limit weight to obtain slippery runway weight adjustment.**
2. **Adjust “Good” field length available by -25 m/+20 m for every 5°C above/below 4°C.**
   Adjust “Medium” field length available by -25 m/+20 m for every 5°C above/below 4°C.
   Adjust “Poor” field length available by -45 m/+40 m for every 5°C above/below 4°C.
3. **Find V1(MCG) limit weight for adjusted field length and pressure altitude.**
4. **Max allowable slippery runway limited weight is lesser of weights from 1 and 3.**

ADVISORY INFORMATION

Slippery Runway Takeoff (24K Derate)
No Reverse Thrust
V1 Adjustment (KIAS)

WEIGHT (1000 KG)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
95	-4	-2	0	-15	-13	-10	-31	-28	-26
90	-5	-3	0	-16	-14	-11	-32	-30	-27
85	-6	-4	-1	-17	-15	-12	-34	-31	-29
80	-7	-5	-2	-19	-16	-14	-36	-33	-31
75	-8	-6	-3	-20	-18	-15	-38	-35	-33
70	-9	-7	-4	-22	-20	-17	-40	-38	-35
65	-11	-8	-6	-24	-22	-19	-43	-41	-38
60	-12	-9	-7	-26	-24	-21	-46	-43	-41
55	-13	-10	-8	-28	-26	-23	-48	-46	-43
50	-14	-11	-9	-30	-28	-25	-50	-48	-45
45	-15	-12	-10	-31	-29	-26	-52	-49	-47
40	-15	-13	-10	-32	-30	-27	-53	-50	-48

1. **Obtain V1, VR and V2 for the actual weight using the 24K Derate Dry Runway Takeoff Speeds table.**
2. **If V1(MCG) limited, set V1 = V1(MCG). If not V1(MCG) limited, enter V1 Adjustment table with the actual weight to obtain V1 speed adjustment. If adjusted V1 is less than V1(MCG), set V1 = V1(MCG). V1 not to exceed VR.**

Takeoff %N1 - (24K Derate)

Based on engine bleeds for packs on, engine and wing anti-ice on or off

OAT (°C)	AIRPORT PRESSURE ALTITUDE (FT)												
	-2000	-1000	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
60	90.3	90.8	91.2	91.2	91.1	91.1	91.0	91.1	91.2	91.0	91.2	91.3	91.4
55	91.0	91.6	92.0	92.0	92.0	91.9	91.9	91.9	92.0	91.9	91.7	91.3	90.8
50	91.8	92.4	92.8	92.8	92.8	92.7	92.7	92.7	92.7	92.6	92.6	92.2	91.8
45	92.6	93.2	93.6	93.6	93.6	93.6	93.5	93.5	93.5	93.4	93.3	93.1	92.8
40	93.4	94.0	94.4	94.4	94.4	94.3	94.3	94.2	94.2	94.1	94.1	94.0	93.8
35	94.2	94.8	95.2	95.2	95.2	95.1	95.1	95.0	95.0	94.9	94.8	94.8	94.7
30	93.8	95.0	96.1	96.0	96.0	96.0	95.9	95.8	95.8	95.7	95.7	95.6	95.6
25	93.1	94.3	95.4	95.9	96.4	96.7	96.7	96.6	96.6	96.5	96.4	96.4	96.3
20	92.3	93.5	94.6	95.1	95.7	96.3	96.9	97.6	97.5	97.5	97.4	97.3	97.2
15	91.6	92.7	93.8	94.3	94.9	95.5	96.1	96.8	97.5	98.2	98.6	98.6	98.5
10	90.8	92.0	93.0	93.6	94.1	94.7	95.3	96.0	96.7	97.5	98.2	99.1	100.0
5	90.0	91.2	92.2	92.8	93.3	93.9	94.5	95.2	95.9	96.7	97.4	98.4	99.3
0	89.2	90.4	91.4	92.0	92.5	93.1	93.7	94.4	95.1	95.9	96.7	97.6	98.5
-5	88.4	89.6	90.6	91.2	91.7	92.3	92.9	93.6	94.3	95.1	95.9	96.8	97.7
-10	87.6	88.8	89.8	90.4	90.9	91.5	92.1	92.8	93.5	94.3	95.1	96.1	97.0
-15	86.8	88.0	89.0	89.5	90.0	90.6	91.3	92.0	92.7	93.5	94.3	95.3	96.2
-20	86.0	87.1	88.2	88.7	89.2	89.8	90.5	91.2	91.9	92.6	93.5	94.5	95.4
-25	85.2	86.3	87.3	87.9	88.4	89.0	89.6	90.3	91.0	91.8	92.6	93.7	94.6
-30	84.4	85.5	86.5	87.0	87.5	88.1	88.8	89.5	90.2	91.0	91.8	92.9	93.8
-35	83.5	84.6	85.6	86.2	86.6	87.3	87.9	88.6	89.3	90.1	91.0	92.1	93.0
-40	82.7	83.8	84.8	85.3	85.8	86.4	87.0	87.8	88.5	89.3	90.1	91.2	92.2
-45	81.8	82.9	83.9	84.4	84.9	85.5	86.2	86.9	87.6	88.4	89.3	90.4	91.4
-50	81.0	82.0	83.0	83.5	84.0	84.6	85.3	86.0	86.7	87.5	88.4	89.5	90.5

%N1 Adjustments for Engine Bleeds

BLEED CONFIGURATION	AIRPORT PRESSURE ALTITUDE (FT)												
	-2000	-1000	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
PACKS OFF	0.7	0.7	0.7	0.7	0.7	0.7	0.8	0.8	0.8	0.8	0.8	0.9	1.0

Assumed Temperature Reduced Thrust (24K Derate)

Maximum Assumed Temperature (Table 1 of 3)

Based on 25% Takeoff Thrust Reduction

OAT (°C)	AIRPORT PRESSURE ALTITUDE (FT)											
	-1000	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
55	73	71	69	67								
50	73	71	69	67	65	63						
45	73	71	69	67	65	63	61	59	57			
40	73	71	69	67	65	63	61	59	57	55		
35	67	67	67	67	65	63	61	59	57	55	53	
30	64	61	62	61	61	61	61	59	57	55	53	51
25	64	61	59	57	56	56	57	57	57	55	53	51
20	64	61	59	57	56	54	53	53	53	53	52	51
15	64	61	59	57	56	54	53	52	50	49	48	47
10 & BELOW	64	61	59	57	56	54	53	52	50	48	45	43

Takeoff %N1 (Table 2 of 3)

Based on engine bleed for packs on, engine and wing anti-ice on or off

ASSUMED TEMP (°C)	AIRPORT PRESSURE ALTITUDE (FT)											
	-1000	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
75	88.3	88.6	89.1	89.6	90.2	90.8	91.5	92.2	92.7	93.1	93.3	93.4
70	89.1	89.5	89.4	89.3	89.6	90.1	90.8	91.6	92.0	92.5	92.6	92.7
65	90.0	90.4	90.3	90.2	90.2	90.1	90.2	90.9	91.4	91.8	91.9	92.1
60	90.8	91.2	91.2	91.1	91.1	91.0	91.1	91.2	91.0	91.2	91.3	91.4
55	91.6	92.0	92.0	92.0	91.9	91.9	91.9	92.0	91.9	91.7	91.3	90.8
50	92.4	92.8	92.8	92.8	92.7	92.7	92.7	92.7	92.6	92.6	92.2	91.8
45	93.2	93.6	93.6	93.6	93.6	93.5	93.5	93.5	93.4	93.3	93.1	92.8
40	94.0	94.4	94.4	94.4	94.3	94.3	94.2	94.2	94.1	94.1	94.0	93.8
35	94.8	95.2	95.2	95.2	95.1	95.1	95.0	95.0	94.9	94.8	94.8	94.7
30	95.0	96.1	96.0	96.0	96.0	95.9	95.8	95.8	95.7	95.7	95.6	95.6
25	94.3	95.4	95.9	96.4	96.7	96.7	96.6	96.6	96.5	96.4	96.4	96.3
20	93.5	94.6	95.1	95.7	96.3	96.9	97.6	97.5	97.5	97.4	97.3	97.2
15	92.7	93.8	94.3	94.9	95.5	96.1	96.8	97.5	98.2	98.6	98.6	98.5
10	92.0	93.0	93.6	94.1	94.7	95.3	96.0	96.7	97.5	98.2	99.1	100.0
MINIMUM ASSUMED TEMP (°C)	32	30	28	26	24	22	20	18	16	15	12	10

With engine bleed for packs off, increase %N1 by 1.0

Assumed Temperature Reduced Thrust (24K Derate)
%N1 Adjustment for Temperature Difference (Table 3 of 3)

ASSUMED TEMP MINUS OAT (°C)	OUTSIDE AIR TEMPERATURE (°C)													
	-40	-20	0	5	10	15	20	25	30	35	40	45	50	55
110	12.1													
100	11.3	8.5												
90	11.7	8.9												
80	12.5	8.0	5.5											
70	11.3	8.4	5.9	5.6	4.0									
60	9.7	9.2	4.8	4.7	4.4	4.2	2.6							
50	7.8	7.9	5.3	3.5	3.3	3.6	3.0	2.7	1.2					
40		6.4	6.0	5.5	3.7	3.2	3.7	3.0	2.8	3.0	3.7			
30		4.6	4.6	4.6	4.5	4.3	4.2	4.0	4.1	4.0	3.9	3.8	3.7	
20			3.1	3.1	3.1	3.0	2.9	2.9	2.8	2.7	2.7	2.6	2.6	2.5
10			1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.4	1.4	1.4	1.3	1.3
0			0	0	0	0	0	0	0	0	0	0	0	0

1. **Determine Maximum Assumed Temperature allowed from Table 1.**
2. **Find Maximum %N1 from Table 2 using the desired assumed temperature (no greater than temperature from Table 1).**
3. **Use the difference between assumed temperature and OAT to determine the %N1 adjustment from Table 3.**
4. **Subtract %N1 adjustment from Maximum %N1 in Table 2.**

Takeoff Speeds - Dry Runway (22K Derate)

V1, VR, V2

WEIGHT (1000 KG)	FLAPS 1			FLAPS 5			FLAPS 10			FLAPS 15			FLAPS 25		
	V1	VR	V2	V1	VR	V2	V1	VR	V2	V1	VR	V2	V1	VR	V2
80	162	163	165	156	156	159									
76	158	158	162	152	152	156									
72	153	154	158	147	147	152	146	146	150	142	142	147			
68	148	149	155	142	143	149	141	141	147	138	138	144			
64	143	144	151	138	138	145	136	137	143	134	134	140	131	131	138
60	138	139	147	132	133	141	131	132	139	128	129	136	126	126	134
56	132	133	142	127	128	137	126	126	135	123	124	132	121	121	130
52	127	127	138	122	122	132	121	121	131	118	118	128	116	116	126
48	121	121	133	116	116	128	115	115	126	112	113	124	110	110	122
44	115	115	128	110	111	123	109	109	122	107	107	119	105	105	117
40	108	108	123	104	104	118	103	103	117	100	101	115	98	99	113

Check V1(MCG).

V1, VR, V2 Adjustments*

TEMP		V1							VR							V2						
		PRESS ALT (1000 FT)							PRESS ALT (1000 FT)							PRESS ALT (1000 FT)						
°C	°F	-2	0	2	4	6	8	10	-2	0	2	4	6	8	10	-2	0	2	4	6	8	10
70	158	5	5						5	5						-3	-3					
60	140	4	4	5	6				4	4	5	6				-2	-3	-3	-4			
50	122	2	3	4	5	6	7	8	2	3	4	5	6	7	8	-1	-2	-2	-3	-3	-4	-5
40	104	1	2	3	4	5	6	7	1	2	3	4	5	6	7	-1	-1	-1	-2	-3	-3	-4
30	86	0	0	1	2	3	5	6	0	0	1	2	3	5	6	0	0	-1	-1	-2	-3	-3
20	68	0	0	0	1	2	3	5	0	0	1	1	2	3	5	0	0	0	-1	-1	-2	-3
-60	-76	0	0	0	1	2	2	3	0	0	1	1	2	3	3	0	0	0	-1	-1	-1	-2

Slope and Wind V1 Adjustments*

WEIGHT (1000 KG)	SLOPE (%)					WIND (KTS)							
	-2	-1	0	1	2	-15	-10	-5	0	10	20	30	40
80	-3	-2	0	1	1	-1	-1	0	0	0	1	1	1
76	-3	-1	0	1	1	-1	-1	0	0	0	1	1	1
72	-2	-1	0	1	1	-1	-1	0	0	0	1	1	1
68	-2	-1	0	1	1	-1	-1	0	0	0	1	1	1
64	-2	-1	0	1	1	-1	-1	0	0	0	1	1	1
60	-1	-1	0	1	1	-1	-1	0	0	0	1	1	1
56	-1	0	0	1	1	-1	-1	0	0	0	1	1	1
52	-1	0	0	1	1	-1	-1	0	0	0	1	1	1
48	-1	0	0	0	1	-1	-1	0	0	0	1	1	1
44	0	0	0	0	1	-1	-1	0	0	0	1	1	1
40	0	0	0	0	1	-1	-1	0	0	0	1	1	1

***V1 not to exceed VR.**

V1(MCG)

TEMP		PRESSURE ALTITUDE(FT)						
°C	°F	-2000	0	2000	4000	6000	8000	10000
70	158	87	85					
60	140	87	85	84	83			
50	122	89	87	84	83	81	79	77
40	104	94	91	88	85	82	79	77
30	86	96	96	93	89	86	82	79
20	68	97	96	94	93	90	86	82
-60	-76	98	98	96	94	91	89	87

Takeoff Speeds - Wet Runway (22K Derate)

V1, VR, V2

WEIGHT (1000 KG)	FLAPS 1			FLAPS 5			FLAPS 10			FLAPS 15			FLAPS 25		
	V1	VR	V2	V1	VR	V2	V1	VR	V2	V1	VR	V2	V1	VR	V2
80	157	163	165	150	156	159									
76	152	158	162	146	152	156									
72	147	154	158	141	147	152	141	146	150	138	142	147			
68	142	149	155	136	143	149	136	141	147	133	138	144			
64	136	144	151	131	138	145	130	137	143	127	134	140	126	131	138
60	131	139	147	125	133	141	125	132	139	122	129	136	120	126	134
56	125	133	142	120	128	137	119	126	135	116	124	132	115	121	130
52	119	127	138	114	122	132	113	121	131	111	118	128	109	116	126
48	113	121	133	108	116	128	108	115	126	105	113	124	103	110	122
44	107	115	128	102	111	123	102	109	122	99	107	119	98	105	117
40	100	108	123	96	104	118	95	103	117	93	101	115	92	99	113

Check V1(MCG).

V1, VR, V2 Adjustments*

TEMP		V1							VR							V2						
		PRESS ALT (1000 FT)							PRESS ALT (1000 FT)							PRESS ALT (1000 FT)						
°C	°F	-2	0	2	4	6	8	10	-2	0	2	4	6	8	10	-2	0	2	4	6	8	10
70	158	8	8						5	5						-3	-3					
60	140	6	6	7	9				4	4	5	6				-2	-3	-3	-4			
50	122	4	4	5	6	8	10	11	2	3	4	5	6	7	8	-1	-2	-2	-3	-3	-4	-5
40	104	1	2	3	4	6	8	9	1	2	3	4	5	6	7	-1	-1	-1	-2	-3	-3	-4
30	86	0	0	1	2	4	6	7	0	0	1	2	3	5	6	0	0	-1	-1	-2	-3	-3
20	68	0	0	0	1	2	4	5	0	0	1	1	2	3	5	0	0	0	-1	-1	-2	-3
-60	-76	0	0	0	1	2	3	4	0	0	1	1	2	3	3	0	0	0	-1	-1	-1	-2

Slope and Wind V1 Adjustments*

WEIGHT (1000 KG)	SLOPE (%)					WIND (KTS)							
	-2	-1	0	1	2	-15	-10	-5	0	10	20	30	40
80	-5	-3	0	3	5	-3	-2	-1	0	1	1	2	2
76	-5	-2	0	3	5	-3	-2	-1	0	1	1	2	2
72	-4	-2	0	2	5	-3	-2	-1	0	1	1	2	2
68	-4	-2	0	2	4	-3	-2	-1	0	1	1	2	3
64	-3	-2	0	2	4	-3	-2	-1	0	1	1	2	3
60	-3	-2	0	2	4	-3	-2	-1	0	1	1	2	3
56	-3	-1	0	2	3	-4	-2	-1	0	1	2	2	3
52	-3	-1	0	1	3	-4	-3	-1	0	1	2	2	3
48	-2	-1	0	1	2	-4	-3	-1	0	1	2	2	3
44	-2	-1	0	1	2	-4	-3	-1	0	1	2	3	3
40	-2	-1	0	1	2	-5	-3	-2	0	1	2	3	4

***V1 not to exceed VR.**

V1(MCG)

TEMP		PRESSURE ALTITUDE (FT)						
°C	°F	-2000	0	2000	4000	6000	8000	10000
70	158	87	85					
60	140	87	85	84	83			
50	122	89	87	84	83	81	79	77
40	104	94	91	88	85	82	79	77
30	86	96	96	93	89	86	82	79
20	68	97	96	94	93	90	86	82
-60	-76	98	98	96	94	91	89	87

Stab Trim Setting (22K Derate)

Flaps 1 and 5

WEIGHT (1000 KG)	C.G. (%MAC)									
	6	8	10	16	21	26	30	33	35	36
85	8 1/2	8 1/2	8 1/2	7 1/2	6 3/4	6	5 1/2	5	4 3/4	4 1/2
80	8 1/2	8 1/2	8 1/4	7 1/4	6 1/2	5 3/4	5	4 3/4	4 1/4	4 1/4
75	8 1/4	8	7 3/4	7	6 1/4	5 1/2	4 3/4	4 1/4	4	3 3/4
70	8	7 3/4	7 1/2	6 3/4	6	5 1/4	4 1/2	4 1/4	3 3/4	3 3/4
65	7 3/4	7 1/2	7 1/4	6 1/2	5 3/4	5	4 1/2	4	3 3/4	3 1/2
60	7 1/2	7 1/4	7	6 1/4	5 1/2	5	4 1/4	3 3/4	3 1/2	3 1/4
55	7 1/4	7 1/4	6 3/4	6	5 1/2	4 3/4	4	3 1/2	3 1/4	3 1/4
50	7	6 3/4	6 1/2	5 3/4	5	4 1/4	3 3/4	3 1/4	3	3
45	6 3/4	6 1/2	6 1/4	5 1/2	4 3/4	4	3 1/2	3	2 3/4	2 3/4
40	6 3/4	6 1/2	6 1/4	5 1/2	4 3/4	4	3 1/2	3	2 3/4	2 3/4

Flaps 10, 15 and 25

WEIGHT (1000 KG)	C.G. %MAC									
	6	8	10	16	21	26	30	33	35	36
85	8 1/2	8 1/2	8 1/2	6 3/4	5 1/2	4 1/2	3 3/4	3 1/4	2 3/4	2 1/2
80	8 1/2	8 1/2	8 1/2	6 3/4	5 3/4	4 3/4	3 3/4	3 1/4	2 3/4	2 1/2
75	8 1/2	8 1/2	8 1/4	6 1/2	5 1/2	4 1/2	3 1/2	3	2 1/2	2 1/2
70	8 1/2	8 1/4	7 3/4	6 1/4	5 1/4	4 1/4	3 1/4	2 3/4	2 1/4	2 1/4
65	8 1/4	7 3/4	7 1/4	5 3/4	4 3/4	3 3/4	3	2 1/2	2 1/4	2 1/4
60	7 3/4	7 1/4	6 3/4	5 1/2	4 1/2	3 1/2	2 3/4	2 1/4	2 1/4	2 1/4
55	7	6 3/4	6 1/4	5 1/4	4 1/4	3 1/2	2 3/4	2 1/4	2 1/4	2 1/4
50	6 1/2	6 1/4	5 3/4	4 3/4	4	3	2 1/4	2 1/4	2 1/4	2 1/4
45	6	5 3/4	5 1/2	4 1/2	3 1/2	2 3/4	2 1/4	2 1/4	2 1/4	2 1/4
40	6	5 3/4	5 1/2	4 1/2	3 1/2	2 3/4	2 1/4	2 1/4	2 1/4	2 1/4

ADVISORY INFORMATION

Slush/Standing Water Takeoff (22K Derate)

Maximum Reverse Thrust

Weight Adjustments (1000 KG)

22K DERATE DRY FIELD/OBSTACLE LIMIT WEIGHT (1000 KG)	SLUSH/STANDING WATER DEPTH								
	3 mm (0.12 INCHES)			6 mm (0.25 INCHES)			13 mm (0.50 INCHES)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
95	-12.9	-15.4	-17.9	-16.6	-19.1	-21.6	-31.8	-34.3	-36.8
90	-11.9	-14.4	-16.9	-15.2	-17.7	-20.2	-27.5	-30.0	-32.5
85	-10.9	-13.4	-15.9	-13.8	-16.3	-18.7	-23.3	-25.8	-28.3
80	-10.0	-12.5	-15.0	-12.3	-14.8	-17.3	-19.4	-21.9	-24.4
75	-9.0	-11.5	-14.0	-10.9	-13.4	-15.9	-16.0	-18.5	-21.0
70	-8.0	-10.5	-13.0	-9.5	-12.0	-14.5	-13.1	-15.6	-18.1
65	-7.1	-9.6	-12.1	-8.3	-10.8	-13.3	-10.7	-13.2	-15.7
60	-6.3	-8.8	-11.3	-7.2	-9.7	-12.2	-8.8	-11.3	-13.8
55	-5.5	-8.0	-10.5	-6.2	-8.7	-11.2	-7.4	-9.9	-12.4
50	-4.6	-7.1	-9.6	-5.1	-7.6	-10.1	-6.5	-9.0	-11.5
45	-3.8	-6.3	-8.8	-4.1	-6.6	-9.1	-6.1	-8.6	-11.1
40	-3.0	-5.5	-8.0	-3.0	-5.5	-8.0	-6.2	-8.7	-11.2

V1(MCG) Limit Weight (1000 KG)

ADJUSTED FIELD LENGTH (M)	SLUSH/STANDING WATER DEPTH								
	3 mm (0.12 INCHES)			6 mm (0.25 INCHES)			13 mm (0.50 INCHES)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
1200	36.2			39.2			44.3		
1400	57.9	41.2		60.6	44.2		65.4	49.1	34.1
1600	81.4	63.3	46.3	84.0	66.0	49.2	89.5	70.8	54.0
1800		87.3	68.8		89.9	71.4		95.6	76.4
2000			93.3			95.8			101.7

1. **Enter Weight Adjustment table with slush/standing water depth and 22K Derate dry field/obstacle limit weight to obtain slush/standing water weight adjustment.**
2. **Adjust field length available by -30 m/+30 m for every 5°C above/below 4°C.**
3. **Find V1(MCG) limit weight for adjusted field length and pressure altitude.**
4. **Max allowable slush/standing water limited weight is lesser of weights from 1 and 3.**

ADVISORY INFORMATION

Slush/Standing Water Takeoff (22K Derate)
Maximum Reverse Thrust
V1 Adjustment (KIAS)

WEIGHT (1000 KG)	SLUSH/STANDING WATER DEPTH								
	3 mm (0.12 INCHES)			6 mm (0.25 INCHES)			13 mm (0.50 INCHES)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
90	-12	-10	-7	-7	-4	-2	0	0	0
85	-13	-10	-8	-7	-4	-2	0	0	0
80	-14	-11	-9	-7	-5	-2	0	0	0
75	-15	-12	-10	-8	-6	-3	0	0	0
70	-16	-13	-11	-10	-7	-5	0	0	0
65	-17	-15	-12	-12	-9	-7	-1	0	0
60	-19	-16	-14	-14	-12	-9	-5	-2	0
55	-20	-18	-15	-17	-14	-12	-9	-6	-4
50	-21	-18	-16	-18	-16	-13	-12	-10	-7
45	-21	-19	-16	-19	-17	-14	-14	-12	-9
40	-21	-18	-16	-19	-17	-14	-16	-14	-11

1. **Obtain V1, VR and V2 for the actual weight using the 22K Derate Dry Runway Takeoff Speeds table.**
2. **If V1(MCG) limited, set V1 = V1(MCG). If not V1(MCG) limited, enter V1 Adjustment table with the actual weight to obtain V1 speed adjustment. If adjusted V1 is less than V1(MCG), set V1 = V1(MCG). V1 not to exceed VR.**

ADVISORY INFORMATION

Slush/Standing Water Takeoff (22K Derate)

No Reverse Thrust

Weight Adjustments (1000 KG)

22K DERATE DRY FIELD/OBSTACLE LIMIT WEIGHT (1000 KG)	SLUSH/STANDING WATER DEPTH								
	3 mm (0.12 INCHES)			6 mm (0.25 INCHES)			13 mm (0.50 INCHES)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
95	-16.1	-19.5	-22.9	-20.3	-23.7	-27.1	-33.9	-37.3	-40.7
90	-14.8	-18.2	-21.6	-18.4	-21.8	-25.2	-29.6	-33.0	-36.4
85	-13.4	-16.8	-20.2	-16.4	-19.8	-23.2	-25.2	-28.6	-32.0
80	-12.2	-15.6	-19.0	-14.6	-18.0	-21.4	-21.2	-24.6	-28.0
75	-10.9	-14.3	-17.7	-12.9	-16.3	-19.7	-17.7	-21.1	-24.5
70	-9.8	-13.2	-16.6	-11.3	-14.7	-18.1	-14.7	-18.1	-21.5
65	-8.7	-12.1	-15.5	-9.9	-13.3	-16.7	-12.2	-15.6	-19.0
60	-7.7	-11.1	-14.5	-8.6	-12.0	-15.4	-10.3	-13.7	-17.1
55	-6.8	-10.2	-13.6	-7.4	-10.8	-14.2	-8.8	-12.2	-15.6
50	-5.9	-9.3	-12.7	-6.4	-9.8	-13.2	-7.7	-11.1	-14.5
45	-5.0	-8.4	-11.8	-5.3	-8.7	-12.1	-6.7	-10.1	-13.5
40	-4.1	-7.5	-10.9	-4.3	-7.7	-11.1	-5.7	-9.1	-12.5

V1(MCG) Limit Weight (1000 KG)

ADJUSTED FIELD LENGTH (M)	SLUSH/STANDING WATER DEPTH								
	3 mm (0.12 INCHES)			6 mm (0.25 INCHES)			13 mm (0.50 INCHES)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
1400				30.9			44.3		
1600	51.3			57.8	35.1		70.0	48.0	
1800	80.5	56.1	31.5	87.3	62.4	39.4	103.8	74.9	51.9
2000		85.2	60.8		92.3	67.0			80.1
2200			89.9			97.3			

1. **Enter Weight Adjustment table with slush/standing water depth and 22K Derate dry field/obstacle limit weight to obtain slush/standing water weight adjustment.**
2. **Adjust field length available by -35 m/+30 m for every 5°C above/below 4°C.**
3. **Find V1(MCG) limit weight for available field length and pressure altitude.**
4. **Max allowable slush/standing water limited weight is lesser of weights from 1 and 3.**

ADVISORY INFORMATION

Slush/Standing Water Takeoff (22K Derate)

No Reverse Thrust

V1 Adjustment (KIAS)

WEIGHT (1000 KG)	SLUSH/STANDING WATER DEPTH								
	3 mm (0.12 INCHES)			6 mm (0.25 INCHES)			13 mm (0.50 INCHES)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
95	-9	-7	-4	0	0	0	0	0	0
90	-12	-10	-7	0	0	0	0	0	0
85	-15	-12	-10	-3	-1	0	0	0	0
80	-17	-15	-12	-7	-5	-2	0	0	0
75	-19	-17	-14	-11	-8	-6	0	0	0
70	-21	-19	-16	-14	-11	-9	0	0	0
65	-23	-21	-18	-17	-14	-12	0	0	0
60	-25	-22	-20	-19	-17	-14	-6	-4	-1
55	-26	-23	-21	-22	-19	-17	-12	-10	-7
50	-27	-24	-22	-24	-21	-19	-16	-14	-11
45	-28	-25	-23	-25	-23	-20	-20	-17	-15
40	-28	-26	-23	-27	-24	-22	-22	-19	-17

1. **Obtain V1, VR and V2 for the actual weight using the 22K Derate Dry Runway Takeoff Speeds table.**
2. **If V1(MCG) limited, set V1 = V1(MCG). If not V1(MCG) limited, enter V1 Adjustment table with the actual weight to obtain V1 speed adjustment. If adjusted V1 is less than V1(MCG), set V1 = V1(MCG). V1 not to exceed VR.**

ADVISORY INFORMATION

Slippery Runway Takeoff (22K Derate)
Maximum Reverse Thrust
Weight Adjustment (1000 KG)

22K DERATE DRY FIELD/OBSTACLE LIMIT WEIGHT (1000 KG)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
95	0.0	0.0	0.0	-4.5	-4.5	-4.5	-9.9	-9.9	-9.9
90	0.0	0.0	0.0	-4.8	-4.8	-4.8	-9.8	-9.8	-9.8
85	-0.3	-0.3	-0.3	-5.1	-5.1	-5.1	-9.6	-9.6	-9.6
80	-0.7	-0.7	-0.7	-5.3	-5.3	-5.3	-9.4	-9.4	-9.4
75	-1.1	-1.1	-1.1	-5.3	-5.3	-5.3	-9.1	-9.1	-9.1
70	-1.3	-1.3	-1.3	-5.3	-5.3	-5.3	-8.7	-8.7	-8.7
65	-1.4	-1.4	-1.4	-5.1	-5.1	-5.1	-8.2	-8.2	-8.2
60	-1.4	-1.4	-1.4	-4.9	-4.9	-4.9	-7.7	-7.7	-7.7
55	-1.4	-1.4	-1.4	-4.6	-4.6	-4.6	-7.1	-7.1	-7.1
50	-1.2	-1.2	-1.2	-4.1	-4.1	-4.1	-6.4	-6.4	-6.4
45	-0.9	-0.9	-0.9	-3.6	-3.6	-3.6	-5.6	-5.6	-5.6
40	-0.5	-0.5	-0.5	-2.9	-2.9	-2.9	-4.7	-4.7	-4.7

V1(MCG) Limit Weight (1000 KG)

ADJUSTED FIELD LENGTH (M)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
1000	53.4	35.2							
1200	85.4	68.7	51.2	36.4					
1400		99.6	83.4	60.3	40.2				
1600				86.3	64.4	44.0	37.8		
1800					90.7	68.5	52.5	34.7	
2000						95.2	68.9	49.1	31.7
2200							87.9	65.1	45.8
2400								83.4	61.4
2600								104.4	79.2
2800									99.7

1. **Enter Weight Adjustment table with reported braking action and 22K Derate dry field/obstacle limit weight to obtain slippery runway weight adjustment.**
2. **Adjust "Good" field length available by -20 m/+20 m for every 5°C above/below 4°C.**
   Adjust "Medium" field length available by -20 m/+20 m for every 5°C above/below 4°C.
   Adjust "Poor" field length available by -30 m/+30 m for every 5°C above/below 4°C.
3. **Find V1(MCG) limit weight for adjusted field length and pressure altitude.**
4. **Max allowable slippery runway limited weight is lesser of weights from 1 and 3.**

ADVISORY INFORMATION

Slippery Runway Takeoff (22K Derate)
Maximum Reverse Thrust
V1 Adjustment (KIAS)

WEIGHT (1000 KG)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
90	-5	-3	-2	-14	-13	-11	-24	-23	-22
85	-5	-4	-2	-13	-12	-11	-24	-22	-21
80	-5	-4	-3	-14	-12	-11	-24	-23	-21
75	-6	-5	-4	-15	-13	-12	-25	-24	-23
70	-7	-6	-5	-16	-15	-13	-27	-26	-24
65	-8	-7	-5	-17	-16	-15	-29	-28	-26
60	-9	-8	-6	-19	-18	-17	-31	-30	-29
55	-10	-8	-7	-21	-19	-18	-33	-32	-31
50	-10	-9	-8	-22	-21	-19	-35	-34	-33
45	-11	-10	-8	-23	-22	-20	-37	-35	-34
40	-11	-10	-8	-23	-22	-21	-37	-36	-35

1. **Obtain V1, VR and V2 for the actual weight using the 22K Derate Dry Runway Takeoff Speeds table.**
2. **If V1(MCG) limited, set V1 = V1(MCG). If not V1(MCG) limited, enter V1 Adjustment table with the actual weight to obtain V1 speed adjustment. If adjusted V1 is less than V1(MCG), set V1 = V1(MCG). V1 not to exceed VR.**

ADVISORY INFORMATION

Slippery Runway Takeoff (22K Derate)

No Reverse Thrust

Weight Adjustments (1000 KG)

22K DERATE DRY FIELD/OBSTACLE LIMIT WEIGHT (1000 KG)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
95	0.0	0.0	0.0	-7.7	-7.7	-7.7	-12.0	-12.0	-12.0
90	0.0	0.0	0.0	-7.8	-7.8	-7.8	-11.7	-11.7	-11.7
85	-0.4	-0.4	-0.4	-7.8	-7.8	-7.8	-11.5	-11.5	-11.5
80	-0.9	-0.9	-0.9	-7.8	-7.8	-7.8	-11.2	-11.2	-11.2
75	-1.3	-1.3	-1.3	-7.6	-7.6	-7.6	-10.8	-10.8	-10.8
70	-1.6	-1.6	-1.6	-7.4	-7.4	-7.4	-10.3	-10.3	-10.3
65	-1.8	-1.8	-1.8	-7.1	-7.1	-7.1	-9.8	-9.8	-9.8
60	-1.9	-1.9	-1.9	-6.7	-6.7	-6.7	-9.1	-9.1	-9.1
55	-1.9	-1.9	-1.9	-6.2	-6.2	-6.2	-8.3	-8.3	-8.3
50	-1.8	-1.8	-1.8	-5.6	-5.6	-5.6	-7.5	-7.5	-7.5
45	-1.5	-1.5	-1.5	-4.9	-4.9	-4.9	-6.5	-6.5	-6.5
40	-1.2	-1.2	-1.2	-4.1	-4.1	-4.1	-5.5	-5.5	-5.5

V1(MCG) Limit Weight (1000 KG)

ADJUSTED FIELD LENGTH (M)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
1000	41.9								
1200	78.9	60.2	39.1						
1400		94.1	76.7						
1600				62.1	35.7				
1800				94.5	70.0	44.1			
2000					102.0	77.8			
2200							35.6		
2400							57.1		
2600							82.0	48.8	
2800								72.2	40.9
3000								99.6	63.1
3200									89.2

1. **Enter Weight Adjustment table with reported braking action and 22K Derate dry field/obstacle limit weight to obtain slippery runway weight adjustment.**
2. **Adjust “Good” field length available by -25 m/+20 m for every 5°C above/below 4°C.**
   Adjust “Medium” field length available by -25 m/+20 m for every 5°C above/below 4°C.
   Adjust “Poor” field length available by -40 m/+35 m for every 5°C above/below 4°C.
3. **Find V1(MCG) limit weight for adjusted field length and pressure altitude.**
4. **Max allowable slippery runway limited weight is lesser of weights from 1 and 3.**

ADVISORY INFORMATION

Slippery Runway Takeoff (22K Derate)
No Reverse Thrust
V1 Adjustment (KIAS)

WEIGHT (1000 KG)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
95	-5	-3	0	-17	-14	-12	-32	-30	-27
90	-6	-3	-1	-17	-14	-12	-32	-30	-27
85	-6	-4	-1	-17	-14	-12	-32	-30	-27
80	-7	-4	-2	-17	-15	-12	-33	-30	-28
75	-8	-5	-3	-18	-16	-13	-35	-32	-30
70	-9	-6	-4	-20	-18	-15	-37	-34	-32
65	-10	-7	-5	-22	-20	-17	-40	-37	-35
60	-11	-8	-6	-24	-22	-19	-43	-40	-38
55	-12	-9	-7	-26	-24	-21	-45	-43	-40
50	-13	-10	-8	-28	-26	-23	-48	-45	-43
45	-13	-11	-8	-30	-27	-25	-49	-47	-44
40	-14	-11	-9	-31	-28	-26	-50	-48	-45

1. **Obtain V1, VR and V2 for the actual weight using the 22K Derate Dry Runway Takeoff Speeds table.**
2. **If V1(MCG) limited, set V1 = V1(MCG). If not V1(MCG) limited, enter V1 Adjustment table with the actual weight to obtain V1 speed adjustment. If adjusted V1 is less than V1(MCG), set V1 = V1(MCG). V1 not to exceed VR.**

Takeoff %N1 (22K Derate)

Based on engine bleeds for packs on, engine and wing anti-ice on or off

OAT (°C)	AIRPORT PRESSURE ALTITUDE (FT)												
	-2000	-1000	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
60	87.7	88.3	88.7	88.8	88.9	89.1	89.2	89.2	89.1	88.6	88.3	88.7	89.2
55	88.5	89.1	89.5	89.7	89.8	89.9	90.0	90.0	90.0	89.5	89.0	88.8	88.6
50	89.3	89.8	90.4	90.5	90.6	90.7	90.9	90.8	90.8	90.4	89.9	89.7	89.6
45	90.2	90.7	91.2	91.3	91.4	91.5	91.7	91.6	91.6	91.2	90.8	90.7	90.5
40	91.1	91.6	92.1	92.2	92.3	92.4	92.5	92.4	92.4	92.1	91.7	91.6	91.5
35	91.9	92.5	93.0	93.1	93.2	93.2	93.3	93.3	93.2	92.9	92.5	92.5	92.4
30	91.5	92.6	93.8	93.9	94.0	94.0	94.1	94.0	93.9	93.7	93.4	93.3	93.2
25	90.8	91.9	93.1	93.7	94.4	94.8	94.9	94.8	94.8	94.4	94.0	94.0	94.0
20	90.0	91.1	92.3	93.0	93.6	94.3	95.0	95.6	95.6	95.3	94.9	94.8	94.7
15	89.3	90.4	91.6	92.2	92.8	93.6	94.3	94.8	95.3	95.9	96.1	95.9	95.5
10	88.5	89.6	90.8	91.4	92.1	92.8	93.5	94.0	94.5	95.1	95.7	96.4	97.1
5	87.8	88.9	90.0	90.7	91.3	92.0	92.7	93.2	93.7	94.3	94.9	95.6	96.3
0	87.0	88.1	89.2	89.9	90.5	91.2	91.9	92.4	92.9	93.5	94.1	94.8	95.5
-5	86.2	87.3	88.4	89.1	89.7	90.4	91.1	91.6	92.1	92.7	93.3	94.0	94.7
-10	85.4	86.5	87.6	88.3	88.9	89.6	90.3	90.8	91.3	91.9	92.5	93.2	93.9
-15	84.6	85.7	86.8	87.5	88.1	88.8	89.4	90.0	90.5	91.1	91.7	92.4	93.1
-20	83.8	84.9	86.0	86.6	87.3	87.9	88.6	89.1	89.7	90.3	90.8	91.6	92.3
-25	83.0	84.1	85.2	85.8	86.4	87.1	87.8	88.3	88.8	89.4	90.0	90.7	91.5
-30	82.2	83.3	84.4	85.0	85.6	86.3	86.9	87.4	88.0	88.6	89.2	89.9	90.6
-35	81.4	82.4	83.5	84.1	84.7	85.4	86.1	86.6	87.1	87.7	88.3	89.0	89.8
-40	80.6	81.6	82.7	83.3	83.9	84.5	85.2	85.7	86.2	86.8	87.4	88.2	88.9
-45	79.7	80.7	81.8	82.4	83.0	83.7	84.3	84.8	85.3	86.0	86.6	87.3	88.0
-50	78.9	79.9	80.9	81.5	82.1	82.8	83.4	83.9	84.5	85.1	85.7	86.4	87.2

%N1 Adjustments for Engine Bleeds

BLEED CONFIGURATION	AIRPORT PRESSURE ALTITUDE (FT)												
	-2000	-1000	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
PACKS OFF	0.7	0.7	0.7	0.7	0.7	0.7	0.8	0.8	0.8	0.8	0.9	0.9	0.9

Assumed Temperature Reduced Thrust (22K Derate)

Maximum Assumed Temperature (Table 1 of 3)

Based on 25% Takeoff Thrust Reduction

OAT (°C)	AIRPORT PRESSURE ALTITUDE (FT)											
	-1000	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
55	73	71	69	67								
50	73	71	69	67	65	63						
45	73	71	69	67	65	63	61	59	57			
40	72	71	69	67	65	63	61	59	57	55		
35	66	66	66	66	65	63	61	59	57	55	53	
30	63	61	61	61	61	61	61	59	57	55	53	51
25	63	61	59	57	56	56	56	56	56	55	53	51
20	63	61	59	57	55	53	51	51	51	50	50	50
15	63	61	59	57	55	53	51	50	47	45	45	45
10 & BELOW	63	61	59	57	55	53	51	50	47	45	43	41

Takeoff %N1 (Table 2 of 3)

Based on engine bleeds for packs on, engine and wing anti-ice on or off

ASSUMED TEMP (°C)	AIRPORT PRESSURE ALTITUDE (FT)											
	-1000	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
75	85.7	86.0	86.7	87.4	88.2	88.9	89.5	90.1	90.2	90.2	90.6	91.1
70	86.6	87.0	87.1	87.1	87.5	88.3	88.9	89.4	89.5	89.6	90.0	90.4
65	87.4	87.8	88.0	88.0	88.2	88.3	88.3	88.8	88.9	88.9	89.4	89.8
60	88.3	88.7	88.8	88.9	89.1	89.2	89.2	89.1	88.6	88.3	88.7	89.2
55	89.1	89.5	89.7	89.8	89.9	90.0	90.0	90.0	89.5	89.0	88.8	88.6
50	89.8	90.4	90.5	90.6	90.7	90.9	90.8	90.8	90.4	89.9	89.7	89.6
45	90.7	91.2	91.3	91.4	91.5	91.7	91.6	91.6	91.2	90.8	90.7	90.5
40	91.6	92.1	92.2	92.3	92.4	92.5	92.4	92.4	92.1	91.7	91.6	91.5
35	92.5	93.0	93.1	93.2	93.2	93.3	93.3	93.2	92.9	92.5	92.5	92.4
30	92.6	93.8	93.9	94.0	94.0	94.1	94.0	93.9	93.7	93.4	93.3	93.2
25	91.9	93.1	93.7	94.4	94.8	94.9	94.8	94.8	94.4	94.0	94.0	94.0
20	91.1	92.3	93.0	93.6	94.3	95.0	95.6	95.6	95.3	94.9	94.8	94.7
15	90.4	91.6	92.2	92.8	93.6	94.3	94.8	95.3	95.9	96.1	95.9	95.5
10	89.6	90.8	91.4	92.1	92.8	93.5	94.0	94.5	95.1	95.7	96.4	97.1
MINIMUM ASSUMED TEMP (°C)	32	30	28	26	24	22	20	18	16	15	12	10

With engine bleed for packs off, increase %N1 by 0.9.

Assumed Temperature Reduced Thrust (22K Derate)

%N1 Adjustment for Temperature Difference (Table 3 of 3)

ASSUMED TEMP MINUS OAT (°C)	OUTSIDE AIR TEMPERATURE (°C)													
	-40	-20	0	5	10	15	20	25	30	35	40	45	50	55
110	11.6													
100	10.3	7.9												
90	10.8	8.4												
80	12.2	7.1	5.0											
70	11.0	7.6	5.4	5.2	3.5									
60	9.6	9.0	4.1	4.0	3.9	3.8	2.1							
50	8.0	7.7	4.5	2.8	2.6	2.7	2.6	2.4	0.8					
40		6.2	5.9	4.7	3.0	2.6	2.7	2.8	2.6	2.5	2.9			
30		4.7	4.6	4.5	4.4	4.2	4.1	4.0	4.0	3.9	3.8	3.7	3.6	
20			3.1	3.0	3.0	3.0	2.9	2.8	2.7	2.7	2.6	2.6	2.5	2.4
10			1.5	1.5	1.5	1.5	1.5	1.5	1.4	1.4	1.4	1.3	1.3	1.3
0			0	0	0	0	0	0	0	0	0	0	0	0

1. **Determine Maximum Assumed Temperature allowed from Table 1.**
2. **Find Maximum %N1 from Table 2 using the desired assumed temperature (no greater than temperature from Table 1).**
3. **Use the difference between assumed temperature and OAT to determine the %N1 adjustment from Table 3.**
4. **Subtract %N1 adjustment from Maximum %N1 in Table 2.**

Max Climb %N1

Based on engine bleed for packs on or off and anti-ice off

TAT (°C)	PRESSURE ALTITUDE (FT)/SPEED (KIAS/MACH)									
	0	5000	10000	15000	20000	25000	30000	35000	37000	41000
	280	280	280	280	280	280	280	.78	.78	.78
60	90.2	90.5	90.4	90.6	90.4	92.1	93.8	95.1	95.2	93.5
55	91.0	91.2	91.3	91.4	90.8	91.5	93.1	94.4	94.5	92.8
50	91.7	92.0	92.1	92.2	91.7	91.5	92.4	93.7	93.8	92.1
45	92.4	92.6	92.8	93.0	92.6	92.4	92.4	93.0	93.1	91.4
40	93.1	93.3	93.6	93.8	93.4	93.2	93.2	92.3	92.4	90.7
35	93.6	94.0	94.3	94.5	94.3	94.0	94.0	93.0	92.4	90.8
30	92.9	94.8	95.0	95.2	95.1	94.8	94.7	93.9	93.3	91.8
25	92.2	94.8	95.7	95.9	95.9	95.5	95.4	94.7	94.1	92.8
20	91.4	94.0	96.5	96.7	96.6	96.2	96.1	95.4	94.9	93.7
15	90.6	93.2	95.9	97.5	97.4	96.9	96.7	96.2	95.7	94.6
10	89.9	92.5	95.1	97.8	98.3	97.7	97.4	96.9	96.5	95.6
5	89.1	91.7	94.3	97.0	99.2	98.6	98.1	97.7	97.3	96.5
0	88.3	90.9	93.5	96.2	98.6	99.6	99.1	98.5	98.2	97.5
-5	87.6	90.1	92.7	95.4	97.8	99.6	100.0	99.2	99.0	98.4
-10	86.8	89.3	91.9	94.6	97.1	98.8	100.3	100.2	99.8	99.4
-15	86.0	88.5	91.0	93.8	96.3	98.0	99.6	101.1	100.8	100.4
-20	85.2	87.6	90.2	93.0	95.5	97.2	98.7	100.8	101.3	101.0
-25	84.3	86.8	89.4	92.2	94.7	96.4	97.9	100.0	100.5	100.1
-30	83.5	86.0	88.5	91.3	93.9	95.6	97.1	99.1	99.6	99.3
-35	82.7	85.1	87.7	90.5	93.1	94.8	96.3	98.3	98.8	98.4
-40	81.8	84.3	86.8	89.6	92.3	93.9	95.4	97.4	97.9	97.6

%N1 Adjustments for Engine Bleeds

BLEED CONFIGURATION	PRESSURE ALTITUDE (1000 FT)					
	0	10	20	30	35	41
ENGINE ANTI-ICE	-0.6	-0.8	-0.9	-0.9	-0.8	-0.8
ENGINE & WING ANTI-ICE*	-1.8	-2.1	-2.5	-2.7	-3.0	-3.0

***Dual bleed sources**

Go-around %N1

Based on engine bleed for packs on, engine and wing anti-ice on or off

AIRPORT OAT		TAT (°C)	AIRPORT PRESSURE ALTITUDE (FT)											
°C	°F		-2000	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
57	134	60	95.0	96.2	96.8									
52	125	55	95.9	96.7	96.6	96.8	97.5							
47	116	50	96.6	97.6	97.8	97.8	97.7	97.5	98.2	98.8				
42	108	45	97.4	98.4	98.5	98.6	98.7	98.8	98.7	98.5	98.5	99.0		
37	99	40	98.0	99.1	99.2	99.3	99.4	99.5	99.6	99.5	99.1	98.9	98.8	99.1
32	90	35	98.1	99.9	100.0	100.1	100.1	100.3	100.3	100.2	99.9	99.6	99.6	99.5
27	81	30	97.3	99.8	100.4	100.7	100.7	100.7	100.7	100.7	100.6	100.4	100.4	100.3
22	72	25	96.6	99.1	99.7	100.2	100.6	100.9	100.9	100.9	100.9	100.9	100.9	100.8
17	63	20	95.8	98.3	98.9	99.5	99.8	100.2	100.5	100.9	101.0	101.1	101.0	101.0
12	54	15	95.0	97.5	98.1	98.7	99.1	99.4	99.8	100.1	100.5	100.9	101.3	101.2
7	45	10	94.2	96.8	97.4	98.0	98.3	98.7	99.0	99.4	99.8	100.2	100.5	100.9
2	36	5	93.4	96.0	96.6	97.2	97.6	97.9	98.3	98.7	99.0	99.4	99.8	100.2
-3	27	0	92.6	95.2	95.8	96.4	96.8	97.2	97.5	97.9	98.3	98.7	99.0	99.4
-8	18	-5	91.8	94.4	95.0	95.6	96.0	96.4	96.8	97.2	97.5	97.9	98.3	98.6
-13	9	-10	91.0	93.6	94.2	94.8	95.2	95.6	96.0	96.4	96.8	97.1	97.5	97.9
-17	1	-15	90.2	92.8	93.4	94.0	94.4	94.8	95.2	95.6	96.0	96.4	96.7	97.1
-22	-8	-20	89.3	92.0	92.6	93.2	93.6	94.0	94.4	94.8	95.2	95.6	95.9	96.3
-27	-17	-25	88.5	91.1	91.8	92.4	92.8	93.2	93.6	94.0	94.4	94.8	95.1	95.5
-32	-26	-30	87.6	90.3	90.9	91.6	92.0	92.4	92.8	93.3	93.6	94.0	94.3	94.7
-37	-35	-35	86.8	89.4	90.1	90.7	91.1	91.6	92.0	92.4	92.8	93.2	93.5	93.9
-42	-44	-40	85.9	88.6	89.2	89.9	90.3	90.7	91.2	91.6	92.0	92.4	92.7	93.0
-47	-53	-45	85.0	87.7	88.4	89.0	89.4	89.9	90.3	90.8	91.2	91.5	91.9	92.2
-52	-62	-50	84.1	86.8	87.5	88.2	88.6	89.0	89.5	90.0	90.3	90.7	91.0	91.4

%N1 Adjustments for Engine Bleeds

BLEED CONFIGURATION	PRESSURE ALTITUDE (FT)											
	-2000	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
PACKS OFF	0.7	0.8	0.8	0.8	0.8	0.9	0.9	0.9	0.9	0.9	0.9	0.9
A/C HIGH	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1

Flight With Unreliable Airspeed/ Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

CLIMB (280/.76)

Flaps Up, Set Max Climb Thrust

PRESSURE ALTITUDE (FT)		WEIGHT (1000 KG)				
		40	50	60	70	80
40000	**PITCH ATT**	**4.0**	**4.0**			
	V/S (FT/MIN)	1700	1000			
30000	**PITCH ATT**	**4.0**	**4.0**	**3.5**	**3.5**	**4.0**
	V/S (FT/MIN)	2500	1900	1400	1100	800
20000	**PITCH ATT**	**7.0**	**6.5**	**6.0**	**6.0**	**6.0**
	V/S (FT/MIN)	4200	3200	2600	2100	1700
10000	**PITCH ATT**	**11.0**	**9.5**	**8.5**	**8.0**	**8.0**
	V/S (FT/MIN)	5600	4400	3600	3000	2500
SEA LEVEL	**PITCH ATT**	**14.5**	**12.5**	**11.0**	**10.0**	**9.5**
	V/S (FT/MIN)	6700	5300	4300	3600	3100

CRUISE (.76/280)

Flaps Up, %N1 for Level Flight

PRESSURE ALTITUDE (FT)		WEIGHT (1000 KG)				
		40	50	60	70	80
40000	**PITCH ATT**	**2.0**	**2.5**	**3.5**		
	%N1	**83.3**	**86.2**	**91.0**		
35000	**PITCH ATT**	**1.0**	**2.0**	**2.5**	**3.0**	**3.5**
	%N1	**81.4**	**83.0**	**85.2**	**88.0**	**93.5**
30000	**PITCH ATT**	**1.0**	**1.5**	**2.0**	**2.5**	**3.0**
	%N1	**80.7**	**81.7**	**83.2**	**84.9**	**87.1**
25000	**PITCH ATT**	**1.0**	**1.5**	**2.0**	**2.5**	**3.0**
	%N1	**77.2**	**78.0**	**79.5**	**81.2**	**83.1**
20000	**PITCH ATT**	**1.0**	**1.5**	**2.0**	**2.5**	**3.5**
	%N1	**73.6**	**74.4**	**75.7**	**77.3**	**79.1**
15000	**PITCH ATT**	**1.0**	**1.5**	**2.0**	**3.0**	**3.5**
	%N1	**69.8**	**70.7**	**72.0**	**73.5**	**75.1**

Flight With Unreliable Airspeed/ Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

DESCENT (.76/280)
Flaps Up, Set Idle Thrust

PRESSURE ALTITUDE (FT)		WEIGHT (1000 KG) 40	50	60	70	80
40000	**PITCH ATT**	**-2.0**	**-0.5**	**0.0**	**0.5**	**1.0**
	V/S (FT/MIN)	-2700	-2500	-2500	-2700	-3000
30000	**PITCH ATT**	**-3.5**	**-2.0**	**-1.0**	**-0.5**	**0.0**
	V/S (FT/MIN)	-3100	-2600	-2300	-2100	-2100
20000	**PITCH ATT**	**-3.5**	**-2.0**	**-1.0**	**-0.5**	**0.5**
	V/S (FT/MIN)	-2900	-2400	-2200	-2000	-1900
10000	**PITCH ATT**	**-3.5**	**-2.0**	**-1.0**	**0.0**	**0.5**
	V/S (FT/MIN)	-2500	-2100	-1800	-1700	-1600
SEA LEVEL	**PITCH ATT**	**-3.5**	**-2.5**	**-1.0**	**-0.5**	**0.5**
	V/S (FT/MIN)	-2300	-1900	-1700	-1500	-1400

HOLDING (VREF40 + 70)
Flaps Up, %N1 for Level Flight

PRESSURE ALTITUDE (FT)		WEIGHT (1000 KG) 40	50	60	70	80
15000	**PITCH ATT**	**5.0**	**5.0**	**5.0**	**5.0**	**5.0**
	%N1	**56.7**	**62.4**	**66.7**	**70.6**	**74.0**
	KIAS	178	195	214	231	247
10000	**PITCH ATT**	**5.0**	**5.0**	**5.0**	**5.0**	**5.0**
	%N1	**53.0**	**58.1**	**62.9**	**66.6**	**69.9**
	KIAS	178	194	213	230	246
5000	**PITCH ATT**	**5.0**	**5.0**	**5.0**	**5.0**	**5.0**
	%N1	**49.5**	**54.5**	**58.7**	**62.8**	**66.2**
	KIAS	178	193	212	229	245

Flight With Unreliable Airspeed/ Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

TERMINAL AREA (5000 FT)

%N1 for Level Flights

Airport Altitude = -2000 FT

FLAP POSITION (VREF + INCREMENT)		WEIGHT (1000 KG)				
		40	50	60	70	80
FLAPS UP (GEAR UP) VREF40+70	**PITCH ATT**	**4.5**	**5.0**	**5.5**	**6.0**	**6.5**
	%N1	**48.2**	**52.9**	**57.0**	**60.8**	**64.5**
	KIAS	178	192	204	215	225
FLAPS 1 (GEAR UP) VREF40+50	**PITCH ATT**	**5.0**	**5.0**	**5.5**	**6.0**	**6.0**
	%N1	**50.2**	**55.1**	**59.5**	**63.5**	**66.9**
	KIAS	158	172	184	195	205
FLAPS 5 (GEAR UP) VREF40+30	**PITCH ATT**	**5.5**	**6.0**	**6.0**	**6.5**	**6.5**
	%N1	**50.5**	**55.9**	**60.5**	**64.7**	**68.4**
	KIAS	138	152	164	175	185
FLAPS 10 (GEAR UP) VREF40+30	**PITCH ATT**	**5.0**	**5.0**	**5.5**	**5.5**	**6.0**
	%N1	**53.7**	**59.1**	**64.0**	**68.1**	**71.8**
	KIAS	138	152	164	175	185
FLAPS 15 (GEAR UP) VREF40+20	**PITCH ATT**	**5.5**	**5.5**	**6.0**	**6.0**	**6.5**
	%N1	**53.8**	**59.4**	**64.3**	**68.6**	**72.4**
	KIAS	128	142	154	165	175
FLAPS 25 (GEAR UP) VREF40+10	**PITCH ATT**	**6.5**	**6.5**	**6.5**	**7.0**	**7.0**
	%N1	**54.7**	**60.5**	**65.6**	**69.8**	**73.8**
	KIAS	118	132	144	155	165
FLAPS 15 (GEAR DOWN) VREF40+20	**PITCH ATT**	**5.5**	**6.0**	**6.0**	**6.0**	**6.5**
	%N1	**58.0**	**63.9**	**68.8**	**73.2**	**77.0**
	KIAS	128	142	154	165	175

Flight With Unreliable Airspeed/ Turbulent Air Penetration
Altitude and/or vertical speed indications may also be unreliable.

TERMINAL AREA (5000 FT)
%N1 for Level Flights
Airport Altitude = -1000 FT

FLAP POSITION (VREF + INCREMENT)		WEIGHT (1000 KG)				
		40	50	60	70	80
FLAPS UP (GEAR UP) VREF40+70	**PITCH ATT**	**4.5**	**5.0**	**5.5**	**6.0**	**6.5**
	%N1	**48.9**	**53.6**	**57.7**	**61.6**	**65.2**
	KIAS	178	192	204	215	225
FLAPS 1 (GEAR UP) VREF40+50	**PITCH ATT**	**5.0**	**5.0**	**5.5**	**6.0**	**6.0**
	%N1	**50.9**	**55.9**	**60.3**	**64.3**	**67.7**
	KIAS	158	172	184	195	205
FLAPS 5 (GEAR UP) VREF40+30	**PITCH ATT**	**5.5**	**6.0**	**6.0**	**6.5**	**6.5**
	%N1	**51.3**	**56.6**	**61.4**	**65.5**	**69.2**
	KIAS	138	152	164	175	185
FLAPS 10 (GEAR UP) VREF40+30	**PITCH ATT**	**5.0**	**5.5**	**5.5**	**5.5**	**6.0**
	%N1	**54.4**	**59.9**	**64.8**	**68.9**	**72.7**
	KIAS	138	152	164	175	185
FLAPS 15 (GEAR UP) VREF40+20	**PITCH ATT**	**5.5**	**5.5**	**6.0**	**6.0**	**6.5**
	%N1	**54.5**	**60.2**	**65.2**	**69.4**	**73.3**
	KIAS	128	142	154	165	175
FLAPS 25 (GEAR UP) VREF40+10	**PITCH ATT**	**6.5**	**6.5**	**6.5**	**7.0**	**7.0**
	%N1	**55.4**	**61.3**	**66.3**	**70.6**	**74.6**
	KIAS	118	132	144	155	165
FLAPS 15 (GEAR DOWN) VREF40+20	**PITCH ATT**	**5.5**	**6.0**	**6.0**	**6.0**	**6.5**
	%N1	**58.8**	**64.7**	**69.6**	**74.0**	**77.8**
	KIAS	128	142	154	165	175

Flight With Unreliable Airspeed/ Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

TERMINAL AREA (5000 FT)
%N1 for Level Flights
Airport Altitude = SEA LEVEL

FLAP POSITION (VREF + INCREMENT)		WEIGHT (1000 KG)				
		40	50	60	70	80
FLAPS UP	**PITCH ATT**	**4.5**	**5.0**	**5.5**	**6.0**	**6.5**
(GEAR UP)	**%N1**	**49.6**	**54.3**	**58.4**	**62.5**	**66.0**
VREF40+70	KIAS	178	192	204	215	225
FLAPS 1	**PITCH ATT**	**5.0**	**5.0**	**5.5**	**6.0**	**6.0**
(GEAR UP)	**%N1**	**51.6**	**56.6**	**61.1**	**65.0**	**68.5**
VREF40+50	KIAS	158	172	184	195	205
FLAPS 5	**PITCH ATT**	**5.5**	**6.0**	**6.0**	**6.5**	**6.5**
(GEAR UP)	**%N1**	**52.0**	**57.4**	**62.2**	**66.4**	**70.1**
VREF40+30	KIAS	138	152	164	175	185
FLAPS 10	**PITCH ATT**	**5.0**	**5.5**	**5.5**	**5.5**	**6.0**
(GEAR UP)	**%N1**	**55.1**	**60.7**	**65.6**	**69.7**	**73.6**
VREF40+30	KIAS	138	152	164	175	185
FLAPS 15	**PITCH ATT**	**5.5**	**5.5**	**6.0**	**6.0**	**6.5**
(GEAR UP)	**%N1**	**55.3**	**61.0**	**66.0**	**70.2**	**74.1**
VREF40+20	KIAS	128	142	154	165	175
FLAPS 25	**PITCH ATT**	**6.5**	**6.5**	**6.5**	**7.0**	**7.0**
(GEAR UP)	**%N1**	**56.2**	**62.1**	**67.1**	**71.5**	**75.5**
VREF40+10	KIAS	118	132	144	155	165
FLAPS 15	**PITCH ATT**	**5.5**	**6.0**	**6.0**	**6.0**	**6.5**
(GEAR DOWN)	**%N1**	**59.6**	**65.5**	**70.5**	**74.9**	**78.6**
VREF40+20	KIAS	128	142	154	165	175

Flight With Unreliable Airspeed/ Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

TERMINAL AREA (5000 FT)

%N1 for Level Flights

Airport Altitude = 1000 FT

FLAP POSITION (VREF + INCREMENT)		WEIGHT (1000 KG) 40	50	60	70	80
FLAPS UP (GEAR UP)	**PITCH ATT**	**4.5**	**5.0**	**5.5**	**6.0**	**6.5**
	%N1	**50.3**	**55.0**	**59.2**	**63.3**	**66.7**
VREF40+70	KIAS	178	192	204	215	225
FLAPS 1 (GEAR UP)	**PITCH ATT**	**5.0**	**5.0**	**5.5**	**6.0**	**6.0**
	%N1	**52.3**	**57.3**	**61.9**	**65.8**	**69.2**
VREF40+50	KIAS	158	172	184	195	205
FLAPS 5 (GEAR UP)	**PITCH ATT**	**5.5**	**6.0**	**6.0**	**6.5**	**6.5**
	%N1	**52.8**	**58.1**	**63.1**	**67.2**	**70.9**
VREF40+30	KIAS	138	152	164	175	185
FLAPS 10 (GEAR UP)	**PITCH ATT**	**5.0**	**5.5**	**5.5**	**5.5**	**6.0**
	%N1	**55.8**	**61.6**	**66.4**	**70.5**	**74.3**
VREF40+30	KIAS	138	152	164	175	185
FLAPS 15 (GEAR UP)	**PITCH ATT**	**5.5**	**5.5**	**6.0**	**6.0**	**6.5**
	%N1	**56.0**	**61.8**	**66.8**	**71.1**	**75.0**
VREF40+20	KIAS	128	142	154	165	175
FLAPS 25 (GEAR UP)	**PITCH ATT**	**6.5**	**6.5**	**6.5**	**7.0**	**7.0**
	%N1	**57.0**	**62.9**	**67.9**	**72.4**	**76.3**
VREF40+10	KIAS	118	132	144	155	165
FLAPS 15 (GEAR DOWN)	**PITCH ATT**	**5.5**	**6.0**	**6.0**	**6.0**	**6.5**
	%N1	**60.4**	**66.3**	**71.3**	**75.7**	**79.5**
VREF40+20	KIAS	128	142	154	165	175

Flight With Unreliable Airspeed/ Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

TERMINAL AREA (5000 FT)
%N1 for Level Flights
Airport Altitude = 2000 FT

FLAP POSITION (VREF + INCREMENT)		WEIGHT (1000 KG)				
		40	50	60	70	80
FLAPS UP (GEAR UP) VREF40+70	**PITCH ATT**	**4.5**	**5.0**	**5.5**	**6.0**	**6.5**
	%N1	**51.0**	**55.8**	**59.9**	**64.1**	**67.5**
	KIAS	178	192	204	215	225
FLAPS 1 (GEAR UP) VREF40+50	**PITCH ATT**	**5.0**	**5.0**	**5.5**	**6.0**	**6.0**
	%N1	**53.0**	**58.1**	**62.7**	**66.5**	**70.1**
	KIAS	158	172	184	195	205
FLAPS 5 (GEAR UP) VREF40+30	**PITCH ATT**	**5.5**	**6.0**	**6.0**	**6.5**	**6.5**
	%N1	**53.4**	**58.9**	**63.8**	**67.9**	**71.7**
	KIAS	138	152	164	175	185
FLAPS 10 (GEAR UP) VREF40+30	**PITCH ATT**	**5.0**	**5.5**	**5.5**	**5.5**	**6.0**
	%N1	**56.6**	**62.4**	**67.2**	**71.4**	**75.2**
	KIAS	138	152	164	175	185
FLAPS 15 (GEAR UP) VREF40+20	**PITCH ATT**	**5.5**	**5.5**	**6.0**	**6.0**	**6.5**
	%N1	**56.8**	**62.6**	**67.5**	**72.0**	**75.8**
	KIAS	128	142	154	165	175
FLAPS 25 (GEAR UP) VREF40+10	**PITCH ATT**	**6.5**	**6.5**	**6.5**	**7.0**	**7.0**
	%N1	**57.8**	**63.8**	**68.7**	**73.2**	**77.1**
	KIAS	118	132	144	155	165
FLAPS 15 (GEAR DOWN) VREF40+20	**PITCH ATT**	**5.5**	**6.0**	**6.0**	**6.0**	**6.5**
	%N1	**61.2**	**67.1**	**72.2**	**76.5**	**80.3**
	KIAS	128	142	154	165	175

Flight With Unreliable Airspeed/ Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

TERMINAL AREA (5000 FT)
%N1 for Level Flights
Airport Altitude = 3000 FT

FLAP POSITION (VREF + INCREMENT)		WEIGHT (1000 KG)				
		40	50	60	70	80
FLAPS UP (GEAR UP) VREF40+70	**PITCH ATT**	**4.5**	**5.0**	**5.5**	**6.0**	**6.5**
	%N1	**51.6**	**56.5**	**60.8**	**64.9**	**68.2**
	KIAS	178	192	205	216	225
FLAPS 1 (GEAR UP) VREF40+50	**PITCH ATT**	**5.0**	**5.0**	**5.5**	**6.0**	**6.0**
	%N1	**53.8**	**58.9**	**63.5**	**67.3**	**70.9**
	KIAS	158	172	185	196	205
FLAPS 5 (GEAR UP) VREF40+30	**PITCH ATT**	**5.5**	**6.0**	**6.0**	**6.5**	**6.5**
	%N1	**54.2**	**59.7**	**64.6**	**68.7**	**72.6**
	KIAS	138	152	165	176	185
FLAPS 10 (GEAR UP) VREF40+30	**PITCH ATT**	**5.0**	**5.5**	**5.5**	**5.5**	**6.0**
	%N1	**57.4**	**63.2**	**68.0**	**72.3**	**76.0**
	KIAS	138	152	165	176	185
FLAPS 15 (GEAR UP) VREF40+20	**PITCH ATT**	**5.5**	**5.5**	**6.0**	**6.0**	**6.5**
	%N1	**57.5**	**63.4**	**68.4**	**72.9**	**76.6**
	KIAS	128	142	155	166	175
FLAPS 25 (GEAR UP) VREF40+10	**PITCH ATT**	**6.5**	**6.5**	**6.5**	**7.0**	**7.0**
	%N1	**58.6**	**64.6**	**69.6**	**74.1**	**77.9**
	KIAS	118	132	145	156	165
FLAPS 15 (GEAR DOWN) VREF40+20	**PITCH ATT**	**5.5**	**6.0**	**6.0**	**6.0**	**6.5**
	%N1	**62.0**	**67.9**	**73.1**	**77.4**	**81.2**
	KIAS	128	142	155	166	175

Flight With Unreliable Airspeed/ Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

TERMINAL AREA (5000 FT)
%N1 for Level Flights
Airport Altitude = 4000 FT

FLAP POSITION (VREF + INCREMENT)		WEIGHT (1000 KG)				
		40	50	60	70	80
FLAPS UP (GEAR UP) VREF40+70	**PITCH ATT**	**4.5**	**5.0**	**5.5**	**6.0**	**6.5**
	%N1	**52.3**	**57.2**	**61.6**	**65.6**	**69.0**
	KIAS	178	192	205	216	225
FLAPS 1 (GEAR UP) VREF40+50	**PITCH ATT**	**5.0**	**5.0**	**5.5**	**6.0**	**6.0**
	%N1	**54.5**	**59.6**	**64.3**	**68.1**	**71.8**
	KIAS	158	172	185	196	205
FLAPS 5 (GEAR UP) VREF40+30	**PITCH ATT**	**5.5**	**6.0**	**6.0**	**6.5**	**6.5**
	%N1	**54.9**	**60.6**	**65.4**	**69.6**	**73.4**
	KIAS	138	152	165	176	185
FLAPS 10 (GEAR UP) VREF40+30	**PITCH ATT**	**5.0**	**5.5**	**5.5**	**5.5**	**6.0**
	%N1	**58.2**	**64.0**	**68.8**	**73.1**	**76.7**
	KIAS	138	152	165	176	185
FLAPS 15 (GEAR UP) VREF40+20	**PITCH ATT**	**5.5**	**5.5**	**6.0**	**6.0**	**6.5**
	%N1	**58.3**	**64.3**	**69.2**	**73.7**	**77.4**
	KIAS	128	142	155	166	175
FLAPS 25 (GEAR UP) VREF40+10	**PITCH ATT**	**6.5**	**6.5**	**6.5**	**7.0**	**7.0**
	%N1	**59.4**	**65.4**	**70.4**	**74.9**	**78.8**
	KIAS	118	132	145	156	165
FLAPS 15 (GEAR DOWN) VREF40+20	**PITCH ATT**	**5.5**	**6.0**	**6.0**	**6.0**	**6.5**
	%N1	**62.8**	**68.7**	**73.9**	**78.2**	**82.1**
	KIAS	128	142	155	166	175

Flight With Unreliable Airspeed/ Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

TERMINAL AREA (5000 FT)
%N1 for Level Flights
Airport Altitude = 5000 FT

FLAP POSITION (VREF + INCREMENT)		WEIGHT (1000 KG) 40	50	60	70	80
FLAPS UP (GEAR UP) VREF40+70	**PITCH ATT**	**4.5**	**5.0**	**5.5**	**6.0**	**6.5**
	%N1	**53.0**	**57.9**	**62.5**	**66.4**	**69.8**
	KIAS	178	192	205	216	225
FLAPS 1 (GEAR UP) VREF40+50	**PITCH ATT**	**5.0**	**5.0**	**5.5**	**6.0**	**6.0**
	%N1	**55.3**	**60.5**	**65.0**	**68.9**	**72.6**
	KIAS	158	172	185	196	205
FLAPS 5 (GEAR UP) VREF40+30	**PITCH ATT**	**5.5**	**6.0**	**6.0**	**6.5**	**6.5**
	%N1	**55.6**	**61.4**	**66.3**	**70.4**	**74.2**
	KIAS	138	152	165	176	185
FLAPS 10 (GEAR UP) VREF40+30	**PITCH ATT**	**5.0**	**5.5**	**5.5**	**5.5**	**6.0**
	%N1	**59.0**	**64.8**	**69.7**	**73.9**	**77.5**
	KIAS	138	152	165	176	185
FLAPS 15 (GEAR UP) VREF40+20	**PITCH ATT**	**5.5**	**5.5**	**6.0**	**6.0**	**6.5**
	%N1	**59.1**	**65.1**	**70.1**	**74.6**	**78.2**
	KIAS	128	142	155	166	175
FLAPS 25 (GEAR UP) VREF40+10	**PITCH ATT**	**6.5**	**6.5**	**6.5**	**7.0**	**7.0**
	%N1	**60.2**	**66.2**	**71.3**	**75.7**	**79.7**
	KIAS	118	132	145	156	165
FLAPS 15 (GEAR DOWN) VREF40+20	**PITCH ATT**	**5.5**	**6.0**	**6.0**	**6.0**	**6.5**
	%N1	**63.7**	**69.6**	**74.7**	**79.1**	**83.0**
	KIAS	128	142	155	166	175

Flight With Unreliable Airspeed/ Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

TERMINAL AREA (5000 FT)
%N1 for Level Flights
Airport Altitude = 6000 FT

FLAP POSITION (VREF + INCREMENT)		WEIGHT (1000 KG) 40	50	60	70	80
FLAPS UP (GEAR UP) VREF40+70	**PITCH ATT**	**4.5**	**5.0**	**5.5**	**6.0**	**6.5**
	%N1	**53.7**	**58.7**	**63.3**	**67.1**	**70.6**
	KIAS	178	192	205	216	225
FLAPS 1 (GEAR UP) VREF40+50	**PITCH ATT**	**5.0**	**5.0**	**5.5**	**6.0**	**6.0**
	%N1	**56.0**	**61.3**	**65.8**	**69.7**	**73.5**
	KIAS	158	172	185	196	205
FLAPS 5 (GEAR UP) VREF40+30	**PITCH ATT**	**5.5**	**6.0**	**6.0**	**6.5**	**6.5**
	%N1	**56.4**	**62.3**	**67.0**	**71.3**	**75.0**
	KIAS	138	152	165	176	185
FLAPS 10 (GEAR UP) VREF40+30	**PITCH ATT**	**5.0**	**5.5**	**5.5**	**5.5**	**6.0**
	%N1	**59.8**	**65.6**	**70.5**	**74.8**	**78.4**
	KIAS	138	152	165	176	185
FLAPS 15 (GEAR UP) VREF40+20	**PITCH ATT**	**5.5**	**5.5**	**6.0**	**6.0**	**6.5**
	%N1	**60.0**	**65.9**	**71.0**	**75.3**	**79.1**
	KIAS	128	142	155	166	175
FLAPS 25 (GEAR UP) VREF40+10	**PITCH ATT**	**6.5**	**6.5**	**6.5**	**7.0**	**7.0**
	%N1	**61.0**	**67.0**	**72.2**	**76.6**	**80.6**
	KIAS	118	132	145	156	165
FLAPS 15 (GEAR DOWN) VREF40+20	**PITCH ATT**	**5.5**	**6.0**	**6.0**	**6.0**	**6.5**
	%N1	**64.5**	**70.5**	**75.6**	**80.0**	**83.9**
	KIAS	128	142	155	166	175

Flight With Unreliable Airspeed/ Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

TERMINAL AREA (5000 FT)
%N1 for Level Flights
Airport Altitude = 7000 FT

FLAP POSITION (VREF + INCREMENT)		WEIGHT (1000 KG)				
		40	50	60	70	80
FLAPS UP (GEAR UP) VREF40+70	**PITCH ATT**	**4.5**	**5.0**	**5.5**	**6.0**	**6.5**
	%N1	**54.5**	**59.5**	**64.1**	**67.9**	**71.5**
	KIAS	178	192	205	216	226
FLAPS 1 (GEAR UP) VREF40+50	**PITCH ATT**	**5.0**	**5.0**	**5.5**	**6.0**	**6.0**
	%N1	**56.8**	**62.1**	**66.6**	**70.6**	**74.3**
	KIAS	158	172	185	196	206
FLAPS 5 (GEAR UP) VREF40+30	**PITCH ATT**	**5.5**	**6.0**	**6.0**	**6.5**	**6.5**
	%N1	**57.2**	**63.1**	**67.8**	**72.2**	**75.9**
	KIAS	138	152	165	176	186
FLAPS 10 (GEAR UP) VREF40+30	**PITCH ATT**	**5.0**	**5.5**	**5.5**	**5.5**	**6.0**
	%N1	**60.7**	**66.4**	**71.4**	**75.5**	**79.3**
	KIAS	138	152	165	176	186
FLAPS 15 (GEAR UP) VREF40+20	**PITCH ATT**	**5.5**	**5.5**	**6.0**	**6.0**	**6.5**
	%N1	**60.8**	**66.7**	**71.9**	**76.1**	**80.0**
	KIAS	128	142	155	166	176
FLAPS 25 (GEAR UP) VREF40+10	**PITCH ATT**	**6.5**	**6.5**	**6.5**	**7.0**	**7.0**
	%N1	**61.8**	**67.8**	**73.1**	**77.4**	**81.5**
	KIAS	118	132	145	156	166
FLAPS 15 (GEAR DOWN) VREF40+20	**PITCH ATT**	**5.5**	**6.0**	**6.0**	**6.0**	**6.5**
	%N1	**65.3**	**71.3**	**76.4**	**80.9**	**84.8**
	KIAS	128	142	155	166	176

Flight With Unreliable Airspeed/ Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

TERMINAL AREA (5000 FT)

%N1 for Level Flights

Airport Altitude = 8000 FT

FLAP POSITION (VREF + INCREMENT)		WEIGHT (1000 KG)				
		40	50	60	70	80
FLAPS UP (GEAR UP) VREF40+70	**PITCH ATT**	**4.5**	**5.0**	**5.5**	**6.0**	**6.5**
	%N1	**55.2**	**60.3**	**64.8**	**68.7**	**72.3**
	KIAS	178	192	205	216	226
FLAPS 1 (GEAR UP) VREF40+50	**PITCH ATT**	**5.0**	**5.0**	**5.5**	**6.0**	**6.0**
	%N1	**57.5**	**63.0**	**67.4**	**71.5**	**75.1**
	KIAS	158	172	185	196	206
FLAPS 5 (GEAR UP) VREF40+30	**PITCH ATT**	**5.5**	**6.0**	**6.0**	**6.5**	**6.5**
	%N1	**58.0**	**63.9**	**68.7**	**73.0**	**76.7**
	KIAS	138	152	165	176	186
FLAPS 10 (GEAR UP) VREF40+30	**PITCH ATT**	**5.0**	**5.5**	**5.5**	**5.5**	**6.0**
	%N1	**61.5**	**67.2**	**72.3**	**76.4**	**80.2**
	KIAS	138	152	165	176	186
FLAPS 15 (GEAR UP) VREF40+20	**PITCH ATT**	**5.5**	**5.5**	**6.0**	**6.0**	**6.0**
	%N1	**61.6**	**67.5**	**72.7**	**77.0**	**80.9**
	KIAS	128	142	155	166	176
FLAPS 25 (GEAR UP) VREF40+10	**PITCH ATT**	**6.5**	**6.5**	**6.5**	**7.0**	**7.0**
	%N1	**62.7**	**68.7**	**73.9**	**78.4**	**82.3**
	KIAS	118	132	145	156	166
FLAPS 15 (GEAR DOWN) VREF40+20	**PITCH ATT**	**5.5**	**6.0**	**6.0**	**6.0**	**6.5**
	%N1	**66.1**	**72.2**	**77.3**	**81.8**	**85.7**
	KIAS	128	142	155	166	176

Flight With Unreliable Airspeed/ Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

TERMINAL AREA (5000 FT)
%N1 for Level Flights
Airport Altitude = 9000 FT

FLAP POSITION (VREF + INCREMENT)		WEIGHT (1000 KG)				
		40	50	60	70	80
FLAPS UP (GEAR UP) VREF40+70	**PITCH ATT**	**4.5**	**5.5**	**5.5**	**6.0**	**6.5**
	%N1	**55.9**	**61.2**	**65.6**	**69.5**	**73.1**
	KIAS	178	192	205	216	226
FLAPS 1 (GEAR UP) VREF40+50	**PITCH ATT**	**5.0**	**5.0**	**5.5**	**6.0**	**6.0**
	%N1	**58.3**	**63.7**	**68.2**	**72.3**	**75.9**
	KIAS	158	172	185	196	206
FLAPS 5 (GEAR UP) VREF40+30	**PITCH ATT**	**5.5**	**6.0**	**6.0**	**6.5**	**6.5**
	%N1	**58.9**	**64.7**	**69.5**	**73.8**	**77.5**
	KIAS	138	152	165	176	186
FLAPS 10 (GEAR UP) VREF40+30	**PITCH ATT**	**5.0**	**5.5**	**5.5**	**5.5**	**6.0**
	%N1	**62.3**	**68.1**	**73.1**	**77.2**	**81.1**
	KIAS	138	152	165	176	186
FLAPS 15 (GEAR UP) VREF40+20	**PITCH ATT**	**5.5**	**5.5**	**6.0**	**6.0**	**6.0**
	%N1	**62.5**	**68.4**	**73.6**	**77.8**	**81.8**
	KIAS	128	142	155	166	176
FLAPS 25 (GEAR UP) VREF40+10	**PITCH ATT**	**6.5**	**6.5**	**6.5**	**7.0**	**7.0**
	%N1	**63.5**	**69.6**	**74.7**	**79.2**	**83.2**
	KIAS	118	132	145	156	166
FLAPS 15 (GEAR DOWN) VREF40+20	**PITCH ATT**	**5.5**	**6.0**	**6.0**	**6.0**	**6.5**
	%N1	**66.9**	**73.1**	**78.2**	**82.7**	**86.6**
	KIAS	128	142	155	166	176

Flight With Unreliable Airspeed/ Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

TERMINAL AREA (5000 FT)
%N1 for Level Flights
Airport Altitude = 10000 FT

FLAP POSITION (VREF + INCREMENT)		WEIGHT (1000 KG) 40	50	60	70	80
FLAPS UP (GEAR UP)	**PITCH ATT**	**4.5**	**5.5**	**5.5**	**6.0**	**6.5**
	%N1	**56.7**	**62.1**	**66.3**	**70.3**	**73.9**
VREF40+70	KIAS	178	192	205	216	227
FLAPS 1 (GEAR UP)	**PITCH ATT**	**5.0**	**5.0**	**5.5**	**6.0**	**6.0**
	%N1	**59.1**	**64.5**	**69.1**	**73.2**	**76.7**
VREF40+50	KIAS	158	172	185	196	207
FLAPS 5 (GEAR UP)	**PITCH ATT**	**5.5**	**6.0**	**6.0**	**6.0**	**6.5**
	%N1	**59.7**	**65.5**	**70.4**	**74.6**	**78.4**
VREF40+30	KIAS	138	152	165	176	187
FLAPS 10 (GEAR UP)	**PITCH ATT**	**5.0**	**5.5**	**5.5**	**5.5**	**6.0**
	%N1	**63.1**	**69.0**	**73.9**	**78.1**	**82.0**
VREF40+30	KIAS	138	152	165	176	187
FLAPS 15 (GEAR UP)	**PITCH ATT**	**5.5**	**5.5**	**6.0**	**6.0**	**6.0**
	%N1	**63.3**	**69.3**	**74.4**	**78.8**	**82.7**
VREF40+20	KIAS	128	142	155	166	177
FLAPS 25 (GEAR UP)	**PITCH ATT**	**6.5**	**6.5**	**6.5**	**7.0**	**7.0**
	%N1	**64.3**	**70.5**	**75.6**	**80.1**	**84.1**
VREF40+10	KIAS	118	132	145	156	167
FLAPS 15 (GEAR DOWN)	**PITCH ATT**	**5.5**	**6.0**	**6.0**	**6.0**	**6.5**
	%N1	**67.8**	**73.9**	**79.1**	**83.6**	**87.6**
VREF40+20	KIAS	128	142	155	166	177

Flight With Unreliable Airspeed/ Turbulent Air Penetration
Altitude and/or vertical speed indications may also be unreliable.

TERMINAL AREA (5000 FT)
%N1 for Level Flights
Airport Altitude = 11000 FT

FLAP POSITION (VREF + INCREMENT)		WEIGHT (1000 KG) 40	50	60	70	80
FLAPS UP (GEAR UP) VREF40+70	**PITCH ATT**	**4.5**	**5.5**	**5.5**	**6.0**	**6.5**
	%N1	**57.5**	**62.9**	**67.1**	**71.2**	**74.7**
	KIAS	178	192	205	217	227
FLAPS 1 (GEAR UP) VREF40+50	**PITCH ATT**	**5.0**	**5.0**	**5.5**	**6.0**	**6.0**
	%N1	**60.2**	**65.3**	**70.0**	**74.0**	**77.6**
	KIAS	158	172	185	197	207
FLAPS 5 (GEAR UP) VREF40+30	**PITCH ATT**	**5.5**	**6.0**	**6.0**	**6.0**	**6.5**
	%N1	**60.9**	**66.4**	**71.4**	**75.5**	**79.4**
	KIAS	138	152	165	177	187
FLAPS 10 (GEAR UP) VREF40+30	**PITCH ATT**	**5.0**	**5.5**	**5.5**	**5.5**	**6.0**
	%N1	**64.1**	**70.0**	**74.8**	**79.1**	**83.0**
	KIAS	138	152	165	177	187
FLAPS 15 (GEAR UP) VREF40+20	**PITCH ATT**	**5.5**	**5.5**	**6.0**	**6.0**	**6.0**
	%N1	**64.3**	**70.4**	**75.3**	**79.8**	**83.7**
	KIAS	128	142	155	167	177
FLAPS 25 (GEAR UP) VREF40+10	**PITCH ATT**	**6.5**	**6.5**	**6.5**	**6.5**	**7.0**
	%N1	**65.4**	**71.6**	**76.6**	**81.1**	**85.1**
	KIAS	118	132	145	157	167
FLAPS 15 (GEAR DOWN) VREF40+20	**PITCH ATT**	**5.5**	**6.0**	**6.0**	**6.0**	**6.5**
	%N1	**68.9**	**74.9**	**80.1**	**84.6**	**88.7**
	KIAS	128	142	155	167	177

Flight With Unreliable Airspeed/ Turbulent Air Penetration
Altitude and/or vertical speed indications may also be unreliable.

TERMINAL AREA (5000 FT)
%N1 for Level Flights
Airport Altitude = 12000 FT

FLAP POSITION (VREF + INCREMENT)		WEIGHT (1000 KG)				
		40	50	60	70	80
FLAPS UP (GEAR UP) VREF40+70	**PITCH ATT**	**5.0**	**5.5**	**5.5**	**6.0**	**6.5**
	%N1	**58.3**	**63.7**	**67.9**	**72.0**	**75.5**
	KIAS	178	192	205	217	228
FLAPS 1 (GEAR UP) VREF40+50	**PITCH ATT**	**5.0**	**5.5**	**5.5**	**6.0**	**6.0**
	%N1	**61.1**	**66.2**	**70.9**	**74.8**	**78.5**
	KIAS	158	172	185	197	208
FLAPS 5 (GEAR UP) VREF40+30	**PITCH ATT**	**5.5**	**6.0**	**6.0**	**6.0**	**6.5**
	%N1	**61.8**	**67.4**	**72.3**	**76.4**	**80.3**
	KIAS	138	152	165	177	188
FLAPS 10 (GEAR UP) VREF40+30	**PITCH ATT**	**5.0**	**5.5**	**5.5**	**5.5**	**6.0**
	%N1	**65.1**	**71.0**	**75.7**	**80.1**	**83.9**
	KIAS	138	152	165	177	188
FLAPS 15 (GEAR UP) VREF40+20	**PITCH ATT**	**5.5**	**5.5**	**6.0**	**6.0**	**6.0**
	%N1	**65.4**	**71.4**	**76.3**	**80.7**	**84.6**
	KIAS	128	142	155	167	178
FLAPS 25 (GEAR UP) VREF40+10	**PITCH ATT**	**6.5**	**6.5**	**6.5**	**6.5**	**6.5**
	%N1	**66.6**	**72.6**	**77.7**	**82.2**	**86.1**
	KIAS	118	132	145	157	168
FLAPS 15 (GEAR DOWN) VREF40+20	**PITCH ATT**	**5.5**	**6.0**	**6.0**	**6.0**	**6.0**
	%N1	**70.1**	**75.9**	**81.1**	**85.6**	**89.8**
	KIAS	128	142	155	167	178

Flight With Unreliable Airspeed/ Turbulent Air Penetration
Altitude and/or vertical speed indications may also be unreliable.

TERMINAL AREA (5000 FT)
%N1 for Level Flights
Airport Altitude = 13000 FT

FLAP POSITION (VREF + INCREMENT)		WEIGHT (1000 KG)				
		40	50	60	70	80
FLAPS UP (GEAR UP) VREF40+70	**PITCH ATT**	**5.0**	**5.5**	**5.5**	**6.0**	**6.5**
	%N1	**59.2**	**64.4**	**68.7**	**72.8**	**76.3**
	KIAS	178	192	205	217	228
FLAPS 1 (GEAR UP) VREF40+50	**PITCH ATT**	**5.0**	**5.5**	**5.5**	**6.0**	**6.0**
	%N1	**62.0**	**67.1**	**71.8**	**75.7**	**79.3**
	KIAS	158	172	185	197	208
FLAPS 5 (GEAR UP) VREF40+30	**PITCH ATT**	**5.5**	**6.0**	**6.0**	**6.0**	**6.5**
	%N1	**62.7**	**68.4**	**73.2**	**77.3**	**81.2**
	KIAS	138	152	165	177	188
FLAPS 10 (GEAR UP) VREF40+30	**PITCH ATT**	**5.0**	**5.5**	**5.5**	**5.5**	**6.0**
	%N1	**66.1**	**71.9**	**76.7**	**81.0**	**84.8**
	KIAS	138	152	165	177	188
FLAPS 15 (GEAR UP) VREF40+20	**PITCH ATT**	**5.5**	**5.5**	**6.0**	**6.0**	**6.0**
	%N1	**66.4**	**72.4**	**77.3**	**81.7**	**85.6**
	KIAS	128	142	155	167	178
FLAPS 25 (GEAR UP) VREF40+10	**PITCH ATT**	**6.5**	**6.5**	**6.5**	**6.5**	**6.5**
	%N1	**67.7**	**73.6**	**78.7**	**83.1**	**87.2**
	KIAS	118	132	145	157	168
FLAPS 15 (GEAR DOWN) VREF40+20	**PITCH ATT**	**5.5**	**6.0**	**6.0**	**6.0**	**6.0**
	%N1	**71.1**	**77.0**	**82.2**	**86.7**	**91.1**
	KIAS	128	142	155	167	178

Flight With Unreliable Airspeed/ Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

TERMINAL AREA (5000 FT)
%N1 for Level Flights
Airport Altitude = 14000 FT

FLAP POSITION (VREF + INCREMENT)		WEIGHT (1000 KG)				
		40	50	60	70	80
FLAPS UP (GEAR UP) VREF40+70	**PITCH ATT**	**5.0**	**5.5**	**5.5**	**6.0**	**6.5**
	%N1	**60.1**	**65.1**	**69.6**	**73.6**	**77.2**
	KIAS	179	192	205	217	228
FLAPS 1 (GEAR UP) VREF40+50	**PITCH ATT**	**5.0**	**5.5**	**5.5**	**6.0**	**6.0**
	%N1	**62.8**	**68.0**	**72.6**	**76.5**	**80.2**
	KIAS	159	172	185	197	208
FLAPS 5 (GEAR UP) VREF40+30	**PITCH ATT**	**5.5**	**6.0**	**6.0**	**6.0**	**6.5**
	%N1	**63.6**	**69.3**	**74.0**	**78.3**	**82.1**
	KIAS	139	152	165	177	188
FLAPS 10 (GEAR UP) VREF40+30	**PITCH ATT**	**5.0**	**5.5**	**5.5**	**5.5**	**6.0**
	%N1	**67.1**	**72.8**	**77.6**	**81.9**	**85.8**
	KIAS	139	152	165	177	188
FLAPS 15 (GEAR UP) VREF40+20	**PITCH ATT**	**5.5**	**5.5**	**6.0**	**6.0**	**6.0**
	%N1	**67.5**	**73.3**	**78.3**	**82.7**	**86.6**
	KIAS	129	142	155	167	178
FLAPS 25 (GEAR UP) VREF40+10	**PITCH ATT**	**6.5**	**6.5**	**6.5**	**6.5**	**6.5**
	%N1	**68.9**	**74.6**	**79.7**	**84.1**	**88.2**
	KIAS	119	132	145	157	168
FLAPS 15 (GEAR DOWN) VREF40+20	**PITCH ATT**	**5.5**	**6.0**	**6.0**	**6.0**	**6.0**
	%N1	**72.1**	**78.0**	**83.1**	**87.7**	**92.6**
	KIAS	129	142	155	167	178

Flight With Unreliable Airspeed/ Turbulent Air Penetration
Altitude and/or vertical speed indications may also be unreliable.

TERMINAL AREA (5000 FT)
%N1 for Level Flights
Airport Altitude = 14500 FT

FLAP POSITION (VREF + INCREMENT)		WEIGHT (1000 KG)				
		40	50	60	70	80
FLAPS UP (GEAR UP) VREF40+70	**PITCH ATT**	**5.0**	**5.5**	**5.5**	**6.0**	**6.5**
	%N1	**60.6**	**65.5**	**70.0**	**74.0**	**77.7**
	KIAS	179	192	206	218	229
FLAPS 1 (GEAR UP) VREF40+50	**PITCH ATT**	**5.0**	**5.5**	**5.5**	**6.0**	**6.0**
	%N1	**63.2**	**68.4**	**73.0**	**77.0**	**80.7**
	KIAS	159	172	186	198	209
FLAPS 5 (GEAR UP) VREF40+30	**PITCH ATT**	**5.5**	**6.0**	**6.0**	**6.0**	**6.5**
	%N1	**64.0**	**69.8**	**74.5**	**78.8**	**82.5**
	KIAS	139	152	166	178	189
FLAPS 10 (GEAR UP) VREF40+30	**PITCH ATT**	**5.0**	**5.5**	**5.5**	**5.5**	**6.0**
	%N1	**67.6**	**73.2**	**78.2**	**82.4**	**86.2**
	KIAS	139	152	166	178	189
FLAPS 15 (GEAR UP) VREF40+20	**PITCH ATT**	**5.5**	**5.5**	**6.0**	**6.0**	**6.0**
	%N1	**68.0**	**73.7**	**78.8**	**83.1**	**87.1**
	KIAS	129	142	156	168	179
FLAPS 25 (GEAR UP) VREF40+10	**PITCH ATT**	**6.5**	**6.5**	**6.5**	**6.5**	**6.5**
	%N1	**69.5**	**75.1**	**80.2**	**84.6**	**88.8**
	KIAS	119	132	146	158	169
FLAPS 15 (GEAR DOWN) VREF40+20	**PITCH ATT**	**5.5**	**6.0**	**6.0**	**6.0**	**6.0**
	%N1	**72.6**	**78.5**	**83.6**	**88.3**	**93.5**
	KIAS	129	142	156	168	179

Flight With Unreliable Airspeed/ Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

FINAL APPROACH (1500 FT)

Gear Down, %N1 for 3° Glideslope

Airport Altitude = -2000 FT

FLAP POSITION (VREF + INCREMENT)		WEIGHT (1000 KG)				
		40	50	60	70	80
FLAPS 15 (VREF15 + 10)	**PITCH ATT**	**2.5**	**2.5**	**2.5**	**2.5**	**3.0**
	%N1	**42.8**	**47.5**	**51.4**	**55.0**	**58.0**
	KIAS	130	145	159	171	181
FLAPS 30 (VREF30 + 10)	**PITCH ATT**	**1.0**	**1.0**	**1.0**	**1.0**	**1.5**
	%N1	**46.9**	**51.7**	**56.1**	**59.8**	**63.2**
	KIAS	125	139	152	163	173
FLAPS 40 (VREF40 + 10)	**PITCH ATT**	**-0.5**	**-0.5**	**-0.5**	**0.0**	**0.0**
	%N1	**51.5**	**56.9**	**61.7**	**65.8**	**69.2**
	KIAS	118	132	144	155	164

Flap placard speed exceeded in shaded area.

Airport Altitude = -1000 FT

FLAP POSITION (VREF + INCREMENT)		WEIGHT (1000 KG)				
		40	50	60	70	80
FLAPS 15 (VREF15 + 10)	**PITCH ATT**	**2.5**	**2.5**	**2.5**	**2.5**	**3.0**
	%N1	**43.4**	**48.1**	**52.0**	**55.6**	**58.7**
	KIAS	130	145	159	171	181
FLAPS 30 (VREF30 + 10)	**PITCH ATT**	**1.0**	**1.0**	**1.0**	**1.0**	**1.5**
	%N1	**47.5**	**52.4**	**56.8**	**60.6**	**64.0**
	KIAS	125	139	152	163	173
FLAPS 40 (VREF40 + 10)	**PITCH ATT**	**-0.5**	**-0.5**	**-0.5**	**0.0**	**0.0**
	%N1	**52.2**	**57.7**	**62.5**	**66.6**	**70.0**
	KIAS	118	132	144	155	165

Flap placard speed exceeded in shaded area.

Flight With Unreliable Airspeed/ Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

FINAL APPROACH (1500 FT)

Gear Down, %N1 for 3° Glideslope

Airport Altitude = SEA LEVEL

FLAP POSITION (VREF + INCREMENT)		WEIGHT (1000 KG) 40	50	60	70	80
FLAPS 15 (VREF15 + 10)	**PITCH ATT**	**2.5**	**2.5**	**2.5**	**2.5**	**3.0**
	%N1	**44.0**	**48.7**	**52.7**	**56.3**	**59.4**
	KIAS	130	145	159	171	181
FLAPS 30 (VREF30 + 10)	**PITCH ATT**	**1.0**	**1.0**	**1.0**	**1.0**	**1.5**
	%N1	**48.1**	**53.1**	**57.5**	**61.4**	**64.7**
	KIAS	125	139	152	163	173
FLAPS 40 (VREF40 + 10)	**PITCH ATT**	**-0.5**	**-0.5**	**-0.5**	**0.0**	**0.0**
	%N1	**52.9**	**58.4**	**63.3**	**67.3**	**70.8**
	KIAS	118	132	144	155	165

Flap placard speed exceeded in shaded area.

Airport Altitude = 1000 FT

FLAP POSITION (VREF + INCREMENT)		WEIGHT (1000 KG) 40	50	60	70	80
FLAPS 15 (VREF15 + 10)	**PITCH ATT**	**2.5**	**2.5**	**2.5**	**2.5**	**3.0**
	%N1	**44.6**	**49.3**	**53.5**	**57.0**	**60.1**
	KIAS	130	145	159	171	181
FLAPS 30 (VREF30 + 10)	**PITCH ATT**	**1.0**	**1.0**	**1.0**	**1.0**	**1.5**
	%N1	**48.7**	**53.8**	**58.2**	**62.2**	**65.5**
	KIAS	125	139	152	163	173
FLAPS 40 (VREF40 + 10)	**PITCH ATT**	**-0.5**	**-0.5**	**-0.5**	**0.0**	**0.0**
	%N1	**53.6**	**59.2**	**64.1**	**68.1**	**71.6**
	KIAS	118	132	144	155	165

Flap placard speed exceeded in shaded area.

Flight With Unreliable Airspeed/ Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

FINAL APPROACH (1500 FT)

Gear Down, %N1 for 3° Glideslope

Airport Altitude = 2000 FT

FLAP POSITION (VREF + INCREMENT)		WEIGHT (1000 KG)				
		40	50	60	70	80
FLAPS 15 (VREF15 + 10)	**PITCH ATT**	**2.5**	**2.5**	**2.5**	**2.5**	**3.0**
	%N1	**45.2**	**49.9**	**54.2**	**57.7**	**60.9**
	KIAS	130	145	159	171	181
FLAPS 30 (VREF30 + 10)	**PITCH ATT**	**1.0**	**1.0**	**1.0**	**1.0**	**1.5**
	%N1	**49.4**	**54.5**	**59.0**	**63.0**	**66.3**
	KIAS	125	139	152	163	173
FLAPS 40 (VREF40 + 10)	**PITCH ATT**	**-0.5**	**-0.5**	**-0.5**	**0.0**	**0.0**
	%N1	**54.3**	**60.0**	**64.9**	**68.9**	**72.5**
	KIAS	118	132	144	155	165

Flap placard speed exceeded in shaded area.

Airport Altitude = 3000 FT

FLAP POSITION (VREF + INCREMENT)		WEIGHT (1000 KG)				
		40	50	60	70	80
FLAPS 15 (VREF15 + 10)	**PITCH ATT**	**2.5**	**2.5**	**2.5**	**2.5**	**3.0**
	%N1	**45.9**	**50.6**	**54.9**	**58.5**	**61.8**
	KIAS	131	145	159	171	181
FLAPS 30 (VREF30 + 10)	**PITCH ATT**	**1.0**	**1.0**	**1.0**	**1.0**	**1.5**
	%N1	**50.1**	**55.2**	**59.8**	**63.7**	**67.1**
	KIAS	125	139	152	163	173
FLAPS 40 (VREF40 + 10)	**PITCH ATT**	**-0.5**	**-0.5**	**-0.5**	**0.0**	**0.0**
	%N1	**55.1**	**60.8**	**65.7**	**69.7**	**73.3**
	KIAS	118	132	144	155	165

Flap placard speed exceeded in shaded area.

Flight With Unreliable Airspeed/ Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

FINAL APPROACH (1500 FT)

Gear Down, %N1 for 3° Glideslope

Airport Altitude = 4000 FT

FLAP POSITION (VREF + INCREMENT)		WEIGHT (1000 KG) 40	50	60	70	80
FLAPS 15 (VREF15 + 10)	**PITCH ATT**	**2.5**	**2.5**	**2.5**	**2.5**	**3.0**
	%N1	**46.6**	**51.3**	**55.6**	**59.2**	**62.5**
	KIAS	131	145	159	171	181
FLAPS 30 (VREF30 + 10)	**PITCH ATT**	**1.0**	**1.0**	**1.0**	**1.0**	**1.5**
	%N1	**50.8**	**55.9**	**60.6**	**64.5**	**67.8**
	KIAS	125	139	152	163	173
FLAPS 40 (VREF40 + 10)	**PITCH ATT**	**-0.5**	**-0.5**	**-0.5**	**0.0**	**0.0**
	%N1	**55.8**	**61.6**	**66.4**	**70.5**	**74.1**
	KIAS	118	132	144	155	165

Flap placard speed exceeded in shaded area.

Airport Altitude = 5000 FT

FLAP POSITION (VREF + INCREMENT)		WEIGHT (1000 KG) 40	50	60	70	80
FLAPS 15 (VREF15 + 10)	**PITCH ATT**	**2.5**	**2.5**	**2.5**	**2.5**	**3.0**
	%N1	**47.2**	**52.0**	**56.3**	**60.0**	**63.3**
	KIAS	131	145	159	171	181
FLAPS 30 (VREF30 + 10)	**PITCH ATT**	**1.0**	**1.0**	**1.0**	**1.0**	**1.5**
	%N1	**51.5**	**56.7**	**61.4**	**65.3**	**68.6**
	KIAS	125	139	152	163	173
FLAPS 40 (VREF40 + 10)	**PITCH ATT**	**-0.5**	**-0.5**	**-0.5**	**0.0**	**0.0**
	%N1	**56.6**	**62.3**	**67.2**	**71.4**	**75.0**
	KIAS	118	132	144	155	165

Flap placard speed exceeded in shaded area.

Flight With Unreliable Airspeed/ Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

FINAL APPROACH (1500 FT)

Gear Down, %N1 for 3° Glideslope

Airport Altitude = 6000 FT

FLAP POSITION (VREF + INCREMENT)		WEIGHT (1000 KG) 40	50	60	70	80
FLAPS 15 (VREF15 + 10)	**PITCH ATT**	**2.5**	**2.5**	**2.5**	**2.5**	**3.0**
	%N1	**47.8**	**52.7**	**57.0**	**60.8**	**64.1**
	KIAS	131	145	159	171	182
FLAPS 30 (VREF30 + 10)	**PITCH ATT**	**1.0**	**1.0**	**1.0**	**1.0**	**1.5**
	%N1	**52.2**	**57.4**	**62.2**	**66.1**	**69.4**
	KIAS	125	139	152	163	173
FLAPS 40 (VREF40 + 10)	**PITCH ATT**	**-0.5**	**-0.5**	**-0.5**	**0.0**	**0.0**
	%N1	**57.3**	**63.1**	**68.0**	**72.2**	**75.7**
	KIAS	118	132	144	155	165

Flap placard speed exceeded in shaded area.

Airport Altitude = 7000 FT

FLAP POSITION (VREF + INCREMENT)		WEIGHT (1000 KG) 40	50	60	70	80
FLAPS 15 (VREF15 + 10)	**PITCH ATT**	**2.5**	**2.5**	**2.5**	**2.5**	**3.0**
	%N1	**48.4**	**53.4**	**57.7**	**61.6**	**64.7**
	KIAS	131	146	159	171	182
FLAPS 30 (VREF30 + 10)	**PITCH ATT**	**1.0**	**1.0**	**1.0**	**1.0**	**1.5**
	%N1	**52.9**	**58.2**	**62.9**	**66.8**	**70.2**
	KIAS	125	139	152	163	173
FLAPS 40 (VREF40 + 10)	**PITCH ATT**	**-0.5**	**-0.5**	**-0.5**	**0.0**	**0.0**
	%N1	**58.1**	**64.0**	**68.8**	**73.1**	**76.5**
	KIAS	118	132	144	156	165

Flap placard speed exceeded in shaded area.

Flight With Unreliable Airspeed/ Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

FINAL APPROACH (1500 FT)

Gear Down, %N1 for 3° Glideslope

Airport Altitude = 8000 FT

FLAP POSITION (VREF + INCREMENT)		WEIGHT (1000 KG)				
		40	50	60	70	80
FLAPS 15 (VREF15 + 10)	**PITCH ATT**	**2.5**	**2.5**	**2.5**	**2.5**	**3.0**
	%N1	**49.1**	**54.1**	**58.5**	**62.4**	**65.5**
	KIAS	131	146	159	171	182
FLAPS 30 (VREF30 + 10)	**PITCH ATT**	**1.0**	**1.0**	**1.0**	**1.0**	**1.5**
	%N1	**53.6**	**59.0**	**63.7**	**67.6**	**71.0**
	KIAS	125	139	152	163	173
FLAPS 40 (VREF40 + 10)	**PITCH ATT**	**-0.5**	**-0.5**	**-0.5**	**0.0**	**0.0**
	%N1	**58.9**	**64.8**	**69.6**	**73.9**	**77.3**
	KIAS	118	132	145	156	165

Flap placard speed exceeded in shaded area.

Airport Altitude = 9000 FT

FLAP POSITION (VREF + INCREMENT)		WEIGHT (1000 KG)				
		40	50	60	70	80
FLAPS 15 (VREF15 + 10)	**PITCH ATT**	**2.5**	**2.5**	**2.5**	**2.5**	**3.0**
	%N1	**49.8**	**54.8**	**59.3**	**63.2**	**66.2**
	KIAS	131	146	159	171	182
FLAPS 30 (VREF30 + 10)	**PITCH ATT**	**1.0**	**1.0**	**1.0**	**1.0**	**1.5**
	%N1	**54.3**	**59.8**	**64.5**	**68.4**	**71.8**
	KIAS	125	139	152	163	173
FLAPS 40 (VREF40 + 10)	**PITCH ATT**	**-0.5**	**-0.5**	**-0.5**	**0.0**	**0.0**
	%N1	**59.7**	**65.5**	**70.5**	**74.7**	**78.2**
	KIAS	118	132	145	156	165

Flap placard speed exceeded in shaded area.

Flight With Unreliable Airspeed/ Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

FINAL APPROACH (1500 FT)

Gear Down, %N1 for 3° Glideslope

Airport Altitude = 10000 FT

FLAP POSITION (VREF + INCREMENT)		WEIGHT (1000 KG) 40	50	60	70	80
FLAPS 15 (VREF15 + 10)	**PITCH ATT**	**2.5**	**2.5**	**2.5**	**2.5**	**3.0**
	%N1	**50.5**	**55.6**	**60.1**	**63.9**	**66.9**
	KIAS	131	146	159	171	182
FLAPS 30 (VREF30 + 10)	**PITCH ATT**	**1.0**	**1.0**	**1.0**	**1.0**	**1.5**
	%N1	**55.1**	**60.6**	**65.3**	**69.2**	**72.7**
	KIAS	125	139	152	163	173
FLAPS 40 (VREF40 + 10)	**PITCH ATT**	**-0.5**	**-0.5**	**-0.5**	**0.0**	**0.0**
	%N1	**60.5**	**66.3**	**71.4**	**75.5**	**79.1**
	KIAS	118	132	145	156	165

Flap placard speed exceeded in shaded area.

Airport Altitude = 11000 FT

FLAP POSITION (VREF + INCREMENT)		WEIGHT (1000 KG) 40	50	60	70	80
FLAPS 15 (VREF15 + 10)	**PITCH ATT**	**2.5**	**2.5**	**2.5**	**2.5**	**3.0**
	%N1	**51.2**	**56.3**	**60.9**	**64.6**	**67.7**
	KIAS	131	146	159	171	182
FLAPS 30 (VREF30 + 10)	**PITCH ATT**	**1.0**	**1.0**	**1.0**	**1.0**	**1.5**
	%N1	**55.8**	**61.4**	**66.1**	**70.0**	**73.4**
	KIAS	125	139	152	163	173
FLAPS 40 (VREF40 + 10)	**PITCH ATT**	**-0.5**	**-0.5**	**-0.5**	**0.0**	**0.0**
	%N1	**61.3**	**67.1**	**72.2**	**76.3**	**79.9**
	KIAS	118	132	145	156	165

Flap placard speed exceeded in shaded area.

Flight With Unreliable Airspeed/ Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

FINAL APPROACH (1500 FT)

Gear Down, %N1 for 3° Glideslope

Airport Altitude = 12000 FT

FLAP POSITION (VREF + INCREMENT)		WEIGHT (1000 KG) 40	50	60	70	80
FLAPS 15 (VREF15 + 10)	**PITCH ATT**	**2.5**	**2.5**	**2.5**	**2.5**	**3.0**
	%N1	**52.0**	**57.0**	**61.7**	**65.3**	**68.4**
	KIAS	131	146	159	172	182
FLAPS 30 (VREF30 + 10)	**PITCH ATT**	**1.0**	**1.0**	**1.0**	**1.0**	**1.5**
	%N1	**56.6**	**62.2**	**66.9**	**70.9**	**74.2**
	KIAS	125	139	152	164	173
FLAPS 40 (VREF40 + 10)	**PITCH ATT**	**-0.5**	**-0.5**	**-0.5**	**0.0**	**0.0**
	%N1	**62.2**	**67.9**	**73.1**	**77.2**	**80.8**
	KIAS	118	132	145	156	166

Flap placard speed exceeded in shaded area.

Airport Altitude = 13000 FT

FLAP POSITION (VREF + INCREMENT)		WEIGHT (1000 KG) 40	50	60	70	80
FLAPS 15 (VREF15 + 10)	**PITCH ATT**	**2.5**	**2.5**	**2.5**	**2.5**	**3.0**
	%N1	**52.7**	**57.8**	**62.5**	**66.0**	**69.3**
	KIAS	131	146	160	172	182
FLAPS 30 (VREF30 + 10)	**PITCH ATT**	**1.0**	**1.0**	**1.0**	**1.0**	**1.5**
	%N1	**57.4**	**63.0**	**67.7**	**71.7**	**75.0**
	KIAS	125	139	152	164	173
FLAPS 40 (VREF40 + 10)	**PITCH ATT**	**-0.5**	**-0.5**	**-0.5**	**0.0**	**0.0**
	%N1	**63.0**	**68.8**	**73.9**	**78.0**	**81.7**
	KIAS	118	132	145	156	166

Flap placard speed exceeded in shaded area.

Flight With Unreliable Airspeed/ Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

FINAL APPROACH (1500 FT)

Gear Down, %N1 for 3° Glideslope

Airport Altitude = 14000 FT

FLAP POSITION (VREF + INCREMENT)		WEIGHT (1000 KG) 40	50	60	70	80
FLAPS 15 (VREF15 + 10)	**PITCH ATT**	**2.5**	**2.5**	**2.5**	**2.5**	**3.0**
	%N1	**53.4**	**58.7**	**63.2**	**66.8**	**70.1**
	KIAS	131	146	160	172	182
FLAPS 30 (VREF30 + 10)	**PITCH ATT**	**1.0**	**1.0**	**1.0**	**1.0**	**1.5**
	%N1	**58.4**	**63.9**	**68.6**	**72.5**	**75.8**
	KIAS	125	139	152	164	174
FLAPS 40 (VREF40 + 10)	**PITCH ATT**	**-0.5**	**-0.5**	**-0.5**	**0.0**	**0.0**
	%N1	**63.9**	**69.8**	**74.7**	**79.0**	**82.7**
	KIAS	118	132	145	156	166

Flap placard speed exceeded in shaded area.

Airport Altitude = 14500 FT

FLAP POSITION (VREF + INCREMENT)		WEIGHT (1000 KG) 40	50	60	70	80
FLAPS 15 (VREF15 + 10)	**PITCH ATT**	**2.5**	**2.5**	**2.5**	**2.5**	**3.0**
	%N1	**53.9**	**59.3**	**63.6**	**67.3**	**70.5**
	KIAS	131	146	160	172	182
FLAPS 30 (VREF30 + 10)	**PITCH ATT**	**1.0**	**1.0**	**1.0**	**1.0**	**1.5**
	%N1	**58.9**	**64.4**	**69.0**	**73.0**	**76.2**
	KIAS	125	139	152	164	174
FLAPS 40 (VREF40 + 10)	**PITCH ATT**	**-0.5**	**-0.5**	**-0.5**	**0.0**	**0.0**
	%N1	**64.4**	**70.4**	**75.2**	**79.5**	**83.2**
	KIAS	118	132	145	156	167

Flap placard speed exceeded in shaded area.

Flight With Unreliable Airspeed/ Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

GO-AROUND

Flaps 15, Gear Up, Set Go-Around Thrust

PRESSURE ALTITUDE (FT)		WEIGHT (1000 KG)				
		40	50	60	70	80
14500	**PITCH ATT**	**17.0**	**13.5**	**11.5**	**10.0**	**9.0**
	V/S (FT/MIN)	3300	2500	2000	1500	1100
	KIAS	128	142	155	166	177
10000	**PITCH ATT**	**20.0**	**16.0**	**13.5**	**11.5**	**10.5**
	V/S (FT/MIN)	3800	3000	2400	1900	1500
	KIAS	128	142	155	166	175
5000	**PITCH ATT**	**23.5**	**19.0**	**15.5**	**13.5**	**12.0**
	V/S (FT/MIN)	4500	3600	2900	2400	2000
	KIAS	128	142	154	165	175
SEA LEVEL	**PITCH ATT**	**27.5**	**22.0**	**18.0**	**15.5**	**14.0**
	V/S (FT/MIN)	5100	4100	3400	2800	2400
	KIAS	128	142	154	165	175
-2000	**PITCH ATT**	**28.0**	**22.0**	**18.5**	**16.0**	**14.0**
	V/S (FT/MIN)	5000	4100	3400	2800	2300
	KIAS	128	142	154	165	174

Performance Inflight — Chapter PI
All Engine — Section 41

Long Range Cruise Maximum Operating Altitude
Max Cruise Thrust
ISA + 10°C and Below

WEIGHT (1000 KG)	OPTIMUM ALT (FT)	TAT (°C)	MARGIN TO INITIAL BUFFET 'G' (BANK ANGLE)				
			1.20 (33°)	1.25 (36°)	1.30 (39°)	1.40 (44°)	1.50 (48°)
85	30300	-5	32800*	32800*	32800*	32100	30700
80	31600	-8	34400*	34400*	34400*	33400	32000
75	33000	-11	35900*	35900*	35900*	34800	33400
70	34500	-15	37300*	37300*	37300*	36200	34900
65	36000	-18	38700*	38700*	38700*	37800	36400
60	37700	-18	40200*	40200*	40200*	39400	38100
55	39500	-18	41000	41000	41000	41000	39900
50	41000	-18	41000	41000	41000	41000	41000
45	41000	-18	41000	41000	41000	41000	41000
40	41000	-18	41000	41000	41000	41000	41000

ISA + 15°C

WEIGHT (1000 KG)	OPTIMUM ALT (FT)	TAT (°C)	MARGIN TO INITIAL BUFFET 'G' (BANK ANGLE)				
			1.20 (33°)	1.25 (36°)	1.30 (39°)	1.40 (44°)	1.50 (48°)
85	30300	0	30600*	30600*	30600*	30600*	30600*
80	31600	-3	32900*	32900*	32900*	32900*	32000
75	33000	-6	34800*	34800*	34800*	34800	33400
70	34500	-9	36300*	36300*	36300*	36200	34900
65	36000	-13	37800*	37800*	37800*	37800	36400
60	37700	-13	39200*	39200*	39200*	39200*	38100
55	39500	-13	40800*	40800*	40800*	40800*	39900
50	41000	-13	41000	41000	41000	41000	41000
45	41000	-13	41000	41000	41000	41000	41000
40	41000	-13	41000	41000	41000	41000	41000

ISA + 20°C

WEIGHT (1000 KG)	OPTIMUM ALT (FT)	TAT (°C)	MARGIN TO INITIAL BUFFET 'G' (BANK ANGLE)				
			1.20 (33°)	1.25 (36°)	1.30 (39°)	1.40 (44°)	1.50 (48°)
85	30300	6	27500*	27500*	27500*	27500*	27500*
80	31600	3	30000*	30000*	30000*	30000*	30000*
75	33000	0	32800*	32800*	32800*	32800*	32800*
70	34500	-3	34900*	34900*	34900*	34900*	34900
65	36000	-7	36500*	36500*	36500*	36500*	36400
60	37700	-7	38000*	38000*	38000*	38000*	38000*
55	39500	-7	39500*	39500*	39500*	39500*	39500*
50	41000	-7	41000	41000	41000	41000	41000
45	41000	-7	41000	41000	41000	41000	41000
40	41000	-7	41000	41000	41000	41000	41000

***Denotes altitude thrust limited in level flight, 100 fpm residual rate of climb.**

Long Range Cruise Control

WEIGHT (1000 KG)		PRESSURE ALTITUDE (1000 FT)								
		25	27	29	31	33	35	37	39	41
85	%N1	86.2	87.5	88.6	90.0	92.6				
	MACH	.752	.771	.782	.792	.794				
	KIAS	316	311	303	294	282				
	FF/ENG	1625	1616	1597	1596	1623				
80	%N1	84.8	86.3	87.4	88.7	90.4	94.1			
	MACH	.732	.759	.774	.785	.794	.792			
	KIAS	307	306	300	291	282	269			
	FF/ENG	1526	1530	1516	1499	1507	1562			
75	%N1	83.2	84.9	86.2	87.4	88.7	90.8			
	MACH	.707	.741	.764	.778	.789	.795			
	KIAS	296	298	295	288	280	270			
	FF/ENG	1419	1437	1436	1414	1405	1419			
70	%N1	81.5	83.2	84.8	86.1	87.2	88.7	91.8		
	MACH	.682	.714	.747	.768	.781	.791	.795		
	KIAS	284	287	288	285	277	269	258		
	FF/ENG	1316	1331	1347	1338	1315	1313	1344		
65	%N1	79.7	81.3	83.0	84.6	85.9	87.1	89.1	93.4	
	MACH	.658	.687	.721	.752	.771	.783	.793	.793	
	KIAS	274	275	277	278	273	266	257	246	
	FF/ENG	1216	1227	1243	1252	1239	1218	1231	1284	
60	%N1	78.1	79.4	81.0	82.7	84.3	85.6	87.2	89.9	
	MACH	.639	.660	.690	.725	.755	.773	.785	.794	
	KIAS	265	263	265	267	267	262	254	246	
	FF/ENG	1130	1126	1138	1151	1156	1140	1135	1155	
55	%N1	76.4	77.6	78.9	80.6	82.3	83.9	85.5	87.6	90.5
	MACH	.621	.639	.661	.692	.727	.757	.774	.786	.795
	KIAS	257	255	252	254	256	256	250	243	235
	FF/ENG	1050	1040	1037	1046	1057	1060	1054	1055	1076
50	%N1	74.6	75.8	77.0	78.3	80.0	81.8	83.7	85.8	87.9
	MACH	.602	.619	.638	.659	.691	.727	.757	.774	.786
	KIAS	249	246	243	241	242	245	244	239	232
	FF/ENG	976	959	951	946	952	962	971	972	973
45	%N1	72.3	73.8	75.0	76.2	77.5	79.2	81.3	83.8	85.8
	MACH	.575	.597	.616	.635	.656	.687	.723	.755	.773
	KIAS	238	237	234	232	229	230	232	232	228
	FF/ENG	895	885	871	862	854	858	872	888	901
40	%N1	69.7	71.2	72.7	74.0	75.3	76.5	78.5	81.0	83.5
	MACH	.545	.567	.590	.611	.630	.650	.679	.714	.749
	KIAS	224	224	224	222	219	217	217	219	220
	FF/ENG	809	820	811	797	784	774	778	795	813

Shaded area approximates optimum altitude.

Long Range Cruise Enroute Fuel and Time - Low Altitudes

Ground to Air Miles Conversions

AIR DISTANCE (NM) HEADWIND COMPONENT (KTS)					GROUND DISTANCE (NM)	AIR DISTANCE (NM) TAILWIND COMPONENT (KTS)				
100	80	60	40	20		20	40	60	80	100
303	275	251	231	215	200	190	180	172	164	158
457	415	378	348	322	300	285	271	258	247	236
611	554	505	464	430	400	380	362	345	329	315
766	695	632	581	538	500	475	452	431	411	394
922	835	760	698	646	600	570	542	517	494	473
1078	976	887	815	754	700	665	632	603	576	552
1235	1118	1015	932	862	800	760	722	688	658	630
1392	1259	1144	1049	970	900	854	812	774	739	709
1550	1402	1272	1167	1078	1000	949	902	859	821	787
1709	1545	1401	1285	1186	1100	1044	992	945	903	865
1869	1688	1531	1402	1295	1200	1139	1082	1031	984	943
2029	1832	1661	1521	1403	1300	1234	1173	1117	1067	1022
2190	1976	1790	1639	1512	1400	1328	1263	1203	1148	1100
2352	2121	1920	1757	1620	1500	1423	1352	1288	1230	1178
2514	2266	2050	1875	1729	1600	1518	1442	1373	1311	1256
2677	2411	2181	1994	1837	1700	1612	1532	1459	1393	1333
2841	2558	2312	2112	1946	1800	1707	1622	1544	1474	1411
3006	2705	2443	2232	2055	1900	1802	1712	1629	1555	1489
3172	2852	2576	2351	2164	2000	1896	1801	1715	1637	1567

Reference Fuel And Time Required at Check Point

AIR DIST (NM)	PRESSURE ALTITUDE (1000 FT)									
	10		14		20		24		28	
	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)
200	1.4	0:44	1.2	0:42	1.0	0:39	0.9	0:38	0.8	0:36
300	2.1	1:05	1.9	1:02	1.6	0:57	1.5	0:54	1.3	0:53
400	2.8	1:26	2.6	1:22	2.2	1:15	2.0	1:11	1.8	1:09
500	3.6	1:48	3.2	1:42	2.8	1:34	2.5	1:29	2.3	1:25
600	4.3	2:09	3.9	2:02	3.4	1:52	3.1	1:46	2.8	1:41
700	5.0	2:31	4.6	2:22	4.0	2:10	3.6	2:03	3.3	1:58
800	5.7	2:52	5.2	2:43	4.6	2:29	4.2	2:20	3.8	2:14
900	6.4	3:14	5.9	3:03	5.2	2:48	4.7	2:38	4.3	2:31
1000	7.1	3:36	6.5	3:24	5.7	3:06	5.2	2:55	4.8	2:47
1100	7.8	3:59	7.2	3:45	6.3	3:25	5.8	3:13	5.3	3:04
1200	8.5	4:21	7.8	4:06	6.9	3:44	6.3	3:31	5.8	3:20
1300	9.2	4:44	8.5	4:27	7.5	4:04	6.8	3:49	6.3	3:37
1400	9.9	5:06	9.1	4:48	8.0	4:23	7.3	4:07	6.8	3:54
1500	10.5	5:29	9.7	5:10	8.6	4:42	7.8	4:25	7.2	4:11
1600	11.2	5:52	10.4	5:32	9.1	5:02	8.4	4:43	7.7	4:28
1700	11.9	6:16	11.0	5:53	9.7	5:21	8.9	5:01	8.2	4:45
1800	12.6	6:39	11.6	6:15	10.3	5:41	9.4	5:19	8.7	5:02
1900	13.2	7:03	12.2	6:37	10.8	6:01	9.9	5:38	9.1	5:19
2000	13.9	7:27	12.8	7:00	11.4	6:21	10.4	5:57	9.6	5:36

Long Range Cruise Enroute Fuel and Time - Low Altitudes

Fuel Required Adjustments (1000 KG)

REFERENCE FUEL REQUIRED (1000 KG)	WEIGHT AT CHECK POINT (1000 KG)				
	40	50	60	70	80
2	-0.1	0.0	0.2	0.3	0.5
3	-0.2	0.0	0.3	0.5	0.8
4	-0.2	0.0	0.4	0.7	1.1
5	-0.3	0.0	0.5	0.9	1.4
6	-0.4	0.0	0.6	1.1	1.7
7	-0.5	0.0	0.7	1.3	2.0
8	-0.5	0.0	0.8	1.5	2.3
9	-0.6	0.0	0.8	1.7	2.6
10	-0.7	0.0	0.9	1.9	2.9
11	-0.7	0.0	1.0	2.1	3.2
12	-0.8	0.0	1.1	2.3	3.5
13	-0.8	0.0	1.2	2.5	3.8
14	-0.9	0.0	1.3	2.7	4.0

Long Range Cruise Enroute Fuel and Time - High Altitudes

Ground to Air Miles Conversions

AIR DISTANCE (NM)					GROUND DISTANCE (NM)	AIR DISTANCE (NM)				
HEADWIND COMPONENT (KTS)						TAILWIND COMPONENT (KTS)				
100	80	60	40	20		20	40	60	80	100
548	510	477	448	423	400	382	366	351	337	325
821	765	715	672	634	600	574	549	527	506	487
1094	1021	955	897	846	800	765	733	703	675	650
1369	1277	1194	1122	1058	1000	957	916	879	844	813
1645	1534	1434	1347	1270	1200	1148	1099	1054	1013	976
1921	1791	1674	1572	1482	1400	1339	1282	1230	1182	1139
2199	2049	1914	1797	1694	1600	1530	1465	1406	1351	1301
2476	2307	2154	2022	1906	1800	1721	1648	1581	1519	1463
2755	2565	2395	2248	2118	2000	1913	1831	1756	1688	1625
3034	2825	2636	2473	2330	2200	2103	2014	1931	1855	1786
3315	3085	2878	2700	2542	2400	2294	2196	2106	2023	1948
3597	3346	3121	2926	2755	2600	2485	2378	2280	2190	2108
3880	3608	3364	3153	2968	2800	2676	2560	2454	2357	2269
4165	3872	3608	3381	3181	3000	2866	2742	2628	2524	2429
4451	4135	3852	3608	3394	3200	3057	2924	2802	2690	2588
4739	4400	4097	3836	3607	3400	3247	3106	2975	2856	2747
5028	4666	4343	4064	3820	3600	3438	3287	3149	3022	2907
5318	4933	4589	4293	4034	3800	3628	3468	3321	3187	3065
5610	5202	4836	4523	4248	4000	3818	3649	3494	3352	3224
5903	5471	5084	4752	4462	4200	4008	3830	3666	3517	3382
6199	5741	5332	4982	4676	4400	4198	4011	3839	3682	3540
6496	6013	5582	5213	4890	4600	4388	4191	4011	3846	3698
6794	6286	5832	5443	5105	4800	4578	4372	4183	4011	3855
7095	6560	6083	5675	5320	5000	4768	4553	4355	4175	4012

Long Range Cruise Enroute Fuel and Time - High Altitudes

Reference Fuel And Time Required at Check Point

AIR DIST (NM)	PRESSURE ALTITUDE (1000 FT)									
	29		31		33		35		37	
	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)
400	1.8	1:08	1.7	1:07	1.7	1:05	1.6	1:03	1.6	1:01
600	2.8	1:40	2.7	1:38	2.6	1:36	2.5	1:32	2.4	1:29
800	3.8	2:13	3.6	2:10	3.5	2:07	3.4	2:02	3.3	1:58
1000	4.7	2:45	4.6	2:42	4.4	2:37	4.3	2:32	4.2	2:26
1200	5.7	3:18	5.5	3:14	5.3	3:09	5.1	3:02	5.0	2:55
1400	6.6	3:52	6.4	3:47	6.2	3:40	6.0	3:32	5.8	3:24
1600	7.6	4:25	7.3	4:19	7.1	4:12	6.9	4:03	6.7	3:53
1800	8.5	4:59	8.2	4:52	8.0	4:44	7.7	4:34	7.5	4:23
2000	9.4	5:32	9.1	5:25	8.9	5:16	8.6	5:05	8.3	4:52
2200	10.4	6:07	10.0	5:59	9.7	5:49	9.4	5:37	9.2	5:23
2400	11.3	6:41	10.9	6:32	10.6	6:22	10.3	6:09	10.0	5:53
2600	12.2	7:16	11.8	7:06	11.4	6:55	11.1	6:41	10.8	6:24
2800	13.1	7:52	12.7	7:40	12.3	7:28	11.9	7:14	11.6	6:55
3000	14.0	8:27	13.6	8:14	13.1	8:01	12.7	7:46	12.3	7:27
3200	14.9	9:04	14.4	8:49	14.0	8:35	13.5	8:19	13.1	7:59
3400	15.8	9:40	15.3	9:24	14.8	9:09	14.3	8:52	13.9	8:31
3600	16.7	10:17	16.1	10:00	15.6	9:43	15.1	9:25	14.6	9:03
3800	17.5	10:55	16.9	10:36	16.4	10:18	15.9	9:59	15.4	9:36
4000	18.4	11:32	17.8	11:12	17.2	10:53	16.6	10:33	16.2	10:08
4200	19.3	12:11	18.6	11:49	18.0	11:28	17.4	11:07	16.9	10:41
4400	20.1	12:50	19.4	12:26	18.8	12:04	18.2	11:41	17.6	11:15
4600	20.9	13:29	20.2	13:04	19.5	12:40	18.9	12:16	18.3	11:48
4800	21.8	14:09	21.0	13:42	20.3	13:17	19.6	12:51	19.1	12:22
5000	22.6	14:49	21.8	14:20	21.1	13:53	20.4	13:26	19.8	12:56

Fuel Required Adjustments (1000 KG)

REFERENCE FUEL REQUIRED (1000 KG)	WEIGHT AT CHECK POINT (1000 KG)				
	40	50	60	70	80
2	-0.1	0.0	0.3	0.8	1.9
4	-0.2	0.0	0.5	1.4	3.3
6	-0.4	0.0	0.7	2.1	4.5
8	-0.6	0.0	1.0	2.6	5.6
10	-0.7	0.0	1.2	3.2	6.6
12	-0.9	0.0	1.5	3.7	7.5
14	-1.1	0.0	1.7	4.1	8.2
16	-1.3	0.0	1.9	4.5	8.8
18	-1.5	0.0	2.1	4.9	9.3
20	-1.7	0.0	2.3	5.3	9.7
22	-1.9	0.0	2.5	5.6	9.9
24	-2.2	0.0	2.7	5.9	10.0

Long Range Cruise Wind-Altitude Trade

PRESSURE ALTITUDE (1000 FT)	CRUISE WEIGHT (1000 KG)									
	85	80	75	70	65	60	55	50	45	40
41						12	2	0	6	18
39				24	10	2	0	5	16	32
37			18	7	1	1	5	15	29	48
35	25	12	4	0	1	6	15	27	44	65
33	7	2	0	2	7	16	27	42	61	82
31	1	0	3	9	17	28	42	58	77	99
29	1	5	11	19	30	43	58	75	94	116
27	7	14	22	32	44	58	74	91	111	132
25	17	25	35	47	60	74	90	107	126	147

The above wind factor tables are for calculation of wind required to maintain present range capability at new pressure altitude, i.e., break-even wind.

Method:

1. **Read wind factors for present and new altitudes from table.**
2. **Determine difference (new altitude wind factor minus present altitude wind factor); this difference may be negative or positive.**
3. **Break-even wind at new altitude is present altitude wind plus difference from step 2.**

Descent

.78/280/250

PRESSURE ALTITUDE (FT)	TIME (MIN)	FUEL (KG)	DISTANCE (NM) LANDING WEIGHT (1000 KG)			
			40	50	60	70
41000	26	340	101	118	130	137
39000	25	330	96	112	124	132
37000	24	330	92	107	119	127
35000	24	320	88	102	113	121
33000	23	320	84	98	109	116
31000	22	310	80	93	103	110
29000	21	310	75	87	96	103
27000	20	300	70	82	90	96
25000	19	290	66	76	84	90
23000	18	280	61	71	78	83
21000	17	270	57	65	72	76
19000	16	260	52	60	66	70
17000	15	250	48	55	60	63
15000	14	240	43	49	54	57
10000	10	200	30	34	36	38
5000	7	150	18	19	20	21
1500	4	110	9	9	9	9

Allowances for a straight-in approach are included.

Holding

Flaps Up

WEIGHT (1000 KG)		PRESSURE ALTITUDE (FT)								
		1500	5000	10000	15000	20000	25000	30000	35000	41000
85	%N1	65.1	67.7	71.6	75.6	79.9	84.1	88.4		
	KIAS	252	253	254	255	257	259	263		
	FF/ENG	1540	1520	1510	1500	1480	1490	1540		
80	%N1	63.4	66.2	69.9	74.0	78.3	82.6	86.8	94.0	
	KIAS	244	245	246	247	249	251	254	250	
	FF/ENG	1460	1430	1420	1410	1390	1400	1430	1560	
75	%N1	61.6	64.7	68.3	72.5	76.5	81.0	85.1	90.2	
	KIAS	236	238	238	239	241	243	246	249	
	FF/ENG	1370	1350	1340	1330	1300	1300	1330	1400	
70	%N1	59.8	62.8	66.6	70.6	74.7	79.2	83.4	88.0	
	KIAS	229	229	230	231	233	234	236	240	
	FF/ENG	1290	1270	1250	1240	1220	1210	1230	1280	
65	%N1	58.1	60.7	64.9	68.6	72.9	77.3	81.5	85.9	
	KIAS	221	221	222	223	224	225	227	230	
	FF/ENG	1210	1190	1170	1150	1140	1120	1140	1170	
60	%N1	56.2	58.7	62.9	66.7	71.0	75.2	79.5	83.9	
	KIAS	211	212	213	214	215	216	218	220	
	FF/ENG	1130	1110	1090	1070	1050	1030	1050	1060	
55	%N1	54.2	56.7	60.5	64.6	68.7	73.0	77.4	81.7	89.8
	KIAS	202	203	203	204	205	207	208	210	214
	FF/ENG	1050	1030	1010	990	970	950	950	970	1050
50	%N1	52.0	54.5	58.1	62.4	66.2	70.7	75.0	79.4	86.9
	KIAS	192	193	194	195	195	197	198	200	203
	FF/ENG	970	950	920	910	890	870	880	890	940
45	%N1	49.6	52.1	55.7	59.6	63.8	68.0	72.2	76.8	84.0
	KIAS	185	185	185	185	185	186	187	189	192
	FF/ENG	900	870	840	840	820	810	790	800	840
40	%N1	47.1	49.5	53.0	56.7	61.1	65.0	69.4	73.9	81.1
	KIAS	178	178	178	178	178	178	178	178	180
	FF/ENG	840	810	780	760	740	730	720	710	740

This table includes additional fuel for holding in a racetrack pattern.

Intentionally
Blank

Performance Inflight — Chapter PI
Advisory Information — Section 42

ADVISORY INFORMATION

Normal Configuration Landing Distance

Flaps 15

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	65000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 65000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF15	ONE REV	NO REV
Dry Runway									
MAX MANUAL	1010	70/-60	25/30	-35/125	15/-10	25/-25	35	25	50
AUTOBRAKE MAX	1300	65/-75	30/40	-45/155	0/0	30/-30	60	0	5
AUTOBRAKE 3	1870	105/-120	50/65	-80/260	0/0	55/-55	100	0	0
AUTOBRAKE 2	2385	155/-170	75/95	-105/360	30/-45	70/-70	100	70	70
AUTOBRAKE 1	2640	185/-200	90/115	-125/425	70/-85	80/-80	95	240	335
Good Reported Braking Action									
MAX MANUAL	1395	80/-85	40/50	-60/210	35/-30	35/-35	50	75	175
AUTOBRAKE MAX	1485	85/-90	40/55	-65/215	30/-25	35/-40	55	85	190
AUTOBRAKE 3	1870	105/-120	50/65	-80/265	5/0	55/-55	100	5	15
AUTOBRAKE 2	2385	155/-170	75/95	-105/360	30/-45	70/-70	100	70	70
AUTOBRAKE 1	2640	185/-200	90/115	-125/425	70/-85	80/-80	95	240	335
Medium Reported Braking Action									
MAX MANUAL	1930	125/-130	60/80	-95/345	90/-70	55/-55	65	215	520
AUTOBRAKE MAX	1965	130/-135	60/85	-100/350	85/-65	55/-55	75	215	520
AUTOBRAKE 3	2065	130/-140	60/85	-100/360	65/-45	60/-60	100	150	450
AUTOBRAKE 2	2440	160/-175	75/100	-115/405	65/-65	70/-75	100	115	250
AUTOBRAKE 1	2655	185/-200	90/120	-130/440	90/-90	80/-80	95	255	395
Poor Reported Braking Action									
MAX MANUAL	2545	180/-185	85/120	-145/550	215/-140	70/-75	80	465	1245
AUTOBRAKE MAX	2545	185/-185	90/120	-145/550	220/-145	70/-75	80	465	1245
AUTOBRAKE 3	2560	185/-185	90/120	-145/550	210/-130	70/-75	95	465	1255
AUTOBRAKE 2	2730	190/-200	90/125	-155/565	200/-130	75/-80	100	375	1090
AUTOBRAKE 1	2855	205/-215	100/135	-160/585	205/-145	80/-85	95	440	1080

Reference distance is based on sea level, standard day, no wind or slope, VREF15, two-engine detent No. 2 reverse thrust, and auto speedbrakes.
For max manual braking and manual speedbrakes, increase reference landing distance by 60 m.
For autobrake and manual speedbrakes, increase reference landing distance by 55 m.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Actual (unfactored) distances are shown.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Normal Configuration Landing Distance

Flaps 30

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	65000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 65000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF30	ONE REV	NO REV

Dry Runway

MAX MANUAL	960	55/-55	20/30	-35/120	10/-10	20/-20	35	20	40
AUTOBRAKE MAX	1215	60/-65	30/35	-45/150	0/0	30/-30	55	0	5
AUTOBRAKE 3	1725	95/-110	45/60	-75/250	0/0	50/-50	95	0	0
AUTOBRAKE 2	2190	140/-150	65/90	-100/345	30/-40	65/-65	95	60	60
AUTOBRAKE 1	2415	165/-180	80/105	-120/405	65/-75	70/-70	85	195	290

Good Reported Braking Action

MAX MANUAL	1330	75/-80	35/45	-60/205	35/-30	35/-35	50	70	155
AUTOBRAKE MAX	1415	80/-85	40/50	-60/210	30/-25	35/-35	60	75	170
AUTOBRAKE 3	1725	95/-110	45/60	-75/250	5/0	50/-50	95	5	15
AUTOBRAKE 2	2190	140/-150	65/90	-100/345	30/-40	65/-65	95	60	60
AUTOBRAKE 1	2415	165/-180	80/105	-120/405	65/-75	70/-70	85	195	290

Medium Reported Braking Action

MAX MANUAL	1815	115/-120	55/75	-95/335	85/-65	50/-50	65	190	450
AUTOBRAKE MAX	1850	120/-125	55/75	-95/340	80/-60	50/-50	75	190	455
AUTOBRAKE 3	1925	120/-125	55/75	-95/345	65/-45	55/-55	95	140	410
AUTOBRAKE 2	2245	140/-155	70/90	-110/390	65/-60	65/-65	95	105	225
AUTOBRAKE 1	2430	165/-180	80/105	-120/420	85/-80	70/-75	85	210	350

Poor Reported Braking Action

MAX MANUAL	2365	165/-170	80/110	-140/530	205/-135	65/-70	75	400	1045
AUTOBRAKE MAX	2370	165/-170	80/110	-140/530	205/-135	65/-70	80	400	1050
AUTOBRAKE 3	2385	170/-170	80/110	-140/535	200/-125	65/-70	85	400	1055
AUTOBRAKE 2	2525	175/-180	85/115	-145/550	190/-125	70/-75	90	335	925
AUTOBRAKE 1	2630	185/-190	85/120	-150/565	195/-135	75/-80	85	380	930

Reference distance is based on sea level, standard day, no wind or slope, VREF30, two-engine detent No. 2 reverse thrust, and auto speedbrakes.
For max manual braking and manual speedbrakes, increase reference landing distance by 60 m.
For autobrake and manual speedbrakes, increase reference landing distance by 55 m.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Actual (unfactored) distances are shown.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Normal Configuration Landing Distance

Flaps 40

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	65000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 65000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF40	ONE REV	NO REV
Dry Runway									
MAX MANUAL	915	55/-50	20/25	-35/115	10/-10	20/-20	35	15	35
AUTOBRAKE MAX	1135	55/-60	25/35	-40/140	0/0	25/-25	55	0	0
AUTOBRAKE 3	1590	85/-100	40/55	-70/235	0/0	45/-45	90	0	0
AUTOBRAKE 2	2030	125/-140	60/80	-95/330	20/-35	60/-60	95	35	35
AUTOBRAKE 1	2260	150/-165	75/95	-115/390	55/-65	65/-65	85	155	220
Good Reported Braking Action									
MAX MANUAL	1270	70/-75	35/45	-55/200	35/-30	30/-30	50	65	140
AUTOBRAKE MAX	1350	75/-80	35/45	-60/205	30/-25	35/-35	60	70	150
AUTOBRAKE 3	1600	85/-100	40/55	-70/240	10/-5	45/-45	95	5	15
AUTOBRAKE 2	2030	125/-140	60/80	-95/330	20/-35	60/-60	95	35	35
AUTOBRAKE 1	2260	150/-165	75/95	-115/390	55/-65	65/-65	85	155	220
Medium Reported Braking Action									
MAX MANUAL	1730	105/-115	50/70	-90/330	85/-65	45/-45	65	170	405
AUTOBRAKE MAX	1750	110/-120	55/70	-90/335	75/-60	45/-50	75	170	405
AUTOBRAKE 3	1800	110/-120	55/70	-95/340	70/-45	50/-50	90	150	390
AUTOBRAKE 2	2090	130/-145	60/85	-105/375	55/-55	60/-60	95	75	190
AUTOBRAKE 1	2275	150/-165	75/95	-115/405	80/-75	65/-65	85	170	275
Poor Reported Braking Action									
MAX MANUAL	2245	155/-160	75/100	-140/520	200/-130	60/-65	75	360	930
AUTOBRAKE MAX	2250	155/-160	75/105	-140/520	200/-130	60/-65	75	360	930
AUTOBRAKE 3	2260	155/-165	75/105	-140/525	195/-125	60/-65	85	360	935
AUTOBRAKE 2	2370	160/-165	75/105	-140/535	185/-120	65/-70	90	290	830
AUTOBRAKE 1	2470	170/-180	80/110	-145/550	190/-130	70/-75	85	335	815

Reference distance is based on sea level, standard day, no wind or slope, VREF40, two-engine detent No. 2 reverse thrust, and auto speedbrakes.
For max manual braking and manual speedbrakes, increase reference landing distance by 55 m.
For autobrake and manual speedbrakes, increase reference landing distance by 45 m.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Actual (unfactored) distances are shown.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

Airspeed Unreliable (Flaps 15)

VREF15

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	65000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 65000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV
Dry Runway									
MAX MANUAL	1075	80/-65	25/35	-40/130	15/-10	25/-25	N/A	30	60
AUTOBRAKE MAX	1435	70/-80	35/45	-50/165	5/-5	35/-35	N/A	0	5
AUTOBRAKE 2	2550	165/-180	85/110	-110/370	50/-55	75/-75	N/A	165	180
Good Reported Braking Action									
MAX MANUAL	1475	80/-85	40/55	-60/215	35/-30	40/-40	N/A	90	205
AUTOBRAKE MAX	1600	85/-95	45/60	-65/225	30/-25	40/-40	N/A	100	230
AUTOBRAKE 2	2550	165/-180	85/110	-110/370	55/-55	75/-75	N/A	165	180
Medium Reported Braking Action									
MAX MANUAL	2025	130/-135	65/85	-100/350	90/-70	55/-55	N/A	240	595
AUTOBRAKE MAX	2080	130/-140	65/90	-100/355	85/-65	55/-60	N/A	245	605
AUTOBRAKE 3	2255	135/-145	70/90	-105/370	60/-45	65/-65	N/A	145	460
Poor Reported Braking Action									
MAX MANUAL	2635	185/-190	90/125	-145/550	210/-140	75/-80	N/A	505	1385
AUTOBRAKE MAX	2635	185/-190	90/125	-145/550	210/-135	75/-80	N/A	500	1380
AUTOBRAKE 3	2685	185/-190	90/125	-150/555	195/-125	75/-80	N/A	485	1375

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Actual (unfactored) distances are shown.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

Airspeed Unreliable (Flaps 30)

VREF30

BRAKING CONFIGURATION	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
	65000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 65000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	1025	60/-60	25/30	-35/125	15/-10	25/-25	N/A	25	55
AUTOBRAKE MAX	1335	60/-70	30/40	-45/155	5/-5	30/-35	N/A	0	5
AUTOBRAKE 2	2345	150/-160	75/95	-105/355	45/-50	70/-70	N/A	140	160

Good Reported Braking Action

MAX MANUAL	1415	75/-80	40/50	-60/210	35/-30	35/-35	N/A	80	185
AUTOBRAKE MAX	1525	80/-90	40/55	-65/220	30/-30	40/-40	N/A	90	205
AUTOBRAKE 2	2345	150/-160	75/95	-105/355	45/-50	70/-70	N/A	140	160

Medium Reported Braking Action

MAX MANUAL	1915	120/-125	60/80	-95/340	85/-70	50/-55	N/A	215	520
AUTOBRAKE MAX	1965	120/-130	60/80	-95/345	80/-65	55/-55	N/A	215	530
AUTOBRAKE 3	2100	120/-135	60/85	-100/360	60/-50	60/-60	N/A	135	420

Poor Reported Braking Action

MAX MANUAL	2460	170/-170	85/115	-140/535	200/-130	65/-70	N/A	435	1165
AUTOBRAKE MAX	2470	170/-175	85/115	-140/535	200/-125	70/-75	N/A	430	1160
AUTOBRAKE 3	2510	170/-175	85/115	-145/540	190/-125	70/-75	N/A	425	1165

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Actual (unfactored) distances are shown.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

Airspeed Unreliable (Flaps 40)

VREF40

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	65000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 65000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	985	55/-55	20/30	-35/120	15/-10	20/-20	N/A	20	45
AUTOBRAKE MAX	1245	55/-65	30/35	-45/150	5/0	30/-30	N/A	0	0
AUTOBRAKE 2	2195	135/-150	70/90	-100/340	40/-45	65/-65	N/A	105	110

Good Reported Braking Action

MAX MANUAL	1360	70/-80	35/50	-60/205	35/-30	35/-35	N/A	75	170
AUTOBRAKE MAX	1455	75/-85	40/50	-60/215	30/-25	35/-35	N/A	85	185
AUTOBRAKE 2	2195	135/-150	70/90	-100/340	40/-45	65/-65	N/A	105	110

Medium Reported Braking Action

MAX MANUAL	1830	110/-120	55/75	-95/335	85/-65	50/-50	N/A	195	465
AUTOBRAKE MAX	1870	115/-125	60/80	-95/340	80/-60	50/-50	N/A	195	475
AUTOBRAKE 3	1965	115/-125	60/80	-100/350	60/-50	55/-55	N/A	135	405

Poor Reported Braking Action

MAX MANUAL	2345	160/-165	80/110	-140/525	195/-130	65/-70	N/A	395	1035
AUTOBRAKE MAX	2355	160/-165	80/110	-140/525	195/-125	65/-70	N/A	390	1035
AUTOBRAKE 3	2380	160/-165	80/110	-140/530	190/-125	65/-70	N/A	395	1045

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Actual (unfactored) distances are shown.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

All Flaps Up Landing

VREF40 + 55

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	65000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 65000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV
Dry Runway									
MAX MANUAL	1330	185/-85	50/105	-45/205	20/-15	35/-35	45	45	95
AUTOBRAKE MAX	1855	85/-90	45/70	-60/195	5/-5	50/-50	75	5	20
AUTOBRAKE 2	3360	195/-225	115/150	-130/430	75/-85	105/-105	100	280	330
Good Reported Braking Action									
MAX MANUAL	1755	85/-95	50/65	-65/230	40/-35	45/-50	45	110	255
AUTOBRAKE MAX	2000	90/-100	55/75	-75/245	30/-25	55/-55	70	85	225
AUTOBRAKE 2	3360	195/-225	115/150	-130/430	75/-85	105/-105	100	280	330
Medium Reported Braking Action									
MAX MANUAL	2495	145/-155	80/110	-110/385	105/-85	70/-75	65	315	775
AUTOBRAKE MAX	2580	150/-160	85/115	-110/390	100/-80	75/-75	75	325	800
AUTOBRAKE 3	2950	145/-170	90/120	-120/420	65/-60	90/-90	110	165	510
Poor Reported Braking Action									
MAX MANUAL	3320	220/-225	120/165	-165/605	250/-170	95/-100	80	690	1915
AUTOBRAKE MAX	3325	215/-225	120/165	-165/605	245/-160	100/-100	90	685	1905
AUTOBRAKE 3	3445	210/-225	120/165	-170/615	220/-150	100/-105	110	600	1840

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Actual (unfactored) distances are shown.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

ANTISKID INOPERATIVE (Flaps 15)

VREF15

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	65000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 65000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV
Dry Runway									
MAX MANUAL	1795	105/-110	50/65	-80/290	55/-45	45/-45	60	145	345
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								
Good Reported Braking Action									
MAX MANUAL	2015	125/-130	60/80	-100/350	85/-65	50/-55	70	215	530
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								
Medium Reported Braking Action									
MAX MANUAL	2585	180/-180	85/120	-145/545	200/-135	70/-75	80	460	1280
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								
Poor Reported Braking Action									
MAX MANUAL	3450	260/-260	120/175	-245/1005	625/-305	85/-105	95	1100	3915
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Actual (unfactored) distances are shown.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

ANTISKID INOPERATIVE (Flaps 30)

VREF30

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	65000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 65000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	1695	95/-105	45/60	-80/280	55/-45	40/-45	60	125	300
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Good Reported Braking Action

MAX MANUAL	1895	115/-120	55/75	-95/340	80/-65	50/-50	65	185	455
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Medium Reported Braking Action

MAX MANUAL	2415	165/-165	80/105	-140/530	190/-125	65/-70	80	395	1075
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Poor Reported Braking Action

MAX MANUAL	3205	235/-235	110/155	-235/980	590/-285	75/-100	90	945	3215
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Actual (unfactored) distances are shown.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

ANTISKID INOPERATIVE (Flaps 40)

VREF40

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	65000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 65000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	1615	90/-100	45/60	-80/275	55/-45	40/-40	60	115	265
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Good Reported Braking Action

MAX MANUAL	1805	105/-115	50/70	-95/335	80/-60	45/-45	65	170	405
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Medium Reported Braking Action

MAX MANUAL	2290	150/-155	70/100	-140/520	185/-120	60/-65	80	355	950
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Poor Reported Braking Action

MAX MANUAL	3040	220/-225	100/145	-230/960	575/-275	70/-95	85	860	2860
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Actual (unfactored) distances are shown.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance
Jammed or Restricted Flight Controls (Flaps 15)
VREF15

BRAKING CONFIGURATION	REF DIST 65000 KG LANDING WEIGHT	WT ADJ PER 5000 KG ABV/BLW 65000 KG	ALT ADJ PER 1000 FT STD/HIGH*	WIND ADJ PER 10 KTS HEAD/ TAIL WIND	SLOPE ADJ PER 1% DOWN/ UP HILL	TEMP ADJ PER 10°C ABV/ BLW ISA	APP SPD ADJ PER 5 KTS ABOVE VREF	REVERSE THRUST ADJ ONE REV	REVERSE THRUST ADJ NO REV
Dry Runway									
MAX MANUAL	1005	70/-60	25/30	-35/125	10/-10	20/-25	35	25	50
AUTOBRAKE MAX	1310	65/-75	30/40	-45/155	5/-5	30/-30	65	0	5
AUTOBRAKE 2	2360	155/-170	75/100	-105/355	35/-50	70/-70	95	100	100
Good Reported Braking Action									
MAX MANUAL	1380	75/-80	35/50	-60/205	35/-30	35/-35	50	80	185
AUTOBRAKE MAX	1485	85/-90	40/55	-60/215	30/-25	35/-35	55	90	205
AUTOBRAKE 2	2360	155/-170	75/100	-105/355	35/-50	70/-70	95	100	100
Medium Reported Braking Action									
MAX MANUAL	1900	125/-130	60/80	-95/340	85/-65	50/-55	65	225	550
AUTOBRAKE MAX	1935	125/-130	60/80	-95/345	80/-65	50/-55	75	225	555
AUTOBRAKE 3	2055	125/-135	60/85	-100/355	60/-40	55/-60	100	145	465
Poor Reported Braking Action									
MAX MANUAL	2480	180/-180	85/120	-145/540	205/-135	70/-75	75	475	1310
AUTOBRAKE MAX	2480	180/-180	85/120	-145/540	205/-135	70/-75	80	475	1305
AUTOBRAKE 3	2500	180/-180	85/120	-145/540	200/-120	70/-75	95	475	1310

Note: LANDING DISTANCE AND ADJUSTMENTS (M)

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Actual (unfactored) distances are shown.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

LEADING EDGE FLAPS TRANSIT (Flaps 15)

VREF15 + 15

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	65000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 65000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV
Dry Runway									
MAX MANUAL	1130	80/-70	25/35	-40/135	15/-15	25/-25	35	30	70
AUTOBRAKE MAX	1500	70/-80	35/45	-50/170	5/-5	40/-40	65	0	5
AUTOBRAKE 2	2725	175/-190	90/115	-115/385	50/-60	85/-85	100	155	160
Good Reported Braking Action									
MAX MANUAL	1570	85/-95	45/60	-65/220	40/-35	40/-40	50	105	240
AUTOBRAKE MAX	1690	90/-100	45/60	-65/230	35/-30	45/-45	60	115	260
AUTOBRAKE 2	2730	175/-190	90/115	-115/385	50/-60	85/-85	100	160	160
Medium Reported Braking Action									
MAX MANUAL	2170	140/-145	70/95	-100/365	95/-75	60/-60	70	275	695
AUTOBRAKE MAX	2210	140/-150	70/95	-105/365	90/-70	60/-65	75	280	700
AUTOBRAKE 3	2375	140/-150	75/100	-110/380	65/-45	70/-70	110	175	570
Poor Reported Braking Action									
MAX MANUAL	2825	200/-205	100/140	-155/570	225/-150	80/-85	80	580	1620
AUTOBRAKE MAX	2825	200/-205	100/140	-155/570	230/-155	80/-85	85	575	1615
AUTOBRAKE 3	2855	200/-200	100/140	-155/570	215/-130	80/-85	100	565	1615

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Actual (unfactored) distances are shown.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance
LOSS OF SYSTEM A (Flaps 15)
VREF15

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	65000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 65000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV
Dry Runway									
MAX MANUAL	1120	70/-65	25/35	-40/135	15/-15	25/-25	45	35	60
AUTOBRAKE MAX	1300	65/-75	30/40	-45/155	0/0	30/-30	60	0	10
AUTOBRAKE 2	2465	150/-175	75/95	-110/365	0/-10	75/-75	140	0	0
Good Reported Braking Action									
MAX MANUAL	1620	95/-100	45/60	-70/235	50/-40	40/-45	70	135	275
AUTOBRAKE MAX	1630	95/-105	45/65	-70/235	40/-35	45/-45	75	135	275
AUTOBRAKE 2	2465	150/-175	75/95	-110/365	0/-10	75/-75	140	0	0
Medium Reported Braking Action									
MAX MANUAL	2235	150/-155	75/100	-110/380	115/-90	60/-65	90	350	840
AUTOBRAKE MAX	2220	150/-155	75/100	-105/380	120/-95	60/-65	90	345	830
AUTOBRAKE 3	2220	150/-155	75/100	-105/380	120/-85	60/-65	90	345	830
Poor Reported Braking Action									
MAX MANUAL	2905	215/-215	105/145	-160/590	265/-175	80/-85	105	710	2025
AUTOBRAKE MAX	2900	215/-215	105/150	-160/590	265/-180	80/-85	105	710	2025
AUTOBRAKE 3	2900	215/-215	105/150	-160/590	265/-180	80/-85	105	710	2025

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Actual (unfactored) distances are shown.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

LOSS OF SYSTEM A (Flaps 30)

VREF30

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	65000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 65000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV
Dry Runway									
MAX MANUAL	1060	65/-55	25/35	-40/130	15/-15	25/-25	45	30	50
AUTOBRAKE MAX	1215	60/-65	30/35	-45/145	0/0	30/-30	55	10	15
AUTOBRAKE 2	2260	135/-155	65/85	-105/350	0/-10	70/-70	135	0	0
Good Reported Braking Action									
MAX MANUAL	1535	85/-95	45/60	-65/225	45/-40	40/-40	70	120	240
AUTOBRAKE MAX	1550	90/-95	45/60	-65/230	40/-35	40/-40	75	120	240
AUTOBRAKE 2	2260	135/-155	65/85	-105/350	0/-10	70/-70	135	0	0
Medium Reported Braking Action									
MAX MANUAL	2090	135/-140	65/90	-105/370	110/-85	55/-60	85	305	710
AUTOBRAKE MAX	2085	135/-140	70/90	-105/370	115/-90	55/-60	90	300	705
AUTOBRAKE 3	2085	135/-140	70/90	-105/370	115/-80	55/-60	90	300	705
Poor Reported Braking Action									
MAX MANUAL	2695	195/-195	95/130	-155/570	250/-165	75/-80	100	605	1650
AUTOBRAKE MAX	2695	195/-195	95/135	-155/570	250/-165	75/-80	100	605	1650
AUTOBRAKE 3	2695	195/-195	95/135	-155/570	250/-165	75/-80	100	605	1650

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Actual (unfactored) distances are shown.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance
LOSS OF SYSTEM A (Flaps 40)
VREF40

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	65000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 65000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV
Dry Runway									
MAX MANUAL	1015	60/-55	25/30	-35/125	15/-15	25/-25	50	30	45
AUTOBRAKE MAX	1140	55/-60	25/35	-40/140	5/0	25/-25	55	10	20
AUTOBRAKE 2	2075	125/-140	60/80	-100/335	0/-5	60/-60	130	0	0
Good Reported Braking Action									
MAX MANUAL	1460	80/-90	40/55	-65/225	45/-40	35/-40	70	105	210
AUTOBRAKE MAX	1470	85/-90	40/55	-65/225	40/-35	40/-40	75	105	210
AUTOBRAKE 2	2075	125/-140	60/80	-100/335	0/-5	60/-60	130	0	0
Medium Reported Braking Action									
MAX MANUAL	1970	125/-135	60/85	-100/360	105/-85	55/-55	85	265	615
AUTOBRAKE MAX	1970	125/-135	60/85	-100/360	110/-85	55/-55	85	265	615
AUTOBRAKE 3	1970	125/-135	60/85	-100/360	110/-80	55/-55	90	265	615
Poor Reported Braking Action									
MAX MANUAL	2525	180/-185	85/120	-150/560	240/-155	70/-75	95	525	1400
AUTOBRAKE MAX	2530	180/-185	90/125	-150/560	245/-160	70/-75	95	530	1405
AUTOBRAKE 3	2530	180/-185	90/125	-150/560	245/-160	70/-75	95	530	1405

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Actual (unfactored) distances are shown.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance
LOSS OF SYSTEM A AND SYSTEM B (Flaps 15)
VREF15

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	65000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 65000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	1570	80/-90	40/50	-60/195	35/-35	40/-40	75	-10	65
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Good Reported Braking Action

MAX MANUAL	2290	135/-145	65/90	-100/335	100/-80	60/-60	105	95	440
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Medium Reported Braking Action

MAX MANUAL	3035	200/-210	100/140	-150/525	215/-160	80/-85	120	365	1415
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Poor Reported Braking Action

MAX MANUAL	3770	275/-275	135/190	-210/785	475/-270	100/-110	130	815	3380
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Actual (unfactored) distances are shown.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance
LOSS OF SYSTEM B (Flaps 15)
VREF15

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	65000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 65000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	1140	55/-60	25/35	-45/145	20/-15	25/-25	40	40	70
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Good Reported Braking Action

MAX MANUAL	1630	95/-100	45/65	-75/255	50/-45	45/-45	60	140	285
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Medium Reported Braking Action

MAX MANUAL	2215	150/-155	70/100	-115/410	125/-95	60/-65	75	340	815
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Poor Reported Braking Action

MAX MANUAL	2835	210/-210	100/140	-170/640	295/-180	75/-85	90	665	1870
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Actual (unfactored) distances are shown.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

MANUAL REVERSION (Flaps 15)

VREF15

BRAKING CONFIGURATION	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
	65000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 65000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV
Dry Runway									
MAX MANUAL	1570	80/-90	40/50	-60/195	35/-35	40/-40	75	-10	65
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								
Good Reported Braking Action									
MAX MANUAL	2290	135/-145	65/90	-100/335	100/-80	60/-60	105	95	440
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								
Medium Reported Braking Action									
MAX MANUAL	3035	200/-210	100/140	-150/525	215/-160	80/-85	120	365	1415
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								
Poor Reported Braking Action									
MAX MANUAL	3770	275/-275	135/190	-210/785	475/-270	100/-110	130	815	3380
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Actual (unfactored) distances are shown.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

One Engine Inoperative Landing (Flaps 15)

VREF15

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	65000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 65000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	1020	75/-65	25/30	-35/130	15/-10	25/-25	35	0	25
AUTOBRAKE MAX	1300	70/-75	30/40	-45/155	0/0	30/-30	60	0	0
AUTOBRAKE 2	2450	150/-170	75/95	-110/365	10/-25	75/-75	120	0	0

Good Reported Braking Action

MAX MANUAL	1440	80/-85	40/50	-65/215	40/-35	40/-40	50	0	100
AUTOBRAKE MAX	1545	85/-95	40/55	-65/225	35/-30	40/-40	60	0	110
AUTOBRAKE 2	2450	150/-170	75/95	-110/365	10/-25	75/-75	120	0	0

Medium Reported Braking Action

MAX MANUAL	2075	135/-140	65/85	-105/370	110/-85	60/-60	70	0	310
AUTOBRAKE MAX	2115	135/-145	65/85	-105/375	105/-80	60/-60	80	0	315
AUTOBRAKE 3	2165	135/-150	65/85	-105/380	90/-65	60/-65	100	0	295

Poor Reported Braking Action

MAX MANUAL	2850	200/-210	95/130	-165/605	290/-185	85/-85	90	0	765
AUTOBRAKE MAX	2850	200/-210	95/130	-165/605	290/-185	85/-85	95	0	765
AUTOBRAKE 3	2875	205/-210	95/130	-165/610	280/-180	85/-85	100	0	775

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Actual (unfactored) distances are shown.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

One Engine Inoperative Landing (Flaps 30)

VREF30

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	65000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 65000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	970	60/-55	20/30	-35/125	15/-10	20/-20	35	0	25
AUTOBRAKE MAX	1215	60/-65	30/35	-45/150	0/0	30/-30	55	0	0
AUTOBRAKE 2	2240	135/-150	65/85	-105/350	10/-25	65/-65	110	0	0

Good Reported Braking Action

MAX MANUAL	1370	75/-80	35/50	-60/210	35/-30	35/-35	50	0	90
AUTOBRAKE MAX	1465	80/-90	40/50	-65/220	35/-30	35/-40	60	0	100
AUTOBRAKE 2	2240	135/-150	65/85	-105/350	10/-25	65/-65	110	0	0

Medium Reported Braking Action

MAX MANUAL	1940	120/-130	60/80	-100/360	105/-80	55/-55	70	0	265
AUTOBRAKE MAX	1975	125/-135	60/80	-100/365	95/-75	55/-55	80	0	270
AUTOBRAKE 3	2015	125/-135	60/80	-105/365	90/-65	55/-60	90	0	260

Poor Reported Braking Action

MAX MANUAL	2625	180/-190	85/115	-155/585	265/-170	75/-80	85	0	635
AUTOBRAKE MAX	2625	180/-190	85/115	-155/585	270/-165	75/-80	90	0	635
AUTOBRAKE 3	2655	185/-190	90/120	-160/585	260/-170	75/-80	90	0	640

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Actual (unfactored) distances are shown.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

Stabilizer Trim Inoperative (Flaps 15)

VREF15

BRAKING CONFIGURATION	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
	65000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 65000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV
Dry Runway									
MAX MANUAL	1005	70/-60	25/30	-35/125	10/-10	20/-25	35	25	50
AUTOBRAKE MAX	1310	65/-75	30/40	-45/155	5/-5	30/-30	65	0	5
AUTOBRAKE 2	2360	155/-170	75/100	-105/355	35/-50	70/-70	95	100	100
Good Reported Braking Action									
MAX MANUAL	1380	75/-80	35/50	-60/205	35/-30	35/-35	50	80	185
AUTOBRAKE MAX	1485	85/-90	40/55	-60/215	30/-25	35/-35	55	90	205
AUTOBRAKE 2	2360	155/-170	75/100	-105/355	35/-50	70/-70	95	100	100
Medium Reported Braking Action									
MAX MANUAL	1900	125/-130	60/80	-95/340	85/-65	50/-55	65	225	550
AUTOBRAKE MAX	1935	125/-130	60/80	-95/345	80/-65	50/-55	75	225	555
AUTOBRAKE 3	2055	125/-135	60/85	-100/355	60/-40	55/-60	100	145	465
Poor Reported Braking Action									
MAX MANUAL	2480	180/-180	85/120	-145/540	205/-135	70/-75	75	475	1310
AUTOBRAKE MAX	2480	180/-180	85/120	-145/540	205/-135	70/-75	80	475	1305
AUTOBRAKE 3	2500	180/-180	85/120	-145/540	200/-120	70/-75	95	475	1310

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Actual (unfactored) distances are shown.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

Trailing Edge Flap Asymmetry (1 ≤ Flap Lever <15)

VREF40 + 30

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	65000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 65000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	1110	90/-65	25/40	-40/135	15/-15	25/-25	35	30	60
AUTOBRAKE MAX	1510	70/-75	35/45	-50/170	5/-5	40/-40	65	0	5
AUTOBRAKE 2	2730	165/-185	90/115	-115/385	55/-60	85/-85	100	165	175

Good Reported Braking Action

MAX MANUAL	1525	80/-85	40/55	-60/215	35/-30	40/-40	45	90	210
AUTOBRAKE MAX	1665	80/-90	45/60	-65/225	30/-25	45/-45	65	95	225
AUTOBRAKE 2	2735	160/-185	90/115	-115/385	55/-65	85/-85	95	165	175

Medium Reported Braking Action

MAX MANUAL	2125	125/-135	70/90	-100/360	90/-75	60/-60	65	255	625
AUTOBRAKE MAX	2180	130/-140	70/95	-100/360	85/-70	60/-60	75	260	640
AUTOBRAKE 3	2385	125/-140	70/95	-110/380	60/-45	70/-70	110	150	470

Poor Reported Braking Action

MAX MANUAL	2795	190/-195	100/135	-150/565	220/-150	80/-85	80	545	1510
AUTOBRAKE MAX	2790	185/-195	100/135	-150/565	220/-145	80/-85	85	540	1500
AUTOBRAKE 3	2845	185/-190	100/135	-155/570	205/-130	80/-85	105	525	1495

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Actual (unfactored) distances are shown.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance
Trailing Edge Flap Asymmetry (Flap Lever 15 or 25)
VREF15

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	65000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 65000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	1005	70/-60	25/30	-35/125	10/-10	20/-25	35	25	50
AUTOBRAKE MAX	1310	65/-75	30/40	-45/155	5/-5	30/-30	65	0	5
AUTOBRAKE 2	2360	155/-170	75/100	-105/355	35/-50	70/-70	95	100	100

Good Reported Braking Action

MAX MANUAL	1380	75/-80	35/50	-60/205	35/-30	35/-35	50	80	185
AUTOBRAKE MAX	1485	85/-90	40/55	-60/215	30/-25	35/-35	55	90	205
AUTOBRAKE 2	2360	155/-170	75/100	-105/355	35/-50	70/-70	95	100	100

Medium Reported Braking Action

MAX MANUAL	1900	125/-130	60/80	-95/340	85/-65	50/-55	65	225	550
AUTOBRAKE MAX	1935	125/-130	60/80	-95/345	80/-65	50/-55	75	225	555
AUTOBRAKE 3	2055	125/-135	60/85	-100/355	60/-40	55/-60	100	145	465

Poor Reported Braking Action

MAX MANUAL	2480	180/-180	85/120	-145/540	205/-135	70/-75	75	475	1310
AUTOBRAKE MAX	2480	180/-180	85/120	-145/540	205/-135	70/-75	80	475	1305
AUTOBRAKE 3	2500	180/-180	85/120	-145/540	200/-120	70/-75	95	475	1310

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Actual (unfactored) distances are shown.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

Trailing Edge Flap Asymmetry (Flap Lever 30)

VREF30

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	65000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 65000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV
Dry Runway									
MAX MANUAL	960	55/-55	20/30	-35/120	10/-10	20/-20	35	20	45
AUTOBRAKE MAX	1215	60/-65	30/35	-45/150	5/0	30/-30	60	0	5
AUTOBRAKE 2	2165	140/-150	65/90	-100/340	30/-45	65/-65	90	85	85
Good Reported Braking Action									
MAX MANUAL	1315	70/-75	35/45	-60/200	30/-30	35/-35	50	75	165
AUTOBRAKE MAX	1410	75/-85	35/50	-60/210	30/-25	35/-35	60	80	185
AUTOBRAKE 2	2165	140/-150	65/90	-100/340	35/-45	65/-65	90	85	85
Medium Reported Braking Action									
MAX MANUAL	1790	115/-120	55/75	-90/330	80/-65	50/-50	65	195	480
AUTOBRAKE MAX	1820	115/-120	55/75	-95/335	75/-60	50/-50	70	200	480
AUTOBRAKE 3	1910	115/-125	55/75	-95/345	60/-40	50/-55	95	140	425
Poor Reported Braking Action									
MAX MANUAL	2315	160/-165	80/105	-140/525	195/-125	60/-65	75	410	1100
AUTOBRAKE MAX	2320	165/-165	80/110	-140/525	195/-130	65/-70	75	410	1100
AUTOBRAKE 3	2335	165/-165	80/110	-140/525	190/-115	65/-70	90	410	1110

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Actual (unfactored) distances are shown.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance
Trailing Edge Flap Disagree (1 ≤ Indicated Flaps <15)
VREF40 + 30

BRAKING CONFIGURATION	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
	65000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 65000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV
Dry Runway									
MAX MANUAL	1110	90/-65	25/40	-40/135	15/-15	25/-25	35	30	60
AUTOBRAKE MAX	1510	70/-75	35/45	-50/170	5/-5	40/-40	65	0	5
AUTOBRAKE 2	2730	165/-185	90/115	-115/385	55/-60	85/-85	100	165	175
Good Reported Braking Action									
MAX MANUAL	1525	80/-85	40/55	-60/215	35/-30	40/-40	45	90	210
AUTOBRAKE MAX	1665	80/-90	45/60	-65/225	30/-25	45/-45	65	95	225
AUTOBRAKE 2	2735	160/-185	90/115	-115/385	55/-65	85/-85	95	165	175
Medium Reported Braking Action									
MAX MANUAL	2125	125/-135	70/90	-100/360	90/-75	60/-60	65	255	625
AUTOBRAKE MAX	2180	130/-140	70/95	-100/360	85/-70	60/-60	75	260	640
AUTOBRAKE 3	2385	125/-140	70/95	-110/380	60/-45	70/-70	110	150	470
Poor Reported Braking Action									
MAX MANUAL	2795	190/-195	100/135	-150/565	220/-150	80/-85	80	545	1510
AUTOBRAKE MAX	2790	185/-195	100/135	-150/565	220/-145	80/-85	85	540	1500
AUTOBRAKE 3	2845	185/-190	100/135	-155/570	205/-130	80/-85	105	525	1495

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Actual (unfactored) distances are shown.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

Trailing Edge Flap Disagree (15 ≤ Indicated Flaps <30)

VREF15

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	65000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 65000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	1005	70/-60	25/30	-35/125	10/-10	20/-25	35	25	50
AUTOBRAKE MAX	1310	65/-75	30/40	-45/155	5/-5	30/-30	65	0	5
AUTOBRAKE 2	2360	155/-170	75/100	-105/355	35/-50	70/-70	95	100	100

Good Reported Braking Action

MAX MANUAL	1380	75/-80	35/50	-60/205	35/-30	35/-35	50	80	185
AUTOBRAKE MAX	1485	85/-90	40/55	-60/215	30/-25	35/-35	55	90	205
AUTOBRAKE 2	2360	155/-170	75/100	-105/355	35/-50	70/-70	95	100	100

Medium Reported Braking Action

MAX MANUAL	1900	125/-130	60/80	-95/340	85/-65	50/-55	65	225	550
AUTOBRAKE MAX	1935	125/-130	60/80	-95/345	80/-65	50/-55	75	225	555
AUTOBRAKE 3	2055	125/-135	60/85	-100/355	60/-40	55/-60	100	145	465

Poor Reported Braking Action

MAX MANUAL	2480	180/-180	85/120	-145/540	205/-135	70/-75	75	475	1310
AUTOBRAKE MAX	2480	180/-180	85/120	-145/540	205/-135	70/-75	80	475	1305
AUTOBRAKE 3	2500	180/-180	85/120	-145/540	200/-120	70/-75	95	475	1310

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Actual (unfactored) distances are shown.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

Trailing Edge Flap Disagree (30 ≤ Indicated Flaps <40)

VREF30

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	65000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 65000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	960	55/-55	20/30	-35/120	10/-10	20/-20	35	20	45
AUTOBRAKE MAX	1215	60/-65	30/35	-45/150	5/0	30/-30	60	0	5
AUTOBRAKE 2	2165	140/-150	65/90	-100/340	30/-45	65/-65	90	85	85

Good Reported Braking Action

MAX MANUAL	1315	70/-75	35/45	-60/200	30/-30	35/-35	50	75	165
AUTOBRAKE MAX	1410	75/-85	35/50	-60/210	30/-25	35/-35	60	80	185
AUTOBRAKE 2	2165	140/-150	65/90	-100/340	35/-45	65/-65	90	85	85

Medium Reported Braking Action

MAX MANUAL	1790	115/-120	55/75	-90/330	80/-65	50/-50	65	195	480
AUTOBRAKE MAX	1820	115/-120	55/75	-95/335	75/-60	50/-50	70	200	480
AUTOBRAKE 3	1910	115/-125	55/75	-95/345	60/-40	50/-55	95	140	425

Poor Reported Braking Action

MAX MANUAL	2315	160/-165	80/105	-140/525	195/-125	60/-65	75	410	1100
AUTOBRAKE MAX	2320	165/-165	80/110	-140/525	195/-130	65/-70	75	410	1100
AUTOBRAKE 3	2335	165/-165	80/110	-140/525	190/-115	65/-70	90	410	1110

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Actual (unfactored) distances are shown.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

Trailing Edge Flaps Up Landing

VREF40 + 40

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	65000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 65000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	1185	110/-70	30/70	-40/140	15/-15	30/-30	45	30	70
AUTOBRAKE MAX	1645	75/-80	40/55	-55/180	5/-5	40/-45	70	5	10
AUTOBRAKE 2	2970	175/-195	100/130	-120/400	65/-70	90/-90	95	205	235

Good Reported Braking Action

MAX MANUAL	1600	80/-90	45/60	-65/220	35/-30	40/-45	45	90	205
AUTOBRAKE MAX	1795	85/-95	50/65	-70/235	25/-25	45/-50	65	80	200
AUTOBRAKE 2	2970	175/-195	100/130	-120/400	65/-70	90/-90	95	205	235

Medium Reported Braking Action

MAX MANUAL	2255	135/-140	70/95	-105/365	95/-75	65/-65	65	260	625
AUTOBRAKE MAX	2330	135/-145	75/100	-105/370	90/-75	65/-65	70	265	645
AUTOBRAKE 3	2605	135/-155	80/105	-115/395	60/-55	75/-80	105	145	435

Poor Reported Braking Action

MAX MANUAL	2990	200/-205	105/145	-155/580	230/-155	85/-90	80	565	1530
AUTOBRAKE MAX	2995	195/-205	105/145	-155/580	230/-150	85/-90	90	560	1520
AUTOBRAKE 3	3080	190/-205	105/145	-160/585	210/-140	90/-95	100	520	1495

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Actual (unfactored) distances are shown.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Recommended Brake Cooling Schedule

Reference Brake Energy Per Brake (Millions of Foot Pounds)

		WIND CORRECTED BRAKES ON SPEED (KIAS)*																	
		80			100			120			140			160			180		
WEIGHT (1000 KG)	OAT (°C)	PRESSURE ALTITUDE (1000 FT)																	
		0	5	10	0	5	10	0	5	10	0	5	10	0	5	10	0	5	10
80	0	15.1	17.0	19.3	22.4	25.3	28.9	30.9	35.0	40.2	40.4	45.9	53.0	50.8	57.9	67.3	60.8	69.6	81.2
	10	15.6	17.6	20.0	23.1	26.1	29.8	31.9	36.2	41.5	41.8	47.5	54.8	52.5	59.9	69.5	62.8	71.9	83.9
	15	15.8	17.8	20.2	23.5	26.5	30.3	32.4	36.7	42.1	42.4	48.2	55.6	53.3	60.7	70.5	63.7	72.9	85.1
	20	16.0	18.1	20.5	23.8	26.9	30.7	32.8	37.2	42.7	42.9	48.8	56.3	54.0	61.5	71.4	64.6	73.9	86.2
	30	16.4	18.5	21.1	24.4	27.6	31.5	33.7	38.2	43.8	44.0	50.0	57.7	55.3	63.1	73.2	66.2	75.7	88.4
	40	16.6	18.7	21.3	24.7	27.9	31.9	34.1	38.7	44.4	44.7	50.9	58.8	56.3	64.3	74.8	67.5	77.4	90.5
	50	16.6	18.7	21.3	24.8	28.0	32.1	34.3	39.0	44.9	45.2	51.5	59.7	57.1	65.4	76.3	68.7	79.0	92.9
70	0	13.7	15.4	17.5	20.2	22.8	26.0	27.7	31.3	35.9	36.1	41.0	47.2	45.3	51.6	59.7	54.9	62.7	72.9
	10	14.2	15.9	18.1	20.8	23.5	26.8	28.6	32.4	37.1	37.3	42.3	48.7	46.8	53.3	61.6	56.7	64.8	75.4
	15	14.4	16.2	18.4	21.1	23.9	27.2	29.0	32.8	37.6	37.8	43.0	49.4	47.5	54.0	62.5	57.5	65.7	76.4
	20	14.6	16.4	18.6	21.4	24.2	27.6	29.4	33.3	38.1	38.4	43.5	50.1	48.1	54.8	63.4	58.3	66.5	77.4
	30	14.9	16.8	19.1	22.0	24.8	28.3	30.2	34.1	39.1	39.3	44.6	51.4	49.3	56.1	64.9	59.8	68.2	79.4
	40	15.1	17.0	19.3	22.2	25.1	28.6	30.5	34.6	39.6	39.9	45.3	52.2	50.1	57.1	66.2	60.9	69.6	81.2
	50	15.1	17.0	19.3	22.3	25.2	28.8	30.7	34.8	40.0	40.2	45.8	52.9	50.7	58.0	67.4	61.8	70.9	83.0
60	0	12.3	13.9	15.7	18.0	20.3	23.1	24.4	27.6	31.6	31.7	35.9	41.2	39.6	45.0	51.8	48.1	54.8	63.5
	10	12.7	14.3	16.3	18.5	20.9	23.8	25.2	28.5	32.6	32.7	37.1	42.6	40.9	46.5	53.6	49.7	56.6	65.6
	15	12.9	14.6	16.5	18.8	21.2	24.2	25.6	29.0	33.1	33.2	37.6	43.2	41.5	47.1	54.4	50.4	57.4	66.5
	20	13.1	14.8	16.7	19.1	21.5	24.5	26.0	29.4	33.5	33.6	38.1	43.8	42.0	47.8	55.1	51.1	58.2	67.4
	30	13.4	15.1	17.2	19.6	22.1	25.1	26.6	30.1	34.4	34.5	39.1	44.9	43.1	49.0	56.5	52.3	59.6	69.1
	40	13.6	15.3	17.3	19.8	22.3	25.4	26.9	30.5	34.9	35.0	39.7	45.6	43.8	49.8	57.5	53.2	60.7	70.5
	50	13.5	15.3	17.3	19.8	22.4	25.5	27.0	30.6	35.1	35.2	40.0	46.0	44.2	50.4	58.3	53.9	61.7	71.9
50	0	11.0	12.3	14.0	15.7	17.7	20.2	21.2	23.9	27.3	27.2	30.8	35.3	33.8	38.3	44.1	40.9	46.4	53.6
	10	11.3	12.7	14.4	16.3	18.3	20.8	21.9	24.7	28.2	28.1	31.8	36.5	34.9	39.6	45.5	42.2	48.0	55.4
	15	11.5	12.9	14.7	16.5	18.6	21.1	22.2	25.1	28.6	28.6	32.3	37.0	35.4	40.2	46.2	42.8	48.7	56.2
	20	11.6	13.1	14.9	16.7	18.9	21.4	22.5	25.4	29.0	28.9	32.8	37.5	35.9	40.7	46.8	43.4	49.3	56.9
	30	11.9	13.4	15.2	17.2	19.3	22.0	23.1	26.1	29.7	29.7	33.6	38.4	36.8	41.8	48.0	44.5	50.6	58.4
	40	12.1	13.6	15.4	17.3	19.5	22.2	23.4	26.4	30.1	30.1	34.0	39.0	37.4	42.4	48.8	45.2	51.4	59.4
	50	12.0	13.6	15.4	17.3	19.6	22.3	23.4	26.5	30.3	30.2	34.2	39.3	37.6	42.8	49.3	45.7	52.1	60.3
40	0	9.6	10.8	12.3	13.5	15.2	17.3	17.9	20.2	23.0	22.8	25.8	29.4	28.1	31.8	36.4	33.7	38.2	43.9
	10	10.0	11.2	12.7	14.0	15.8	17.9	18.5	20.9	23.8	23.6	26.6	30.4	29.0	32.8	37.6	34.8	39.5	45.4
	15	10.1	11.4	12.9	14.2	16.0	18.1	18.8	21.2	24.1	23.9	27.0	30.8	29.4	33.3	38.2	35.3	40.0	46.0
	20	10.2	11.5	13.1	14.4	16.2	18.4	19.1	21.5	24.5	24.2	27.4	31.3	29.8	33.8	38.7	35.8	40.6	46.6
	30	10.5	11.8	13.4	14.8	16.6	18.9	19.6	22.1	25.1	24.9	28.1	32.1	30.6	34.6	39.7	36.7	41.6	47.8
	40	10.6	11.9	13.5	14.9	16.8	19.1	19.8	22.3	25.4	25.2	28.4	32.5	31.0	35.1	40.2	37.2	42.2	48.6
	50	10.6	11.9	13.5	14.9	16.8	19.1	19.8	22.3	25.5	25.2	28.6	32.7	31.1	35.3	40.6	37.5	42.6	49.1

***To correct for wind, enter table with the brakes on speed minus one half the headwind or plus 1.5 times the tailwind. If ground speed is used for brakes on speed, ignore wind and enter table with sea level, 15°C.**

ADVISORY INFORMATION

Recommended Brake Cooling Schedule

Adjusted Brake Energy Per Brake (Millions of Foot Pounds)

No Reverse Thrust

		REFERENCE BRAKE ENERGY PER BRAKE (MILLIONS OF FOOT POUNDS)								
EVENT		10	20	30	40	50	60	70	80	90
RTO MAX MAN		10	20	30	40	50	60	70	80	90
LANDING	MAX MAN	7.8	16.3	25.3	34.7	44.7	55.0	65.7	76.6	87.9
LANDING	MAX AUTO	7.5	15.4	23.6	32.4	41.8	51.8	62.5	74.1	86.5
LANDING	AUTOBRAKE 3	7.3	14.7	22.3	30.2	38.6	47.6	57.4	68.1	80.0
LANDING	AUTOBRAKE 2	7.0	13.8	20.5	27.4	34.8	42.7	51.5	61.3	72.4
LANDING	AUTOBRAKE 1	6.7	13.1	19.2	25.3	31.8	38.8	46.6	55.4	65.5

Two Engine Detent Reverse Thrust

		REFERENCE BRAKE ENERGY PER BRAKE (MILLIONS OF FOOT POUNDS)								
EVENT		10	20	30	40	50	60	70	80	90
RTO MAX MAN		10	20	30	40	50	60	70	80	90
LANDING	MAX MAN	7.0	14.6	22.8	31.4	40.5	49.9	59.7	69.8	80.0
LANDING	MAX AUTO	5.8	12.3	19.5	27.2	35.6	44.5	53.9	63.7	74.1
LANDING	AUTOBRAKE 3	4.3	9.2	14.7	20.7	27.2	34.4	42.0	50.2	59.0
LANDING	AUTOBRAKE 2	2.5	5.6	9.1	13.1	17.8	23.0	28.8	35.2	42.3
LANDING	AUTOBRAKE 1	1.8	3.8	6.1	8.8	11.9	15.5	19.6	24.4	29.8

Cooling Time (Minutes) - Category C Steel Brakes

	EVENT ADJUSTED BRAKE ENERGY (MILLIONS OF FOOT POUNDS)								
	16 & BELOW	17	20	23	25	28	32	33 TO 48	49 & ABOVE
	BRAKE TEMPERATURE MONITOR SYSTEM INDICATION ON CDS								
	UP TO 2.4	2.6	3.1	3.5	3.9	4.4	4.9	5.0 TO 7.5	7.5 & ABOVE
INFLIGHT GEAR DOWN	NO SPECIAL PROCEDURE REQUIRED	1	2	3	4	5	6	CAUTION	FUSE PLUG MELT ZONE
GROUND		10	20	30	40	50	60		

Cooling Time (Minutes) - Category N Carbon Brakes

	EVENT ADJUSTED BRAKE ENERGY (MILLIONS OF FOOT POUNDS)								
	16 & BELOW	17	19	20.9	23.5	26.9	29.4	30 TO 41	41 & ABOVE
	BRAKE TEMPERATURE MONITOR SYSTEM INDICATION ON CDS								
	UP TO 2.5	2.6	3	3.3	3.8	4.5	4.9	5.0 TO 7.1	7.1 & ABOVE
INFLIGHT GEAR DOWN	NO SPECIAL PROCEDURE REQUIRED	1	4	5	6	7	7.6	CAUTION	FUSE PLUG MELT ZONE
GROUND		6.7	16.0	24.1	34.2	45.9	53.3		

Observe maximum quick turnaround limit.
Table shows energy per brake added by a single stop with all brakes operating. Energy is assumed to be equally distributed among the operating brakes. Total energy is the sum of residual energy plus energy added.
Add 1.0 million foot pounds per brake for each taxi mile.

When in caution zone, wheel fuse plugs may melt. Delay takeoff and inspect after one hour. If overheat occurs after takeoff, extend gear soon for at least 7 minutes.

When in fuse plug melt zone, clear runway immediately. Unless required, do not set parking brake. Do not approach gear or attempt to taxi for one hour. Tire, wheel and brake replacement may be required. If overheat occurs after takeoff, extend gear soon for at least 12 minutes.

Brake temperature monitor system (BTMS) indication on CDS systems page may be used 10 to 15 minutes after airplane has come to a complete stop or inflight with gear retracted to determine recommended cooling schedule.

Performance Inflight — Chapter PI
Engine Inoperative — Section 43

ENGINE INOP

Initial Max Continuous %N1
Based on .79M, A/C high and anti-ice off

TAT (°C)	PRESSURE ALTITUDE (1000 FT)								
	25	27	29	31	33	35	37	39	41
20	96.8	96.6	96.3	96.1	95.9	95.4	95.0	94.7	93.9
15	97.4	97.2	96.9	96.8	96.6	96.2	95.7	95.5	94.8
10	98.0	97.8	97.5	97.4	97.4	96.9	96.5	96.3	95.7
5	98.3	98.6	98.3	98.1	98.1	97.7	97.3	97.1	96.6
0	97.5	98.7	99.2	99.0	98.9	98.5	98.2	98.0	97.5
-5	96.7	98.0	99.1	99.8	99.7	99.3	98.9	98.7	98.4
-10	96.0	97.2	98.4	99.6	100.5	100.2	99.8	99.6	99.4
-15	95.2	96.4	97.6	98.8	100.1	101.0	100.8	100.6	100.3
-20	94.4	95.6	96.8	98.0	99.3	100.5	101.1	100.8	100.6
-25	93.6	94.9	96.0	97.2	98.5	99.7	100.2	100.0	99.8
-30	92.8	94.1	95.2	96.4	97.7	98.8	99.4	99.2	99.0
-35	92.0	93.2	94.4	95.6	96.8	98.0	98.5	98.3	98.1
-40	91.2	92.4	93.5	94.7	96.0	97.1	97.6	97.4	97.2

%N1 Adjustments for Engine Bleeds

BLEED CONFIGURATION	PRESSURE ALTITUDE (1000 FT)								
	25	27	29	31	33	35	37	39	41
ENGINE ANTI-ICE	-1.2	-1.1	-1.0	-0.9	-0.8	-0.8	-0.8	-0.8	-0.8
ENGINE & WING ANTI-ICE	-4.2	-4.4	-4.5	-4.7	-5.0	-4.8	-4.8	-4.8	-4.8

ENGINE INOP

Max Continuous %N1

37000 FT to 29000 FT Pressure Altitudes

37000 FT PRESS ALT		TAT (°C)											
KIAS	M	-55	-50	-45	-40	-35	-30	-25	-20	-15	-10	-5	0
160	.51	96.6	97.6	98.5	99.4	100.2	99.6	98.8	97.6	96.3	94.7	93.2	91.8
200	.63	96.0	96.9	97.8	98.7	99.6	100.4	100.1	99.3	98.4	97.5	96.3	95.2
240	.74	95.1	96.0	96.8	97.7	98.6	99.4	100.3	100.7	100.0	99.2	98.4	97.5
280	.86	94.3	95.2	96.1	97.0	97.8	98.7	99.5	100.4	101.2	100.9	100.0	99.1
35000 FT PRESS ALT		**TAT (°C)**											
KIAS	M	-55	-50	-45	-40	-35	-30	-25	-20	-15	-10	-5	0
160	.49	96.5	97.4	98.3	99.2	100.1	99.8	99.0	98.0	96.8	95.4	94.0	92.7
200	.60	96.1	97.0	97.9	98.8	99.7	100.6	100.5	99.6	98.6	97.6	96.5	95.4
240	.71	95.0	95.9	96.8	97.7	98.6	99.4	100.3	100.8	100.2	99.5	98.6	97.7
280	.82	93.8	94.6	95.5	96.4	97.3	98.1	98.9	99.8	100.6	100.3	99.5	98.8
33000 FT PRESS ALT		**TAT (°C)**											
KIAS	M	-50	-45	-40	-35	-30	-25	-20	-15	-10	-5	0	5
160	.47	97.4	98.3	99.2	100.0	100.8	100.0	99.1	97.9	96.7	95.3	93.9	92.6
200	.58	97.0	97.9	98.8	99.7	100.6	101.4	100.6	99.6	98.6	97.5	96.3	95.1
240	.68	95.9	96.8	97.7	98.5	99.4	100.2	101.1	100.9	100.2	99.4	98.4	97.4
280	.79	94.3	95.1	96.0	96.8	97.7	98.5	99.3	100.2	100.5	99.7	98.9	98.1
320	.89	93.6	94.5	95.4	96.2	97.1	97.9	98.7	99.5	100.3	101.1	100.7	99.8
31000 FT PRESS ALT		**TAT (°C)**											
KIAS	M	-50	-45	-40	-35	-30	-25	-20	-15	-10	-5	0	5
160	.45	97.3	98.2	99.1	100.0	100.9	101.1	100.2	99.2	98.0	96.6	95.2	93.9
200	.55	97.1	98.0	98.9	99.7	100.6	101.5	101.6	100.7	99.7	98.6	97.4	96.2
240	.66	95.6	96.5	97.4	98.3	99.1	100.0	100.8	101.3	100.5	99.8	98.8	97.8
280	.76	93.8	94.7	95.5	96.4	97.2	98.0	98.8	99.7	100.5	99.8	98.9	98.0
320	.85	92.4	93.2	94.1	94.9	95.7	96.5	97.4	98.2	98.9	99.7	99.9	99.1
29000 FT PRESS ALT		**TAT (°C)**											
KIAS	M	-45	-40	-35	-30	-25	-20	-15	-10	-5	0	5	10
160	.43	98.1	99.0	99.9	100.8	101.6	101.2	100.2	99.1	97.9	96.4	95.1	93.8
200	.53	97.5	98.4	99.3	100.2	101.0	101.9	101.3	100.4	99.3	98.2	96.9	95.8
240	.63	96.3	97.1	98.0	98.9	99.7	100.5	101.4	101.1	100.2	99.2	98.3	97.2
280	.73	94.2	95.0	95.9	96.7	97.5	98.3	99.1	99.9	100.1	99.1	98.2	97.5
320	.82	92.1	92.9	93.7	94.5	95.3	96.1	96.9	97.7	98.5	99.2	98.5	97.6
360	.91	92.1	92.9	93.7	94.5	95.3	96.1	96.9	97.7	98.5	99.2	100.0	100.1

%N1 Adjustments for Engine Bleeds

BLEED CONFIGURATION	PRESSURE ALTITUDE (1000 FT)				
	29	31	33	35	37
ENGINE ANTI-ICE ON	-0.9	-0.9	-0.8	-0.8	-0.8
ENGINE & WING ANTI-ICE ON	-4.1	-4.3	-4.5	-4.7	-4.7

ENGINE INOP

Max Continuous %N1
27000 FT to 20000 FT Pressure Altitudes

27000 FT PRESS ALT		TAT (°C)											
KIAS	M	-45	-40	-35	-30	-25	-20	-15	-10	-5	0	5	10
160	.41	98.0	98.8	99.7	100.6	101.4	102.2	101.2	100.2	99.0	97.8	96.4	95.1
200	.51	96.9	97.8	98.7	99.6	100.4	101.2	101.8	100.8	99.9	98.8	97.6	96.4
240	.60	95.6	96.5	97.4	98.2	99.1	99.9	100.7	101.3	100.4	99.4	98.5	97.5
280	.70	93.6	94.4	95.3	96.1	96.9	97.7	98.5	99.3	100.1	99.4	98.4	97.6
320	.79	91.6	92.4	93.2	94.0	94.8	95.6	96.4	97.2	98.0	98.7	98.6	97.8
360	.88	91.0	91.8	92.6	93.4	94.2	95.0	95.8	96.6	97.3	98.1	98.8	99.4
25000 FT PRESS ALT		TAT (°C)											
KIAS	M	-40	-35	-30	-25	-20	-15	-10	-5	0	5	10	15
160	.39	98.8	99.7	100.5	101.4	102.2	102.4	101.4	100.3	99.1	97.7	96.5	95.2
200	.49	97.5	98.3	99.2	100.0	100.9	101.7	101.5	100.6	99.5	98.4	97.3	96.2
240	.58	95.7	96.5	97.4	98.2	99.0	99.9	100.7	100.5	99.5	98.6	97.6	96.7
280	.67	93.9	94.7	95.5	96.3	97.1	97.9	98.7	99.5	99.5	98.6	97.6	96.9
320	.76	91.7	92.6	93.4	94.2	95.0	95.8	96.5	97.3	98.0	98.6	97.8	97.2
360	.85	90.4	91.2	92.1	92.9	93.7	94.5	95.3	96.1	96.9	97.6	98.4	98.2
24000 FT PRESS ALT		TAT (°C)											
KIAS	M	-40	-35	-30	-25	-20	-15	-10	-5	0	5	10	15
160	.38	98.6	99.5	100.4	101.2	102.1	102.9	101.9	100.8	99.6	98.4	97.1	95.8
200	.48	97.5	98.4	99.2	100.1	100.9	101.8	102.2	101.1	100.1	99.0	97.8	96.7
240	.57	95.9	96.8	97.6	98.5	99.3	100.1	100.9	101.2	100.2	99.2	98.2	97.3
280	.66	94.2	95.1	95.9	96.7	97.5	98.3	99.1	99.9	100.4	99.4	98.3	97.5
320	.75	92.1	93.0	93.8	94.6	95.4	96.2	96.9	97.7	98.5	99.2	98.6	97.8
360	.83	90.6	91.4	92.2	93.1	93.9	94.7	95.5	96.2	97.0	97.8	98.5	98.6
22000 FT PRESS ALT		TAT (°C)											
KIAS	M	-35	-30	-25	-20	-15	-10	-5	0	5	10	15	20
160	.37	99.1	100.0	100.9	101.7	102.5	102.8	101.8	100.7	99.5	98.2	97.0	95.8
200	.46	98.4	99.3	100.1	101.0	101.8	102.6	102.3	101.2	100.0	98.9	97.8	96.8
240	.55	97.2	98.1	98.9	99.7	100.5	101.3	102.1	101.6	100.5	99.4	98.5	97.5
280	.63	95.7	96.5	97.4	98.2	99.0	99.8	100.6	101.3	101.0	99.8	98.9	98.1
320	.72	93.9	94.7	95.5	96.3	97.1	97.9	98.6	99.4	100.1	100.2	99.3	98.6
360	.80	92.2	93.0	93.8	94.6	95.4	96.1	96.9	97.7	98.4	99.2	99.7	99.1
20000 FT PRESS ALT		TAT (°C)											
KIAS	M	-35	-30	-25	-20	-15	-10	-5	0	5	10	15	20
160	.35	98.7	99.5	100.4	101.2	102.0	102.8	102.5	101.5	100.4	99.2	98.0	96.8
200	.44	98.3	99.2	100.0	100.9	101.7	102.5	103.3	102.3	101.1	100.0	98.9	97.8
240	.53	97.5	98.4	99.2	100.0	100.8	101.7	102.5	103.1	101.8	100.5	99.5	98.6
280	.61	96.2	97.0	97.8	98.7	99.5	100.3	101.1	101.8	102.5	101.3	100.1	99.3
320	.69	94.7	95.5	96.3	97.1	97.9	98.7	99.5	100.2	101.0	101.7	100.9	99.9
360	.77	93.0	93.8	94.6	95.4	96.2	97.0	97.7	98.5	99.2	100.0	100.7	100.4

%N1 Adjustments for Engine Bleeds

BLEED CONFIGURATION	PRESSURE ALTITUDE (1000 FT)				
	20	22	24	25	27
ENGINE ANTI-ICE ON	-0.9	-0.9	-1.0	-1.0	-1.0
ENGINE & WING ANTI-ICE ON	-3.6	-3.8	-3.8	-3.9	-4.0

ENGINE INOP

Max Continuous %N1
18000 FT to 12000 FT Pressure Altitudes

18000 FT PRESS ALT		TAT (°C)											
KIAS	M	-30	-25	-20	-15	-10	-5	0	5	10	15	20	25
160	.34	98.5	99.3	100.2	101.0	101.8	102.6	101.6	100.3	99.2	98.1	97.0	95.9
200	.42	98.7	99.6	100.4	101.2	102.0	102.8	103.1	101.7	100.4	99.3	98.3	97.3
240	.51	97.8	98.7	99.5	100.3	101.1	101.9	102.7	102.5	101.1	99.9	99.0	98.1
280	.59	96.3	97.1	97.9	98.7	99.5	100.3	101.0	101.8	101.6	100.5	99.6	98.8
320	.67	94.8	95.6	96.4	97.2	97.9	98.7	99.5	100.2	101.0	100.9	100.0	99.2
360	.75	93.0	93.8	94.6	95.3	96.1	96.9	97.6	98.4	99.1	99.9	100.2	99.6

16000 FT PRESS ALT		TAT (°C)											
KIAS	M	-30	-25	-20	-15	-10	-5	0	5	10	15	20	25
160	.33	97.1	98.0	98.8	99.6	100.4	101.2	101.6	100.3	99.1	98.1	97.1	96.1
200	.41	98.0	98.8	99.6	100.4	101.2	102.0	102.8	102.5	101.3	100.2	99.3	98.3
240	.49	97.1	97.9	98.7	99.5	100.3	101.1	101.9	102.7	101.8	100.5	99.6	98.7
280	.57	95.6	96.4	97.2	98.0	98.8	99.6	100.3	101.1	101.8	100.9	99.8	99.0
320	.64	94.0	94.8	95.6	96.4	97.2	97.9	98.7	99.4	100.2	100.9	100.2	99.4
360	.72	92.1	92.9	93.7	94.5	95.3	96.1	96.9	97.7	98.4	99.2	99.9	99.6

14000 FT PRESS ALT		TAT (°C)											
KIAS	M	-25	-20	-15	-10	-5	0	5	10	15	20	25	30
160	.31	96.6	97.4	98.2	99.0	99.8	100.6	100.4	99.1	98.0	97.1	96.2	95.3
200	.39	97.1	97.9	98.7	99.5	100.3	101.1	101.8	101.5	101.0	100.1	99.3	98.4
240	.47	96.6	97.4	98.2	99.0	99.8	100.6	101.3	101.8	101.1	100.3	99.5	98.7
280	.54	95.5	96.3	97.1	97.8	98.6	99.4	100.1	100.9	101.0	100.1	99.2	98.5
320	.62	94.1	94.9	95.7	96.5	97.2	98.0	98.7	99.5	100.2	100.3	99.5	98.8
360	.69	92.2	93.1	93.9	94.7	95.5	96.3	97.0	97.8	98.6	99.3	99.6	99.0

12000 FT PRESS ALT		TAT (°C)											
KIAS	M	-20	-15	-10	-5	0	5	10	15	20	25	30	35
160	.30	96.3	97.0	97.8	98.6	99.4	100.1	99.3	98.1	97.1	96.3	95.4	94.5
200	.38	97.1	97.9	98.7	99.5	100.3	101.0	101.5	100.8	99.8	99.0	98.2	97.3
240	.45	96.5	97.3	98.0	98.8	99.6	100.3	101.1	101.0	100.1	99.4	98.6	97.9
280	.52	95.5	96.3	97.0	97.8	98.6	99.3	100.0	100.8	100.3	99.4	98.6	98.0
320	.60	94.0	94.8	95.6	96.4	97.2	97.9	98.7	99.4	100.2	99.7	98.9	98.2
360	.67	92.3	93.2	94.0	94.8	95.6	96.4	97.1	97.9	98.7	99.4	99.1	98.5

%N1 Adjustments for Engine Bleeds

BLEED CONFIGURATION	PRESSURE ALTITUDE (1000 FT)			
	12	14	16	18
ENGINE ANTI-ICE ON	-0.9	-0.9	-0.9	-0.9
ENGINE & WING ANTI-ICE ON	-3.2	-3.4	-3.4	-3.5

ENGINE INOP

Max Continuous %N1
10000 FT to 1000 FT Pressure Altitudes

10000 FT PRESS ALT		TAT (°C)											
KIAS	M	-20	-15	-10	-5	0	5	10	15	20	25	30	35
160	.29	95.2	96.0	96.8	97.6	98.3	99.1	99.8	98.6	97.4	96.6	95.8	94.9
200	.36	96.0	96.7	97.5	98.3	99.0	99.8	100.5	100.5	99.4	98.5	97.8	97.0
240	.43	95.6	96.4	97.2	97.9	98.7	99.4	100.2	100.9	100.1	99.2	98.4	97.7
280	.51	94.5	95.3	96.1	96.9	97.6	98.4	99.1	99.9	100.4	99.5	98.7	98.0
320	.58	93.0	93.9	94.7	95.5	96.2	97.0	97.8	98.6	99.3	99.7	99.0	98.2
360	.65	91.6	92.4	93.2	94.0	94.8	95.6	96.4	97.2	98.0	98.7	99.1	98.5
5000 FT PRESS ALT		TAT (°C)											
KIAS	M	-10	-5	0	5	10	15	20	25	30	35	40	45
160	.26	94.9	95.7	96.4	97.2	98.0	98.8	99.2	98.3	97.4	96.6	95.9	95.1
200	.33	94.7	95.5	96.3	97.1	97.8	98.6	99.4	98.9	98.0	97.3	96.6	95.8
240	.40	94.0	94.8	95.6	96.4	97.2	97.9	98.7	99.5	98.7	97.9	97.2	96.5
280	.46	93.3	94.1	94.9	95.7	96.5	97.3	98.1	98.8	98.9	98.2	97.5	96.8
320	.53	92.5	93.3	94.1	94.9	95.7	96.5	97.2	98.0	98.7	98.4	97.7	97.1
360	.59	91.5	92.3	93.1	93.9	94.7	95.5	96.2	97.0	97.8	98.5	98.0	97.3
3000 FT PRESS ALT		TAT (°C)											
KIAS	M	-5	0	5	10	15	20	25	30	35	40	45	50
160	.26	94.8	95.6	96.4	97.2	98.0	98.7	98.8	97.9	97.1	96.4	95.6	94.8
200	.32	94.5	95.3	96.1	96.9	97.6	98.4	99.2	98.3	97.5	96.8	96.1	95.3
240	.38	94.1	94.9	95.6	96.4	97.2	98.0	98.7	98.8	98.0	97.2	96.6	95.9
280	.45	93.2	94.0	94.8	95.6	96.4	97.2	97.9	98.7	98.3	97.5	96.9	96.2
320	.51	92.5	93.3	94.1	94.9	95.7	96.4	97.2	98.0	98.5	97.8	97.1	96.5
360	.57	91.6	92.4	93.2	94.0	94.7	95.5	96.3	97.1	97.8	98.1	97.4	96.8
1000 FT PRESS ALT		TAT (°C)											
KIAS	M	-5	0	5	10	15	20	25	30	35	40	45	50
160	.25	93.9	94.7	95.4	96.2	97.0	97.8	98.5	98.2	97.4	96.7	96.0	95.2
200	.31	93.5	94.3	95.1	95.9	96.7	97.4	98.2	98.5	97.8	97.0	96.3	95.6
240	.37	93.0	93.8	94.6	95.4	96.1	96.9	97.7	98.4	98.1	97.3	96.6	95.9
280	.43	92.3	93.2	93.9	94.7	95.5	96.3	97.1	97.8	98.3	97.6	96.9	96.2
320	.49	91.6	92.4	93.2	94.0	94.8	95.6	96.3	97.1	97.9	97.9	97.2	96.5
360	.55	90.7	91.5	92.3	93.1	93.9	94.7	95.4	96.2	96.9	97.7	97.3	96.6

%N1 Adjustments for Engine Bleeds

BLEED CONFIGURATION	PRESSURE ALTITUDE (1000 FT)			
	1	3	5	10
ENGINE ANTI-ICE ON	-0.6	-0.8	-0.8	-0.8
ENGINE & WING ANTI-ICE ON	-2.9	-3.0	-3.1	-3.2

ENGINE INOP

MAX CONTINUOUS THRUST

Driftdown Speed/Level Off Altitude

100 ft/min residual rate of climb

WEIGHT (1000 KG)		OPTIMUM DRIFTDOWN SPEED (KIAS)	LEVEL OFF ALTITUDE (FT)		
START DRIFTDOWN	LEVEL OFF		ISA + 10°C & BELOW	ISA + 15°C	ISA + 20°C
85	81	270	17500	16200	15000
80	77	262	19200	18000	16700
75	72	255	20800	19800	18500
70	67	246	22300	21300	20300
65	62	238	23900	23000	22000
60	57	228	25800	24800	23900
55	53	219	28100	27100	26000
50	48	209	30300	29500	28500
45	43	198	32500	31800	30900
40	38	187	34900	34100	33300

Includes APU fuel burn.

ENGINE INOP

MAX CONTINUOUS THRUST

Driftdown/LRC Cruise Range Capability

Ground to Air Miles Conversion

AIR DISTANCE (NM)					GROUND DISTANCE (NM)	AIR DISTANCE (NM)				
HEADWIND COMPONENT (KTS)						TAILWIND COMPONENT (KTS)				
100	80	60	40	20		20	40	60	80	100
139	129	120	113	106	100	95	90	86	82	78
277	257	240	225	212	200	189	180	171	164	156
416	386	360	338	318	300	284	270	257	245	235
554	515	480	450	424	400	379	360	343	327	313
693	643	600	563	529	500	474	450	428	409	391
831	772	720	675	635	600	568	540	514	491	469
969	900	840	788	741	700	663	630	600	573	548
1108	1029	960	900	847	800	758	720	686	655	626
1246	1157	1080	1012	953	900	853	810	771	736	704
1385	1286	1200	1125	1059	1000	947	900	857	818	783
1523	1414	1320	1237	1165	1100	1042	990	943	900	861
1662	1543	1440	1350	1271	1200	1137	1080	1029	982	939
1800	1672	1560	1463	1376	1300	1232	1170	1114	1064	1017
1939	1800	1680	1575	1482	1400	1326	1260	1200	1145	1095
2078	1929	1800	1688	1588	1500	1421	1350	1285	1227	1174
2217	2058	1921	1800	1694	1600	1516	1440	1371	1309	1252
2356	2187	2041	1913	1800	1700	1610	1530	1457	1390	1330
2496	2317	2161	2026	1906	1800	1705	1619	1542	1472	1408

Driftdown/Cruise Fuel and Time

AIR DIST (NM)	FUEL REQUIRED (1000 KG)										TIME (HR:MIN)
	WEIGHT AT START OF DRIFTDOWN (1000 KG)										
	40	45	50	55	60	65	70	75	80	85	
100	0.4	0.4	0.4	0.4	0.5	0.5	0.5	0.5	0.6	0.6	0:17
200	0.8	0.8	0.9	1.0	1.0	1.1	1.1	1.2	1.3	1.3	0:34
300	1.3	1.3	1.4	1.6	1.7	1.7	1.9	2.0	2.1	2.2	0:50
400	1.7	1.8	2.0	2.2	2.3	2.4	2.6	2.8	2.9	3.1	1:07
500	2.1	2.3	2.5	2.7	2.9	3.1	3.3	3.5	3.7	3.9	1:24
600	2.5	2.8	3.0	3.3	3.5	3.7	4.0	4.2	4.5	4.7	1:40
700	2.9	3.2	3.5	3.8	4.1	4.3	4.6	4.9	5.2	5.5	1:57
800	3.4	3.7	4.0	4.3	4.7	5.0	5.3	5.6	6.0	6.3	2:14
900	3.8	4.1	4.5	4.9	5.3	5.6	6.0	6.4	6.7	7.1	2:30
1000	4.2	4.6	5.0	5.4	5.8	6.2	6.6	7.0	7.5	7.9	2:47
1100	4.6	5.0	5.5	5.9	6.4	6.8	7.3	7.7	8.2	8.7	3:04
1200	5.0	5.4	5.9	6.5	6.9	7.4	7.9	8.4	8.9	9.4	3:21
1300	5.3	5.9	6.4	7.0	7.5	8.0	8.6	9.1	9.7	10.2	3:37
1400	5.7	6.3	6.9	7.5	8.1	8.6	9.2	9.8	10.4	11.0	3:54
1500	6.1	6.7	7.3	8.0	8.6	9.2	9.8	10.4	11.1	11.7	4:11
1600	6.5	7.2	7.8	8.5	9.1	9.8	10.4	11.1	11.8	12.5	4:28
1700	6.9	7.6	8.3	9.0	9.7	10.3	11.1	11.8	12.5	13.2	4:45
1800	7.2	8.0	8.7	9.5	10.2	10.9	11.7	12.4	13.2	13.9	5:02

Includes APU fuel burn.
Driftdown at optimum driftdown speed and cruise at Long Range Cruise speed.

ENGINE INOP

MAX CONTINUOUS THRUST

Long Range Cruise Altitude Capability

100 ft/min residual rate of climb

WEIGHT (1000 KG)	PRESSURE ALTITUDE (FT)		
	ISA + 10°C & BELOW	ISA + 15°C	ISA + 20°C
85	13800	11300	8900
80	16100	13700	11400
75	18100	16300	14000
70	20200	18500	16300
65	21800	20600	18600
60	23400	22300	20700
55	25300	24100	22700
50	28100	26700	24800
45	30700	29700	28100
40	33200	32300	31100

With engine anti-ice on, decrease altitude capability by 2100 ft.
With engine and wing anti-ice on, decrease altitude capability by 5700 ft.

ENGINE INOP

Long Range Cruise Control

WEIGHT (1000 KG)		PRESSURE ALTITUDE (1000 FT)							
		10	14	18	22	25	27	29	31
85	%N1	92.5	95.7						
	MACH	.561	.593						
	KIAS	311	306						
	FF/ENG	3152	3144						
80	%N1	90.8	94.2	98.5					
	MACH	.545	.585	.612					
	KIAS	302	302	292					
	FF/ENG	2951	2983	2973					
75	%N1	89.0	92.4	96.2					
	MACH	.528	.569	.599					
	KIAS	293	293	286					
	FF/ENG	2751	2781	2756					
70	%N1	87.1	90.6	94.1					
	MACH	.510	.551	.589					
	KIAS	282	284	281					
	FF/ENG	2552	2581	2578					
65	%N1	85.1	88.5	92.0	96.3				
	MACH	.491	.532	.574	.604				
	KIAS	271	273	274	266				
	FF/ENG	2356	2381	2394	2388				
60	%N1	82.9	86.3	89.9	93.8				
	MACH	.471	.511	.553	.590				
	KIAS	261	262	263	260				
	FF/ENG	2168	2183	2196	2192				
55	%N1	80.7	83.9	87.5	91.2	94.5	97.7		
	MACH	.453	.488	.530	.574	.597	.614		
	KIAS	250	250	252	252	247	244		
	FF/ENG	1991	1987	1998	2009	2010	2060		
50	%N1	78.3	81.4	84.9	88.5	91.7	94.0	97.1	
	MACH	.434	.466	.505	.549	.583	.596	.613	
	KIAS	240	239	240	241	241	236	233	
	FF/ENG	1822	1803	1801	1811	1831	1829	1873	
45	%N1	75.9	78.8	82.0	85.7	88.4	90.6	93.2	96.2
	MACH	.415	.444	.478	.522	.556	.578	.593	.610
	KIAS	229	227	227	229	229	229	225	222
	FF/ENG	1661	1629	1608	1615	1627	1647	1649	1683
40	%N1	73.4	76.0	79.1	82.5	85.2	87.1	89.2	91.8
	MACH	.395	.422	.453	.491	.525	.548	.571	.589
	KIAS	218	216	215	215	216	216	216	214
	FF/ENG	1506	1466	1434	1422	1432	1445	1461	1470

ENGINE INOP

MAX CONTINUOUS THRUST

Long Range Cruise Diversion Fuel and Time

Ground to Air Miles Conversion

AIR DISTANCE (NM)					GROUND DISTANCE (NM)	AIR DISTANCE (NM)				
HEADWIND COMPONENT (KTS)						TAILWIND COMPONENT (KTS)				
100	80	60	40	20		20	40	60	80	100
309	279	253	233	215	200	190	180	172	164	157
625	564	511	467	432	400	379	360	342	326	312
943	850	769	703	648	600	568	540	513	489	468
1263	1137	1028	939	865	800	758	719	683	652	623
1586	1426	1287	1175	1082	1000	947	898	853	813	778
1912	1717	1548	1412	1299	1200	1136	1076	1023	975	932
2240	2009	1810	1649	1517	1400	1324	1255	1192	1136	1086
2570	2304	2074	1888	1735	1600	1513	1434	1362	1297	1240
2903	2600	2337	2127	1953	1800	1702	1613	1531	1458	1393

Reference Fuel and Time Required at Check Point

AIR DIST (NM)	PRESSURE ALTITUDE (1000 FT)									
	10		14		18		22		26	
	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)
200	1.3	0:46	1.1	0:43	1.0	0:41	0.9	0:39	0.8	0:38
400	2.7	1:30	2.4	1:25	2.2	1:20	2.0	1:15	1.9	1:12
600	4.0	2:14	3.7	2:07	3.4	2:00	3.1	1:52	2.9	1:46
800	5.3	3:00	4.9	2:50	4.5	2:40	4.2	2:29	4.0	2:21
1000	6.7	3:45	6.1	3:33	5.7	3:20	5.3	3:07	5.0	2:56
1200	8.0	4:32	7.3	4:17	6.8	4:01	6.3	3:45	6.0	3:31
1400	9.3	5:18	8.6	5:01	7.9	4:42	7.4	4:23	7.0	4:07
1600	10.5	6:06	9.7	5:45	9.0	5:24	8.4	5:02	7.9	4:43
1800	11.8	6:54	10.9	6:31	10.1	6:07	9.4	5:42	8.9	5:20

Fuel Required Adjustments (1000 KG)

REFERENCE FUEL REQUIRED (1000 KG)	WEIGHT AT CHECK POINT (1000 KG)								
	40	45	50	55	60	65	70	75	80
1	-0.1	0.0	0.0	0.0	0.1	0.2	0.3	0.4	0.5
2	-0.1	-0.1	0.0	0.1	0.3	0.5	0.7	0.9	1.2
3	-0.2	-0.1	0.0	0.2	0.4	0.7	1.0	1.4	1.8
4	-0.3	-0.2	0.0	0.3	0.6	1.0	1.4	1.9	2.4
5	-0.4	-0.2	0.0	0.3	0.7	1.2	1.8	2.4	3.0
6	-0.5	-0.2	0.0	0.4	0.9	1.4	2.1	2.8	3.6
7	-0.6	-0.3	0.0	0.4	1.0	1.6	2.4	3.2	4.2
8	-0.6	-0.3	0.0	0.5	1.1	1.9	2.7	3.6	4.7
9	-0.7	-0.4	0.0	0.6	1.2	2.0	3.0	4.0	5.2
10	-0.8	-0.4	0.0	0.6	1.4	2.2	3.2	4.4	5.6
11	-0.9	-0.4	0.0	0.7	1.5	2.4	3.5	4.7	6.1
12	-1.0	-0.5	0.0	0.7	1.6	2.6	3.7	5.0	6.5
13	-1.0	-0.5	0.0	0.8	1.7	2.7	3.9	5.3	6.9
14	-1.1	-0.6	0.0	0.8	1.8	2.8	4.1	5.6	7.2

Includes APU fuel burn.

ENGINE INOP

MAX CONTINUOUS THRUST

Holding
Flaps Up

WEIGHT (1000 KG)		PRESSURE ALTITUDE (FT)							
		1500	5000	10000	15000	20000	25000	30000	35000
85	%N1	82.0	84.9	89.2	94.1				
	KIAS	252	253	254	255				
	FF/ENG	2820	2830	2850	2920				
80	%N1	80.3	83.2	87.5	92.0				
	KIAS	244	245	246	247				
	FF/ENG	2650	2650	2660	2710				
75	%N1	78.6	81.4	85.6	90.1	96.9			
	KIAS	236	238	238	239	241			
	FF/ENG	2490	2480	2480	2520	2620			
70	%N1	76.7	79.4	83.7	88.1	93.6			
	KIAS	229	229	230	231	233			
	FF/ENG	2330	2310	2310	2330	2380			
65	%N1	74.7	77.5	81.6	85.9	90.7			
	KIAS	221	221	222	223	224			
	FF/ENG	2160	2150	2130	2150	2170			
60	%N1	72.5	75.4	79.4	83.7	88.3	95.6		
	KIAS	211	212	213	214	215	216		
	FF/ENG	2000	1980	1970	1970	1980	2080		
55	%N1	70.1	73.0	77.0	81.3	85.8	91.4		
	KIAS	202	203	203	204	205	207		
	FF/ENG	1850	1820	1800	1790	1790	1840		
50	%N1	67.7	70.4	74.5	78.7	83.2	87.9	96.7	
	KIAS	192	193	194	195	195	197	198	
	FF/ENG	1690	1660	1640	1630	1620	1630	1780	
45	%N1	64.9	67.6	71.7	75.8	80.3	84.9	91.2	
	KIAS	185	185	185	185	185	186	187	
	FF/ENG	1540	1510	1480	1470	1450	1450	1510	
40	%N1	61.8	64.6	68.5	72.8	77.0	81.6	86.5	96.3
	KIAS	178	178	178	178	178	178	178	178
	FF/ENG	1380	1360	1330	1310	1280	1280	1310	1440

This table includes 5% additional fuel for holding in a racetrack pattern.

ENGINE INOP

ADVISORY INFORMATION

Gear Down Landing Rate of Climb Available

Flaps 15

TAT (°C)	RATE OF CLIMB (FT/MIN)					
	PRESSURE ALTITUDE (FT)					
	-2000	0	2000	4000	6000	8000
52	-110	-180				
50	-80	-150	-250			
48	-50	-120	-230			
46	-20	-100	-200	-310		
44	0	-70	-180	-280		
42	30	-40	-150	-260	-380	
40	60	-10	-120	-230	-350	
38	90	20	-90	-200	-320	-470
36	100	50	-60	-180	-300	-440
34	100	80	-40	-160	-280	-420
32	100	90	-20	-140	-260	-400
30	110	100	10	-120	-250	-380
20	120	110	20	-90	-210	-320
10	130	110	20	-90	-210	-320
0	140	120	30	-90	-200	-320
-20	150	130	30	-90	-210	-330
-40	160	140	40	-80	-210	-340

Rate of climb capability shown is valid for 60000 kg, gear down at VREF15+5.
Decrease rate of climb 130 ft/min per 5000 kg greater than 60000 kg.
Increase rate of climb 170 ft/min per 5000 kg less than 60000 kg.

Flaps 30

TAT (°C)	RATE OF CLIMB (FT/MIN)					
	PRESSURE ALTITUDE (FT)					
	-2000	0	2000	4000	6000	8000
52	-300	-360				
50	-270	-340	-440			
48	-240	-310	-420			
46	-220	-290	-390	-500		
44	-190	-260	-370	-480		
42	-160	-230	-340	-450	-570	
40	-140	-210	-320	-430	-550	
38	-110	-180	-290	-400	-520	-670
36	-100	-150	-260	-380	-500	-640
34	-90	-120	-240	-360	-480	-620
32	-90	-110	-220	-340	-460	-600
30	-90	-100	-200	-330	-450	-580
20	-80	-100	-190	-300	-410	-530
10	-80	-90	-190	-300	-410	-530
0	-70	-90	-190	-300	-420	-530
-20	-70	-90	-190	-310	-430	-550
-40	-70	-90	-190	-310	-440	-570

Rate of climb capability shown is valid for 60000 kg, gear down at VREF30+5.
Decrease rate of climb 130 ft/min per 5000 kg greater than 60000 kg.
Increase rate of climb 170 ft/min per 5000 kg less than 60000 kg.

ALTERNATE MODE EEC

Alternate Mode EEC Limit Weight

PERFORMANCE LIMIT	NORMAL MODE PERFORMANCE LIMIT WEIGHT (1000 KG)										
	44	48	52	56	60	64	68	72	76	80	84
FIELD	41.8	45.6	49.5	53.3	57.0	60.8	64.2	68.4	72.2	75.9	79.8
CLIMB	41.1	44.9	48.6	52.4	56.1	60.0	63.6	67.3	71.1	74.3	78.6
OBSTACLE	41.3	45.1	48.8	52.6	56.3	60.1	63.7	67.4	71.1	74.7	78.6

Alternate Mode EEC Takeoff Speed Adjustment

TAKEOFF SPEEDS	TAKEOFF SPEED ADJUSTMENT (KTS)
DRY V1	+1
WET V1	+2
VR	+1
V2	0

Alternate Mode EEC Max Takeoff %N1

Based on engine bleeds for packs on, engine and wing anti-ice on or off

AIRPORT OAT		AIRPORT PRESSURE ALTITUDE (FT)										
°C	°F	-2000	0	1000	2000	3000	4000	5000	6000	7000	8000	9000
60	140	92.6	93.6	93.7	93.8	93.9	94.0	94.1	94.0	93.7	93.6	93.5
55	131	93.2	94.3	94.4	94.5	94.6	94.7	94.9	94.7	94.4	94.1	93.7
50	122	93.8	95.0	95.1	95.2	95.4	95.5	95.6	95.5	95.2	94.9	94.4
45	113	94.5	95.7	95.8	95.9	96.1	96.2	96.3	96.2	95.9	95.6	95.3
40	104	95.2	96.4	96.5	96.6	96.7	96.8	97.0	96.8	96.6	96.3	96.2
35	95	95.7	97.2	97.3	97.4	97.5	97.6	97.7	97.6	97.3	97.0	96.9
30	86	95.4	97.7	98.0	98.2	98.1	98.3	98.2	98.2	98.0	97.8	97.7
25	77	94.6	97.3	97.9	98.3	98.3	98.5	98.5	98.5	98.5	98.3	98.3
20	68	93.8	96.6	97.1	97.7	98.0	98.3	98.5	98.6	98.7	98.6	98.6
15	59	93.0	95.8	96.4	97.0	97.3	97.6	97.9	98.3	98.7	98.8	98.8
10	50	92.3	95.0	95.6	96.2	96.5	96.8	97.2	97.5	97.9	98.3	98.8
5	41	91.5	94.2	94.8	95.4	95.8	96.1	96.4	96.8	97.2	97.6	98.1
0	32	90.7	93.4	94.1	94.7	95.0	95.3	95.7	96.0	96.4	96.8	97.3
-5	23	89.8	92.6	93.3	93.9	94.2	94.5	94.9	95.3	95.7	96.1	96.5
-10	14	89.0	91.8	92.5	93.1	93.4	93.7	94.1	94.5	94.9	95.3	95.8
-15	5	88.2	91.0	91.7	92.3	92.6	93.0	93.4	93.7	94.1	94.5	95.0
-20	-4	87.4	90.2	90.8	91.5	91.8	92.2	92.6	93.0	93.4	93.7	94.2
-25	-13	86.5	89.4	90.0	90.7	91.0	91.4	91.8	92.2	92.6	93.0	93.4
-30	-22	85.7	88.5	89.2	89.8	90.2	90.6	91.0	91.4	91.8	92.2	92.6
-35	-31	84.8	87.7	88.3	89.0	89.4	89.7	90.2	90.6	90.9	91.3	91.8
-40	-40	83.9	86.8	87.5	88.1	88.5	88.9	89.3	89.7	90.1	90.5	90.9
-45	-49	83.1	86.0	86.6	87.3	87.7	88.1	88.5	88.9	89.3	89.7	90.1
-50	-58	82.2	86.0	85.7	86.4	86.8	87.2	87.7	88.1	88.5	88.8	89.3
-55	-67	81.3	86.0	84.9	85.6	86.0	86.4	86.8	87.2	87.6	88.0	88.4

%N1 Adjustments for Engine Bleed

BLEED CONFIGURATION	AIRPORT PRESSURE ALTITUDE (FT)										
	-2000	0	1000	2000	3000	4000	5000	6000	7000	8000	9000
PACKS OFF	0.7	0.8	0.9	0.9	0.9	1.0	1.0	1.0	1.0	1.0	1.0

Intentionally
Blank

Performance Inflight — Chapter PI

Gear Down — Section 45

GEAR DOWN

Long Range Cruise Altitude Capability

Max Cruise Thrust, 100 ft/min residual rate of climb

WEIGHT (1000 KG)	PRESSURE ALTITUDE (FT)		
	ISA + 10°C & BELOW	ISA + 15°C	ISA + 20°C
85	14600	11500	8500
80	17400	14600	11700
75	20300	17600	14900
70	22800	20500	17800
65	25400	23500	20900
60	27800	26300	24400
55	30200	29000	27300
50	32300	31300	30100
45	34500	33500	32400
40	36900	36000	34900

Long Range Cruise Control

WEIGHT (1000 KG)		PRESSURE ALTITUDE (1000 FT)									
		10	21	23	25	27	29	31	33	35	37
80	%N1	84.8									
	MACH	.468									
	KIAS	259									
	FF/ENG	2313									
70	%N1	81.1	90.4	92.6							
	MACH	.440	.541	.557							
	KIAS	243	242	240							
	FF/ENG	2010	2004	2002							
60	%N1	76.9	86.2	88.0	89.8	92.3	95.7				
	MACH	.409	.504	.525	.544	.562	.580				
	KIAS	226	225	225	224	222	220				
	FF/ENG	1722	1694	1696	1697	1709	1756				
50	%N1	72.3	81.2	83.0	84.8	86.6	88.5	91.1	94.7		
	MACH	.376	.463	.482	.502	.523	.544	.561	.580		
	KIAS	207	206	206	206	206	205	203	201		
	FF/ENG	1443	1395	1392	1394	1403	1409	1418	1461		
40	%N1	66.6	75.3	77.0	78.8	80.5	82.3	84.2	86.1	88.6	92.5
	MACH	.340	.417	.434	.452	.471	.491	.513	.535	.554	.573
	KIAS	187	185	185	185	185	185	185	185	183	181
	FF/ENG	1184	1114	1102	1102	1108	1112	1115	1119	1125	1160

GEAR DOWN

Long Range Cruise Enroute Fuel and Time

Ground to Air Miles Conversion

AIR DISTANCE (NM)					GROUND DISTANCE (NM)	AIR DISTANCE (NM)				
HEADWIND COMPONENT (KTS)						TAILWIND COMPONENT (KTS)				
100	80	60	40	20		20	40	60	80	100
327	291	260	236	217	200	188	177	167	159	152
657	585	524	475	435	400	377	356	337	320	305
992	882	788	714	653	600	565	534	505	480	458
1331	1182	1055	954	872	800	754	712	674	640	610
1676	1486	1323	1195	1091	1000	942	889	842	799	762
2026	1792	1593	1436	1310	1200	1130	1066	1009	958	913
2382	2103	1865	1680	1530	1400	1318	1244	1176	1116	1064
2744	2418	2140	1924	1751	1600	1506	1420	1342	1274	1214
3112	2737	2418	2171	1972	1800	1694	1597	1510	1432	1364

Reference Fuel and Time Required at Check Point

AIR DIST (NM)	PRESSURE ALTITUDE (1000 FT)									
	10		14		20		24		28	
	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)
200	2.4	0:49	2.2	0:47	1.9	0:44	1.8	0:42	1.6	0:41
400	5.0	1:36	4.6	1:31	4.1	1:24	3.8	1:20	3.6	1:17
600	7.5	2:25	7.0	2:17	6.2	2:06	5.8	1:59	5.5	1:54
800	9.9	3:14	9.2	3:03	8.3	2:48	7.7	2:38	7.4	2:31
1000	12.3	4:05	11.5	3:51	10.3	3:31	9.7	3:18	9.2	3:08
1200	14.6	4:56	13.7	4:39	12.3	4:14	11.5	3:59	11.0	3:46
1400	16.9	5:49	15.8	5:28	14.2	4:59	13.3	4:40	12.7	4:24
1600	19.1	6:43	17.9	6:19	16.1	5:44	15.1	5:22	14.4	5:04
1800	21.3	7:39	19.9	7:11	18.0	6:30	16.9	6:05	16.1	5:43

Fuel Required Adjustments (1000 KG)

REFERENCE FUEL REQUIRED (1000 KG)	WEIGHT AT CHECK POINT (1000 KG)				
	40	50	60	70	80
2	-0.3	-0.2	0.0	0.3	0.7
4	-0.7	-0.3	0.0	0.7	1.5
6	-1.0	-0.5	0.0	1.0	2.2
8	-1.4	-0.7	0.0	1.2	2.8
10	-1.7	-0.9	0.0	1.5	3.4
12	-2.0	-1.0	0.0	1.8	4.0
14	-2.4	-1.2	0.0	2.0	4.5
16	-2.7	-1.4	0.0	2.2	4.9
18	-3.1	-1.5	0.0	2.4	5.3
20	-3.4	-1.7	0.0	2.5	5.7
22	-3.8	-1.9	0.0	2.6	6.0

GEAR DOWN

Descent
VREF40 + 70 KIAS

PRESSURE ALTITUDE (FT)	TIME (MIN)	FUEL (KG)	DISTANCE (NM)
41000	20	270	88
39000	20	270	84
37000	19	260	79
35000	18	260	75
33000	18	250	71
31000	17	250	67
29000	16	240	63
27000	15	240	59
25000	15	230	55
23000	14	220	51
21000	13	220	47
19000	12	210	43
17000	11	200	39
15000	11	190	35
10000	8	170	25
5000	6	130	16
1500	4	110	9

Allowances for a straight-in approach are included.

GEAR DOWN

Holding
Flaps Up

WEIGHT (1000 KG)		PRESSURE ALTITUDE (FT)							
		1500	5000	10000	15000	20000	25000	30000	35000
80	%N1	74.8	77.5	81.8	86.1	90.8			
	KIAS	225	225	225	225	225			
	FF/ENG	2160	2150	2140	2160	2170			
75	%N1	73.1	76.0	80.0	84.4	89.0			
	KIAS	220	220	220	220	220			
	FF/ENG	2040	2030	2010	2020	2030			
70	%N1	71.3	74.3	78.2	82.5	87.1	93.1		
	KIAS	216	216	216	216	216	216		
	FF/ENG	1920	1900	1890	1890	1890	1940		
65	%N1	69.5	72.4	76.4	80.7	85.1	90.2		
	KIAS	211	211	211	211	211	211		
	FF/ENG	1800	1780	1770	1760	1750	1780		
60	%N1	67.5	70.3	74.5	78.6	83.1	87.7	95.7	
	KIAS	204	204	204	204	204	204	204	
	FF/ENG	1680	1660	1640	1630	1620	1630	1740	
55	%N1	65.5	68.2	72.4	76.4	80.9	85.5	91.6	
	KIAS	198	198	198	198	198	198	198	
	FF/ENG	1570	1540	1520	1500	1490	1490	1550	
50	%N1	63.3	66.0	70.0	74.2	78.5	83.0	87.9	
	KIAS	192	192	192	192	192	192	192	
	FF/ENG	1450	1430	1400	1380	1360	1360	1390	
45	%N1	60.8	63.7	67.6	71.8	76.0	80.5	85.1	92.6
	KIAS	185	185	185	185	185	185	185	185
	FF/ENG	1330	1310	1290	1270	1240	1230	1250	1320
40	%N1	58.2	61.0	65.0	69.1	73.4	77.7	82.2	87.7
	KIAS	178	178	178	178	178	178	178	178
	FF/ENG	1220	1200	1170	1150	1130	1110	1120	1140

This table includes 5% additional fuel for holding in a racetrack pattern.

Performance Inflight — Chapter PI
Gear Down, Engine Inop — Section 46

GEAR DOWN
ENGINE INOP

MAX CONTINUOUS THRUST

Driftdown Speed/Level Off Altitude

100 ft/min residual rate of climb

WEIGHT (1000 KG)		OPTIMUM DRIFTDOWN SPEED (KIAS)	LEVEL OFF ALTITUDE (FT)		
START DRIFTDOWN	LEVEL OFF		ISA + 10°C & BELOW	ISA + 15°C	ISA + 20°C
80	76	224	3000	1300	
75	71	219	5400	4000	2000
70	67	215	7800	6400	4600
65	62	210	10200	9000	7300
60	57	204	12500	11600	10200
55	53	198	15000	14100	13200
50	48	192	17500	16700	15900
45	43	185	20100	19300	18400
40	38	178	22600	21800	21000

Includes APU fuel burn.

Long Range Cruise Altitude Capability

100 ft/min residual rate of climb

WEIGHT (1000 KG)	PRESSURE ALTITUDE (FT)		
	ISA + 10°C & BELOW	ISA + 15°C	ISA + 20°C
75	700		
70	3800	1600	
65	6800	5200	2600
60	10000	8400	6200
55	12700	11600	9800
50	15600	14800	13700
45	18700	17800	17000
40	21800	20900	20000

GEAR DOWN

ENGINE INOP

MAX CONTINUOUS THRUST

Long Range Cruise Control

WEIGHT (1000 KG)		PRESSURE ALTITUDE (1000 FT) 5	7	9	11	13	15	17	19	21
70	%N1	95.5								
	MACH	.389								
	KIAS	235								
	FF/ENG	3850								
65	%N1	93.1	95.0							
	MACH	.376	.389							
	KIAS	228	227							
	FF/ENG	3544	3556							
60	%N1	90.7	92.4	94.3	97.3					
	MACH	.364	.375	.388	.402					
	KIAS	220	219	218	218					
	FF/ENG	3250	3252	3263	3326					
55	%N1	88.2	89.8	91.6	93.5	96.4				
	MACH	.351	.362	.374	.387	.400				
	KIAS	212	211	210	209	209				
	FF/ENG	2973	2961	2961	2971	3027				
50	%N1	85.7	87.2	88.7	90.5	92.3	95.1	99.5		
	MACH	.338	.348	.359	.371	.384	.398	.412		
	KIAS	204	203	202	201	200	199	198		
	FF/ENG	2714	2691	2676	2674	2684	2722	2824		
45	%N1	83.1	84.4	85.9	87.4	89.1	90.9	93.5	97.7	
	MACH	.325	.334	.344	.355	.367	.380	.393	.408	
	KIAS	196	195	193	192	191	190	189	189	
	FF/ENG	2468	2437	2412	2396	2393	2396	2411	2489	
40	%N1	80.2	81.5	82.9	84.3	85.8	87.5	89.3	91.5	95.1
	MACH	.311	.320	.329	.339	.349	.361	.374	.387	.402
	KIAS	188	186	184	183	182	181	180	179	179
	FF/ENG	2234	2196	2164	2139	2122	2113	2106	2107	2160

GEAR DOWN
ENGINE INOP
MAX CONTINUOUS THRUST

Long Range Cruise Diversion Fuel and Time
Ground to Air Miles Conversion

AIR DISTANCE (NM)					GROUND DISTANCE (NM)	AIR DISTANCE (NM)				
HEADWIND COMPONENT (KTS)						TAILWIND COMPONENT (KTS)				
100	80	60	40	20		20	40	60	80	100
167	148	132	119	109	100	94	88	82	78	74
341	300	266	239	218	200	187	174	164	155	147
516	454	402	361	328	300	280	261	245	231	219
692	608	537	482	438	400	373	348	326	307	291
869	763	673	603	548	500	465	434	407	383	363
1048	919	809	725	658	600	558	521	488	459	434
1228	1076	947	847	768	700	651	607	568	535	506
1410	1234	1084	970	879	800	744	693	648	610	577
1593	1392	1222	1092	989	900	836	779	729	685	648
1778	1552	1361	1215	1100	1000	929	865	809	760	719

Reference Fuel and Time Required at Check Point

AIR DIST (NM)	PRESSURE ALTITUDE (1000 FT)					
	6		10		14	
	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)
100	1.3	0:27	1.1	0:26	1.1	0:26
200	2.6	0:53	2.4	0:50	2.4	0:48
300	4.0	1:18	3.7	1:15	3.7	1:11
400	5.3	1:44	5.0	1:39	4.9	1:35
500	6.6	2:10	6.2	2:04	6.1	1:58
600	7.9	2:37	7.5	2:29	7.3	2:22
700	9.2	3:04	8.7	2:55	8.5	2:46
800	10.5	3:31	9.9	3:20	9.7	3:10
900	11.7	3:58	11.1	3:46	10.8	3:35
1000	13.0	4:25	12.2	4:12	11.9	4:00

Fuel Required Adjustments (1000 KG)

REFERENCE FUEL REQUIRED (1000 KG)	WEIGHT AT CHECK POINT (1000 KG)				
	40	50	60	70	80
1	-0.2	-0.1	0.0	0.1	0.3
2	-0.4	-0.2	0.0	0.3	0.6
3	-0.5	-0.3	0.0	0.5	1.0
4	-0.7	-0.4	0.0	0.7	1.3
5	-0.9	-0.5	0.0	0.9	1.7
6	-1.1	-0.6	0.0	1.1	2.0
7	-1.3	-0.7	0.0	1.2	2.4
8	-1.4	-0.7	0.0	1.4	2.7
9	-1.6	-0.8	0.0	1.6	3.1
10	-1.8	-0.9	0.0	1.8	3.4
11	-2.0	-1.0	0.0	1.9	3.8
12	-2.2	-1.1	0.0	2.1	4.1
13	-2.3	-1.2	0.0	2.2	4.5

Includes APU fuel burn.

GEAR DOWN

ENGINE INOP

MAX CONTINUOUS THRUST

Holding

Flaps Up

WEIGHT (1000 KG)		PRESSURE ALTITUDE (FT)			
		1500	5000	10000	15000
80	%N1	94.1			
	KIAS	225			
	FF/ENG	4240			
75	%N1	92.1	95.5		
	KIAS	220	220		
	FF/ENG	3960	4010		
70	%N1	90.0	93.3		
	KIAS	216	216		
	FF/ENG	3680	3730		
65	%N1	88.0	91.1	97.0	
	KIAS	211	211	211	
	FF/ENG	3430	3450	3560	
60	%N1	85.8	88.8	93.6	
	KIAS	204	204	204	
	FF/ENG	3170	3180	3230	
55	%N1	83.5	86.4	91.0	98.4
	KIAS	198	198	198	198
	FF/ENG	2920	2920	2940	3110
50	%N1	80.9	83.9	88.3	93.6
	KIAS	192	192	192	192
	FF/ENG	2670	2660	2670	2730
45	%N1	78.3	81.2	85.5	90.2
	KIAS	185	185	185	185
	FF/ENG	2440	2420	2420	2450
40	%N1	75.6	78.3	82.6	87.1
	KIAS	178	178	178	178
	FF/ENG	2210	2190	2170	2180

This table includes 5% additional fuel for holding in a racetrack pattern.

Performance Inflight — Chapter PI
Text — Section 47

Introduction

This chapter contains information to supplement performance data from the Flight Management Computer (FMC). In addition, sufficient inflight data is provided to complete a flight with the FMC inoperative. In the event of conflict between data presented in this chapter and that contained in the approved Airplane Flight Manual, the Flight Manual shall always take precedence.

General

Takeoff Speeds

The speeds presented in the Takeoff Speeds table as well as FMC computed takeoff speeds can be used for all performance conditions except where adjustments must be made for anti-skid inoperative, thrust reversers inoperative, improved climb, contaminated runway situations, or brake energy limits.

V1 adjustments are not necessary for equal amounts of clearway and stopway. V1 for takeoff limit weights based on unequal clearway and stopway should be obtained from computerized takeoff speeds calculations for the specific takeoff conditions.

These speeds may be used for weights less than or equal to the performance limited weight subject to the restrictions noted above.

The FMC will protect for minimum control speeds by increasing V1, VR and V2 as required. However, the FMC will not compute takeoff speeds for weights where the required speed increase exceeds the maximum certified speed increase. This typically occurs at full rated thrust and light weights. In this case, the message "V SPEEDS UNAVAILABLE" will appear on the FMC scratchpad and the takeoff speed entries will be blank. In this situation, manually verify takeoff speeds using an approved source of takeoff performance information. Upon verifying the takeoff speeds, takeoff is permitted. When selected takeoff speeds cannot be verified, the options are to select a lower number flap setting, select derate thrust and/or increase airplane gross weight (e.g. add fuel). Selecting derate thrust is the preferred method as this will reduce the minimum control speeds. Note that the assumed temperature method will not help this condition as the minimum control speeds are determined at the actual temperature and therefore are not reduced by an assumed temperature selection.

Normal takeoff speeds, V1, VR, and V2 are read from either the dry or wet table by entering with takeoff flap setting and brake release weight. Use the tables provided to adjust takeoff speeds for altitude and actual temperature or assumed temperature for reduced thrust takeoffs. Slope and wind adjustments to V1 are obtained by entering the Slope and Wind V1 Adjustment table.

V1(MCG)

Regulations prohibit scheduling takeoff with a V1 less than minimum V1 for control on the ground, V1(MCG). It is therefore necessary to compare the adjusted V1 to V1(MCG). The V1(MCG) presented in this manual is conservative for all weight and bleed configurations.

To find V1(MCG) enter the V1(MCG) table with the airport pressure altitude and actual OAT. If the adjusted V1 is less than V1(MCG), set V1 equal to V1(MCG). If the adjusted VR is less than V1(MCG), set VR equal to V1(MCG), and determine a new V2 by adding the difference between the normal VR and V1(MCG) to the normal V2. No takeoff weight adjustment is necessary provided that the actual field length exceeds the minimum field length shown in the Field and Climb Limit Weight table in chapter Performance Dispatch.

Stab Trim

To find takeoff stabilizer trim setting, enter Stab Trim Setting table with anticipated brake release weight and center of gravity (C.G. % MAC) and read required stabilizer trim units.

VREF

This table contains flaps 40, 30 and 15 reference speeds for a given weight.

Flap Maneuver Speeds

This table provides flap maneuver speeds for various flap settings. During flap retraction, selection of the next flap position is initiated when reaching the maneuver speed for the existing flap position. During flap retraction, at least adequate maneuver capability or 30° of bank (15° of bank and 15° overshoot) to stick shaker is provided at the flap retraction speed. Full maneuver capability or at least 40° of bank (25° of bank and 15° overshoot) is provided when the airplane has accelerated to the recommended maneuver speed for the selected flap position.

During flap extension, selection of the flaps to the next flap position should be made when approaching, and before decelerating below, the maneuver speed for the existing flap position. The flap extension speed schedule varies with airplane weight and provides full maneuver capability or at least 40° of bank (25° of bank and 15° overshoot) to stick shaker at all weights.

Slush/Standing Water Takeoff

Experience has shown that aircraft performance may deteriorate significantly on runways covered with snow, slush, standing water or ice. Therefore, reductions in field/obstacle limited takeoff weight and revised takeoff speeds are necessary. The tables are intended for guidance in accordance with advisory material and assume an engine failure at the critical point during the takeoff.

The entire runway is assumed to be completely covered by a contaminant of uniform thickness and density. Therefore this information is conservative when operating under typical cold weather conditions where patches of slush exist and some degree of sanding is common. Takeoffs in slush or standing water depths greater than 13 mm (0.5 inches) are not recommended because of possible airplane damage as a result of spray impingement on the airplane structure. The use of assumed temperature for reduced thrust is not allowed on contaminated runways. Interpolation for slush/standing water depths between the values shown is permitted.

Takeoff weight determination:

1. Enter the Weight Adjustment table with the dry field/obstacle limit weight to obtain the weight reduction for the slush/standing water depth and airport pressure altitude.
2. Adjust field length available for temperature by amount shown beneath V1(MCG) limit weight table.
3. Enter the V1(MCG) Limit Weight table with the adjusted field length and pressure altitude to obtain the slush/standing water limit weight with respect to minimum field length required for V1(MCG) speed.
4. The maximum allowable takeoff weight in slush/standing water is the lesser of the limit weights found in steps 1 and 3.

Takeoff speed determination:

1. Determine takeoff speeds V1, VR and V2 for actual brake release weight using the Dry Runway Takeoff Speeds table for the appropriate flap setting and thrust rating.
2. If V1(MCG) limited, set V1=V1(MCG). If not limited by V1(MCG) considerations, enter the V1 Adjustment table with actual brake release weight to determine the V1 reduction to apply to V1 speed. If the adjusted V1 is less than V1(MCG), set V1=V1(MCG).

Slippery Runway Takeoff

Airplane braking action is reported as good, medium or poor, depending on existing runway conditions. If braking action is reported as good, conditions should not be expected to be as good as on clean, dry runways. The value “good” is comparative and is intended to mean that airplanes should not experience braking or directional control difficulties when stopping. The performance level used to calculate the “good” data is consistent with wet runway testing done on early Boeing jets. The performance level used to calculate the “poor” data reflects a runway covered with wet ice. Performance is based on a 15 ft screen height at the end of the runway. The tables provided are used in the same manner as the Slush/Standing Water tables.

Anti-Skid Inoperative

When operating with anti-skid inoperative, the field limit weight and V1 must be reduced to account for the effect on accelerate-stop performance. Anti-skid inoperative is only allowed on a dry runway. A simplified method which conservatively accounts for the effects of anti-skid inoperative is to reduce the normal dry field/obstacle limited weight by 8500 kg and the V1 associated with the reduced weight by the amount shown in the table below.

ANTI-SKID INOPERATIVE V1 ADJUSTMENTS	
FIELD LENGTH (M)	V1 ADJUSTMENT (KIAS)
2000	-19
2500	-16
3000	-14
3500	-12
4000	-11

If the resulting V1 is less than V1(MCG), takeoff is permitted with V1 set equal to V1(MCG) provided the dry accelerate-stop distance adjusted for wind and slope exceeds approximately 1800 m.

Detailed analysis for the specific case from the Airplane Flight Manual may yield a less restrictive penalty.

Thrust Reverser Inoperative

When dispatching on a wet runway with both thrust reversers operative, an operative anti-skid system, and all brakes operating, regulations allow deceleration credit for one thrust reverser in the engine failure case and two thrust reversers in the all engine stop case.

When dispatching on a wet runway with one thrust reverser inoperative, the field/obstacle limited weight and V1 must be reduced to account for the effect on accelerate-stop performance. A simplified method, which conservatively accounts for this, is to reduce the normal wet runway/field/obstacle limited weight by 1050 kg and the V1 associated with the reduced weight by 2 knots.

If the resulting V1 is less than minimum V1, takeoff is permitted with V1 set equal to V1(MCG) provided the accelerate-stop distance available adjusted for wind and slope exceeds approximately 1200 m.

Detailed analysis for the specific case from the Airplane Flight Manual may yield a less restrictive penalty.

Takeoff %N1

To find Max Takeoff %N1 based on normal engine bleed for air conditioning packs on, enter Takeoff %N1 Table with airport pressure altitude and airport OAT and read %N1. Apply %N1 adjustments as provided when applicable.

Assumed Temperature Reduced Thrust

Regulations permit the use of up to 25% takeoff thrust reduction for operation with assumed temperature reduced thrust. Use of assumed temperature reduced thrust is not allowed with anti-skid inoperative or on runways contaminated with standing water, ice, slush, or snow. Use of assumed temperature reduced thrust is not recommended if potential windshear conditions exist.

To find the maximum allowable assumed temperature enter the Maximum Assumed Temperature table with airport pressure altitude and OAT. Compare this temperature to that at which the airplane is performance limited as determined from available takeoff performance data. Next, enter the Maximum Takeoff %N1 table with airport pressure altitude and the lower of the two temperatures previously determined, to obtain a maximum takeoff %N1. Do not use an assumed temperature less than the minimum assumed temperature shown. Enter the %N1 Adjustment table with OAT and the difference between the assumed and actual OAT to obtain a %N1 adjustment. Subtract the %N1 adjustment from the maximum takeoff %N1 found previously to determine the assumed temperature reduced thrust %N1.

Apply %N1 adjustments as provided when applicable.

Max Climb %N1

This table shows Max Climb %N1 for a 280/.78 climb speed schedule, normal engine bleed for packs on or off and anti-ice off. Enter the table with airport pressure altitude and TAT and read %N1. %N1 adjustments are shown for anti-ice operation.

Go-around %N1

To find Max Go-around %N1 based on normal engine bleed for packs on (AUTO) and anti-ice on or off, enter the Go-around %N1 table with airport pressure altitude and reported OAT or TAT and read %N1. For packs OFF or HIGH operation, apply the %N1 adjustment shown below the table.

Flight with Unreliable Airspeed / Turbulent Air Penetration

Pitch attitude and average %N1 information is provided for use in all phases of flight in the event of unreliable airspeed/Mach indications resulting from blocking or freezing of the pitot system. Loss of radome or turbulent air may also cause unreliable airspeed/Mach indications. The cruise table in this section may also be used for turbulent air penetration.

Pitch attitude is shown in bold type for emphasis since altitude and/or vertical speed indications may also be unreliable.

All Engines

Long Range Cruise Maximum Operating Altitude

These tables provide the maximum operating altitude in the same manner as the FMC. Maximum altitudes are shown for a given cruise weight and maneuver capability. This table considers both thrust and buffet limits, providing the more limiting of the two. Any data that is thrust limited is denoted by an asterisk and represents only a thrust limited condition in level flight with 100 ft/min residual rate of climb. Flying above these altitudes with sustained banks in excess of approximately 15° may cause the airplane to lose speed and/or altitude. The altitudes shown in the table are limited to the maximum certified altitude of 41000 ft.

Long Range Cruise Control

These tables provide target %N1, Long Range Cruise Mach number, IAS and standard day fuel flow per engine for the airplane weight and pressure altitude. As indicated by the shaded area, at optimum altitude .79M approximates the Long Range Cruise Mach schedule.

Long Range Cruise Enroute Fuel and Time

Long Range Cruise Enroute Fuel and Time tables are provided to determine remaining time and fuel required to destination. The data is based on Long Range Cruise and .78/280/250 descent. Tables are presented for low altitudes and high altitudes.

To determine remaining fuel and time required, first enter the Ground to Air Miles Conversion table to convert ground distance and enroute wind to an equivalent still air distance for use with the Reference Fuel and Time tables. Next, enter the Reference Fuel and Time table with air distance from the Ground to Air Miles Conversion table and the desired altitude and read Reference Fuel and Time Required. Lastly, enter the Fuel Required Adjustment table with the Reference Fuel and the actual weight at checkpoint to obtain fuel required to destination.

APU Operation During Flight

For APU operation during flight, increase fuel flow according to the table in the Engine Inoperative text section.

Long Range Cruise Wind-Altitude Trade

Wind is a factor which may justify operations considerably below optimum altitude. For example, a favorable wind component may have an effect on ground speed which more than compensates for the loss in air range.

Using this table, it is possible to determine the break-even wind (advantage necessary or disadvantage that can be tolerated) to maintain the same range at another altitude and long range cruise speed. The tables make no allowance for climb or descent time, fuel or distance, and are based on comparing ground fuel mileage.

Descent

Time, fuel, and distance for descent are shown for a .78/280/250 descent speed schedule. Enter the table with top of descent pressure altitude and read distance, time and fuel. Data is based on flight idle thrust descent in zero wind. Allowances are included for a straight-in approach with gear down and landing flaps at the outer marker.

Holding

Target %N1, indicated airspeed and fuel flow per engine information is tabulated for holding with flaps up based on the FMC optimum holding speed schedule. This is the higher of the maximum endurance speed and the maneuvering speed. Small variations in airspeed will not appreciably affect the overall endurance time. Enter the table with weight and pressure altitude to read %N1, IAS and fuel flow per engine.

Advisory Information

Normal Configuration Landing Distance

The normal configuration distance tables are provided as advisory information to help determine the actual landing distance performance of the airplane for different runway surface conditions and brake configurations.

Flaps 15, 30, and 40 landing distances and adjustments are provided for dry runways as well as runways with good, medium, and poor reported braking action, which are commonly referred to as slippery runway conditions.

If the surface is affected by water, snow or ice, and the braking action is reported as "good", conditions should not be expected to be as good as on clean, dry runways. The value "good" is comparative and is intended to mean that airplanes should not experience braking or directional control difficulties when landing. The performance level used to calculate the "good" data is consistent with wet runway testing done on early Boeing jets. The performance level used to calculate "poor" data reflects runways covered with wet ice.

Dry runway landing performance is shown for max manual braking configuration and autobrake settings max, 3, 2, and 1. The autobrake performance may be used to assist in the selection of the most desirable autobrake setting for a given field length. Selection of an autobrake setting results in a constant rate of deceleration. Maximum effort manual braking should achieve shorter landing distance than the max autobrake setting. The reference landing distance is a reference distance from 50 ft above the threshold to stop based on a reference landing weight and normal approach speed for the selected landing flap at sea level, zero wind, zero slope, and two engine detent reverse thrust. Subsequent columns provide adjustments for off-reference landing weight, altitude, wind, slope, temperature, speed, and reverse thrust. Each adjustment is independently added to the reference landing distance.

Non-normal Configuration Landing Distance

Advisory information is provided to support non-normal configurations that affect the landing performance of the airplane. Landing distances and adjustments are provided for dry runways and runways with good, medium, and poor reported braking action.

Enter the table with the applicable non-normal configuration and read the normal approach speed. The reference landing distance is a reference distance from 50 ft above the threshold to stop based on a reference landing weight and speed at sea level, zero wind, and zero slope. Subsequent columns provide adjustments for off-reference landing weight, altitude, wind, slope, and speed conditions. Each adjustment is independently added to the reference landing distance. Landing distance includes the effect of reverse thrust.

Recommended Brake Cooling Schedule

Advisory information is provided to assist in avoiding the problems associated with hot brakes. For normal operation, most landings are at weights below the AFM quick turnaround limit weight.

Use of the recommended cooling schedule will help avoid brake overheat and fuse plug problems that could result from repeated landings at short time intervals or a rejected takeoff.

Enter the Recommended Brake Cooling Schedule table with the airplane weight and brakes on speed, adjusted for wind at the appropriate temperature and altitude condition. Instructions for applying wind adjustments are included below the table. Linear interpolation may be used to obtain intermediate values. The resulting number is the reference brake energy per brake in millions of foot-pounds, and represents the amount of energy absorbed by each brake during a rejected takeoff. Notes providing adjustments for wind are included below the table.

To determine the energy per brake absorbed during landing, enter the appropriate Adjusted Brake Energy Per Brake table (No Reverse Thrust or 2 Engine Reverse) with the reference brake energy per brake and the type of braking used during landing (Max Manual, Max Auto, or Autobrake). The resulting number is the adjusted brake energy per brake and represents the energy absorbed in each brake during the landing.

The recommended cooling time is found in the appropriate (steel or carbon brakes) final table by entering with the adjusted brake energy per brake. Times are provided for ground cooling and inflight gear down cooling.

Brake Temperature Monitor System (BTMS) indications are also shown. If brake cooling is determined from the BTMS, use the hottest brake indication 10 to 15 minutes after the airplane has come to a complete stop, or inflight with gear retracted to determine recommended cooling schedule.

Engine Inoperative

Initial Max Continuous %N1

The Initial Max Continuous %N1 setting for use following an engine failure is shown. The table is based on the typical all engine cruise speed of .79M to provide a target %N1 setting at the start of driftdown. Once driftdown is established, the Max Continuous %N1 table should be used to determine %N1 for the given conditions.

Max Continuous %N1

Power setting is based on one engine operating with one A/C pack operating and all anti-ice bleeds off. Enter the table with pressure altitude, TAT, and IAS or Mach to read %N1.

It is desirable to maintain engine thrust level within the limits of the Max Cruise thrust rating. However, where thrust level in excess of Max Cruise rating is required, such as for meeting terrain clearance, ATC altitude assignments, or to attain maximum range capability, it is permissible to use the thrust needed up to the Max Continuous thrust rating. The Max Continuous thrust rating is intended primarily for emergency use at the discretion of the pilot and is the maximum thrust that may be used continuously.

Driftdown Speed/Level Off Altitude

The table shows optimum driftdown speed as a function of cruise weight at start of driftdown. Also shown are the approximate weight and pressure altitude at which the airplane will level off considering 100 ft/min residual rate of climb.

The level off altitude is dependent on air temperature (ISA deviation).

Driftdown/LRC Range Capability

This table shows the range capability from the start of driftdown. Driftdown is continued to level off altitude. As weight decreases due to fuel burn, the airplane is accelerated to Long Range Cruise speed. Cruise is continued at level off altitude and Long Range Cruise speed.

To determine fuel required, enter the Ground to Air Miles Conversion table with the desired ground distance and adjust for anticipated winds to obtain air distance to destination. Then enter the Driftdown/Cruise Fuel and Time table with air distance and weight at start of driftdown to determine fuel and time required. If altitudes other than the level off altitude is used, fuel and time required may be obtained by using the Engine Inoperative Long Range Cruise Enroute Fuel and Time table.

Long Range Cruise Altitude Capability

The table shows the maximum altitude that can be maintained at a given weight and air temperature (ISA deviation), based on Long Range Cruise speed, Max Continuous thrust, and 100 ft/min residual rate of climb.

Long Range Cruise Control

The table provides target %N1, engine inoperative Long Range Cruise Mach number, IAS and fuel flow for the airplane weight and pressure altitude. The fuel flow values in this table reflect single engine fuel burn.

APU Operation During Flight

For APU operation during flight, increase fuel flow according to the following table. These increments include the APU fuel flow and the effect of increased drag from the APU door.

PRESSURE ALTITUDE (1000 FT)	APU FUEL FLOW (KG/HR)
39	45
35	45
31	50
25	60
20	65
15	75
10	85
5	95

Long Range Cruise Diversion Fuel and Time

Tables are provided for crews to determine the fuel and time required to proceed to an alternate airfield with one engine inoperative. The data is based on single engine Long Range Cruise speed and .78/280/250 descent. Enter with Air Distance as determined from the Ground to Air Miles Conversion table and read Fuel and Time required at the cruise pressure altitude. Adjust the fuel obtained for deviation from the reference weight at checkpoint as required by entering the off reference fuel adjustments table with the fuel required for the reference weight and the actual weight at checkpoint. Read fuel required and time for the actual weight.

Holding

Single engine holding data is provided in the same format as the all engine holding data and is based on the same assumptions.

Gear Down Landing Rate of Climb Available

Rate of climb data is provided as guidance information in the event an engine inoperative landing (manual or autoland) is planned. The tables show gear down rate of climb available for Flaps 15 and Flaps 30. Enter the table with TAT and pressure altitude to read rate of climb available. Apply adjustments shown to correct for weight.

Alternate Mode EEC

Introduction

This section contains performance data for airplane operation with the Electronic Engine Control (EEC) in the alternate mode (ALTN EEC switch illuminated) for applicable thrust ratings. The data includes engine bleed effects for normal air conditioning operation i.e., two packs on at normal flow all engines operating.

Operation with derate and/or assumed temperature reduced thrust is not permitted with the EEC in alternate mode.

Limit Weight

A simplified method which conservatively accounts for the effects of EEC in alternate mode is to reduce the normal mode (ON EEC switch illuminated) performance limited weights. The Limit Weight table provides takeoff field, climb, and obstacle limit weights. To determine limit weights for operations with the EEC in alternate mode, enter the table with the limit weights for normal mode EEC operation and read the associated limit weight for each performance condition. The most limiting of the takeoff weights must be used. Analysis from the Airplane Flight Manual - Digital Performance Information may yield less restrictive limit weights.

Takeoff Speed Adjustment

Takeoff speeds for the reduced weight should be increased by the amount shown in the Takeoff Speeds Adjustment table. The adjusted V1 should not exceed the adjusted VR.

Note: The FMC does not incorporate alternate mode EEC performance in its takeoff speeds calculations.

Max Takeoff %N1

The alternate mode EEC thrust schedule provides equal or greater thrust than the normal mode thrust for the same thrust lever position. Thrust limit protection is not provided in alternate mode EEC and maximum rated thrust may be reached at thrust lever position less than full forward. As a result, thrust overboost may occur if the target alternate mode EEC Max Takeoff %N1 settings are not observed.

To find alternate mode EEC Max Takeoff %N1 based on normal engine bleed for air conditioning packs on, enter the Alternate Mode EEC Max Takeoff %N1 table with airport pressure altitude and airport OAT and read %N1. For packs off apply the %N1 adjustment provided below the table. No %N1 adjustment is required for engine or wing anti-ice.

Gear Down

This section contains performance for airplane operation with the landing gear extended. The data is based on engine bleeds for normal air conditioning.

Note: The Flight Management Computer System (FMCS) does not contain special provisions for operation with landing gear extended. As a result, the FMCS may generate inappropriate enroute speed schedules, display non-conservative predictions of fuel burn, estimated time of arrival (ETA), maximum altitude, and compute overly shallow descent path. An accurate estimated time of arrival (ETA) is available if current speed or Mach is entered into the VNAV cruise page.

Tables for gear down performance in this section are identical in format and used in the same manner as tables for the gear up configuration previously described.

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Performance Inflight — Chapter PI
Table of Contents — Section 50

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Performance Inflight — Chapter PI
Pkg Model Identification — Section 50

General

The table below shows the airplanes that have been identified with the following performance package. Note, some airplanes may be identified with more than one performance package. This configuration table information reflects the Boeing delivered configuration updated for service bulletin incorporations in conformance with the policy stated in the introduction section of the FCOM. The performance data is prepared for the owner/operator named on the title page. The intent of this information is to assist flight crews and airlines in knowing which performance package is applicable to a given airplane. The performance package model identification information is based on Boeing's knowledge of the airline's fleet at a point in time approximately three months prior to the page date. Notice of Errata (NOE) will not be provided to airlines to identify airplanes that are moved between performance packages within this manual or airplanes added to the airline's fleet whose performance packages are already represented in this manual. These types of changes will be updated in the next block revision. Owners/operators are responsible for ensuring the operational documentation they are using is complete and matches the current configuration of their airplanes, and the accuracy and validity of all information furnished by the owner/operator or any other party. Owners/operators receiving active revision service are responsible to ensure that any modifications to the listed airplanes are properly reflected in this manual.

Serial and tabulation number are supplied by Boeing.

Registry Number	Serial Number	Tabulation Number
YX802	YX802	YX802

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Performance Inflight — Chapter PI
General — Section 50

Takeoff Speeds - Dry Runway
V1, VR, V2 for Max Takeoff Thrust

WEIGHT (1000 KG)	FLAPS 1			FLAPS 5			FLAPS 10			FLAPS 15			FLAPS 25		
	V1	VR	V2	V1	VR	V2	V1	VR	V2	V1	VR	V2	V1	VR	V2
90	169	171	175	161	163	168									
85	163	166	171	157	159	164	156	157	162						
80	158	160	167	152	154	160	151	152	158	148	149	155	145	146	153
75	153	155	162	147	148	156	146	147	154	142	144	151	140	141	149
70	147	149	158	141	143	152	140	141	150	137	138	147	135	136	145
65	141	143	153	135	137	147	134	136	146	131	133	143	129	130	140
60	135	136	148	129	131	143	128	129	141	125	126	138	123	124	136
55	128	129	143	123	124	137	122	123	136	119	120	133	117	118	131
50	121	122	137	116	117	132	115	116	130	112	113	128	110	111	126
45	113	114	131	109	110	126	108	108	125	105	106	122	103	104	120
40	105	106	125	101	102	120	100	101	119	98	99	117	96	97	115

Check V1(MCG).

V1, VR, V2 Adjustments*

TEMP		V1							VR							V2						
		PRESS ALT (1000 FT)							PRESS ALT (1000 FT)							PRESS ALT (1000 FT)						
°C	°F	-2	0	2	4	6	8	10	-2	0	2	4	6	8	10	-2	0	2	4	6	8	10
70	158	5	6						4	5						-3	-3					
60	140	4	5	6	7				3	4	5	6				-2	-3	-3	-4			
50	122	2	3	4	5	6	7	9	2	3	4	5	6	7	8	-2	-2	-3	-3	-4	-5	-6
40	104	1	1	3	4	5	6	7	1	1	3	4	5	6	7	-1	-1	-2	-2	-3	-4	-5
30	86	0	0	1	2	4	5	6	0	0	1	3	4	5	6	0	0	-1	-2	-2	-3	-4
20	68	0	0	1	2	3	4	5	0	0	1	2	3	4	5	0	0	-1	-1	-2	-3	-3
-60	-76	0	0	1	2	3	4	5	0	0	1	2	3	4	5	0	0	-1	-1	-2	-2	-3

Slope and Wind V1 Adjustments*

WEIGHT (1000 KG)	SLOPE (%)					WIND (KTS)							
	-2	-1	0	1	2	-15	-10	-5	0	10	20	30	40
90	-4	-2	0	1	1	-2	-2	-1	0	0	0	0	1
80	-3	-2	0	1	1	-2	-1	-1	0	0	0	1	1
70	-2	-1	0	1	1	-2	-1	-1	0	0	1	1	1
60	-2	-1	0	1	1	-2	-1	-1	0	0	1	1	1
50	-1	0	0	0	1	-2	-1	0	0	0	1	1	1
40	0	0	0	0	0	-2	-1	0	0	0	0	0	0

***V1 not to exceed VR.**

V1(MCG)
Max Takeoff Thrust

TEMP		PRESSURE ALTITUDE (FT)						
°C	°F	-2000	0	2000	4000	6000	8000	10000
70	158	95	93					
60	140	95	93	92	90			
50	122	97	95	92	90	88	86	83
40	104	101	99	96	93	89	86	83
30	86	104	103	100	96	92	88	85
20	68	104	104	101	98	94	90	87
-60	-76	106	105	102	99	95	92	89

Takeoff Speeds - Wet Runway
V1, VR, V2 for Max Takeoff Thrust

WEIGHT (1000 KG)	FLAPS 1			FLAPS 5			FLAPS 10			FLAPS 15			FLAPS 25		
	V1	VR	V2	V1	VR	V2	V1	VR	V2	V1	VR	V2	V1	VR	V2
90	164	171	175	156	164	168									
85	157	166	171	150	159	164	151	157	162						
80	151	160	167	145	154	160	145	152	158	141	149	155	140	146	153
75	145	155	162	139	148	156	139	147	154	136	144	151	134	141	149
70	139	149	158	133	143	152	133	141	150	130	138	147	128	136	145
65	133	143	153	127	137	148	127	136	146	124	133	143	122	130	140
60	126	136	148	121	131	143	120	129	141	117	126	138	115	124	136
55	119	129	143	114	124	137	113	123	136	111	120	133	109	118	131
50	111	122	137	107	117	132	106	116	130	104	113	128	102	111	126
45	104	114	131	99	110	126	99	108	125	96	106	122	95	104	120
40	96	106	125	92	102	120	91	101	119	89	99	117	87	97	115

Check V1(MCG).

V1, VR, V2 Adjustment*

TEMP		V1							VR							V2						
		PRESS ALT (1000 FT)							PRESS ALT (1000 FT)							PRESS ALT (1000 FT)						
°C	°F	-2	0	2	4	6	8	10	-2	0	2	4	6	8	10	-2	0	2	4	6	8	10
70	158	7	8						4	5						-3	-4					
60	140	5	6	7	9				3	4	5	6				-2	-3	-3	-4			
50	122	3	4	5	6	8	9	12	2	3	4	5	6	7	8	-2	-2	-3	-3	-4	-5	-6
40	104	1	2	3	4	6	7	9	1	1	3	4	5	6	7	-1	-1	-2	-2	-3	-4	-5
30	86	0	0	1	3	4	6	7	0	0	1	3	4	5	6	0	0	-1	-2	-2	-3	-4
20	68	0	0	1	2	4	5	6	0	0	1	2	3	4	5	0	0	-1	-1	-2	-2	-3
-60	-76	0	0	1	2	4	5	7	0	0	1	2	3	4	5	0	0	-1	-1	-2	-2	-3

Slope and Wind V1 Adjustment*

WEIGHT (1000 KG)	SLOPE (%)					WIND (KTS)							
	-2	-1	0	1	2	-15	-10	-5	0	10	20	30	40
90	-5	-3	0	3	6	-3	-2	-1	0	1	2	2	3
80	-5	-2	0	3	5	-4	-2	-1	0	1	2	2	3
70	-4	-2	0	2	4	-4	-2	-1	0	1	1	2	3
60	-3	-1	0	2	3	-4	-3	-1	0	1	2	2	3
50	-2	-1	0	1	3	-4	-3	-1	0	1	2	3	4
40	-1	0	0	1	2	-5	-3	-1	0	1	3	4	5

***V1 not to exceed VR.**

V1(MCG)
Max Takeoff Thrust

TEMP		PRESSURE ALTITUDE (FT)						
°C	°F	-2000	0	2000	4000	6000	8000	10000
70	158	95	93					
60	140	95	93	92	90			
50	122	97	95	92	90	88	86	83
40	104	101	99	96	93	89	86	83
30	86	104	103	100	96	92	88	85
20	68	104	104	101	98	94	90	87
-60	-76	106	105	102	99	95	92	89

Stab Trim Setting

Max Takeoff Thrust

Flaps 1 and 5

WEIGHT (1000 KG)	C.G. (%MAC)									
	6	9	14	18	22	26	30	32	33	36
80	8 1/2	8 1/2	7 1/2	7	6 1/4	5 1/2	4 3/4	4 1/2	4 1/4	3 3/4
70	8 1/4	7 3/4	7	6 1/4	5 3/4	5	4 1/4	4	3 3/4	3 1/2
60	7 1/4	7	6 1/4	5 3/4	5	4 1/2	3 3/4	3 1/2	3 1/4	3
50	6 1/2	6 1/4	5 1/2	5	4 1/4	3 3/4	3 1/4	3	2 3/4	2 3/4
45	6 1/4	5 3/4	5	4 1/2	4	3 1/2	3	2 3/4	2 3/4	2 3/4
35	6 1/4	5 3/4	5	4 1/2	4	3 1/2	3	2 3/4	2 3/4	2 3/4

Flaps 10, 15 and 25

WEIGHT (1000 KG)	C.G. (%MAC)									
	6	9	11	16	24	28	29	31	33	36
80	8 1/2	8 1/2	8 1/4	6 1/2	5	4 1/4	4	3 1/2	3 1/4	2 3/4
70	8 1/2	8 1/4	7 1/2	6	4 1/2	3 1/2	3 1/2	3	2 3/4	2 3/4
60	7 3/4	7	6 1/2	5 1/4	3 3/4	3	3	2 3/4	2 3/4	2 3/4
50	6 1/4	5 3/4	5 1/4	4 1/4	3	2 3/4	2 3/4	2 3/4	2 3/4	2 3/4
45	5 1/4	4 3/4	4 1/2	3 3/4	2 3/4	2 3/4	2 3/4	2 3/4	2 3/4	2 3/4
35	5 1/4	4 3/4	4 1/2	3 3/4	2 3/4	2 3/4	2 3/4	2 3/4	2 3/4	2 3/4

VREF

Based on 10000 ft reference pressure altitude

WEIGHT (1000 KG)	FLAPS		
	40	30	15
85	160	168	177
80	155	163	172
75	151	158	167
70	146	153	161
65	141	148	156
60	135	142	149
55	128	136	143
50	122	129	136
45	115	122	128
40	108	115	121

Flap Maneuver Speeds

FLAP POSITION	MANEUVER SPEED
UP	VREF40 + 70
1	VREF40 + 50
5	VREF40 + 30
10	VREF40 + 30
15	VREF40 + 20
25	VREF40 + 10
30	VREF30
40	VREF40

ADVISORY INFORMATION

Slush/Standing Water Takeoff

Maximum Reverse Thrust

Weight Adjustments (1000 KG)

DRY FIELD/OBSTACLE LIMIT WEIGHT (1000 KG)	SLUSH/STANDING WATER DEPTH								
	3 mm (0.12 INCHES)			6 mm (0.25 INCHES)			13 mm (0.50 INCHES)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
95	-12.8	-15.3	-17.8	-15.8	-18.2	-20.7	-21.9	-24.4	-26.9
90	-11.8	-14.3	-16.8	-14.3	-16.8	-19.3	-19.7	-22.1	-24.6
85	-10.7	-13.2	-15.7	-12.9	-15.4	-17.9	-17.4	-19.9	-22.4
80	-9.7	-12.2	-14.7	-11.5	-14.0	-16.5	-15.2	-17.7	-20.2
75	-8.8	-11.2	-13.7	-10.2	-12.7	-15.2	-13.2	-15.7	-18.2
70	-7.8	-10.3	-12.8	-8.9	-11.4	-13.9	-11.4	-13.9	-16.4
65	-6.9	-9.4	-11.9	-7.8	-10.3	-12.8	-9.7	-12.2	-14.7
60	-6.0	-8.5	-11.0	-6.7	-9.2	-11.7	-8.1	-10.6	-13.1
55	-5.2	-7.7	-10.2	-5.7	-8.2	-10.6	-6.7	-9.2	-11.7
50	-4.3	-6.8	-9.3	-4.7	-7.2	-9.7	-5.5	-8.0	-10.5
45	-3.5	-6.0	-8.5	-3.7	-6.2	-8.7	-4.2	-6.7	-9.2
40	-2.7	-5.2	-7.7	-2.8	-5.3	-7.8	-3.0	-5.5	-8.0

V1(MCG) Limit Weight (1000 KG)

ADJUSTED FIELD LENGTH (M)	SLUSH/STANDING WATER DEPTH								
	3 mm (0.12 INCHES)			6 mm (0.25 INCHES)			13 mm (0.50 INCHES)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
1200							33.1		
1400	41.6			45.3	30.9		51.5	37.4	
1600	61.6	46.2		65.2	49.9	32.5	71.0	56.1	39.0
1800	83.3	66.6	47.9	86.7	70.2	51.6	91.8	75.8	57.7
2000		88.7	68.4		92.0	72.0		96.8	77.6
2200			90.8			93.9			98.7

1. **Enter Weight Adjustment table with slush/standing water depth and dry field/obstacle limit weight to obtain slush/standing water weight adjustment.**
2. **Adjust field length available by -35 m/+35 m for every 5°C above/below 4°C.**
3. **Find V1(MCG) limit weight for adjusted field length and pressure altitude.**
4. **Max allowable slush/standing water limited weight is lesser of weights from 1 and 3.**

V1 Adjustment (KIAS)

WEIGHT (1000 KG)	SLUSH/STANDING WATER DEPTH								
	3 mm (0.12 INCHES)			6 mm (0.25 INCHES)			13 mm (0.50 INCHES)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
90	-14	-9	-4	-8	-3	0	0	0	0
85	-16	-11	-6	-10	-5	0	0	0	0
80	-17	-12	-7	-12	-7	-2	0	0	0
75	-19	-14	-9	-14	-9	-4	-1	0	0
70	-20	-15	-10	-15	-10	-5	-4	0	0
65	-21	-16	-11	-17	-12	-7	-7	-2	0
60	-22	-17	-12	-19	-14	-9	-11	-6	-1
55	-23	-18	-13	-20	-15	-10	-14	-9	-4
50	-24	-19	-14	-22	-17	-12	-17	-12	-7
45	-25	-20	-15	-23	-18	-13	-19	-14	-9
40	-25	-20	-15	-24	-19	-14	-20	-15	-10

1. **Obtain V1, VR and V2 for the actual weight using the Dry Runway Takeoff Speeds table.**
2. **If V1(MCG) limited, set V1 = V1(MCG). If not V1(MCG) limited, enter V1 Adjustment table with the actual weight to obtain V1 speed adjustment. If adjusted V1 is less than V1(MCG), set V1 = V1(MCG). V1 not to exceed VR.**

ADVISORY INFORMATION

Slush/Standing Water Takeoff

No Reverse Thrust

Weight Adjustments (1000 KG)

DRY FIELD/OBSTACLE LIMIT WEIGHT (1000 KG)	SLUSH/STANDING WATER DEPTH								
	3 mm (0.12 INCHES)			6 mm (0.25 INCHES)			13 mm (0.50 INCHES)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
90	-15.1	-17.5	-20.0	-17.6	-20.1	-22.6	-23.0	-25.5	-28.0
85	-13.9	-16.4	-18.9	-16.1	-18.6	-21.1	-20.6	-23.1	-25.6
80	-12.8	-15.3	-17.8	-14.5	-17.0	-19.5	-18.3	-20.8	-23.3
75	-11.7	-14.2	-16.7	-13.1	-15.6	-18.1	-16.1	-18.6	-21.1
70	-10.6	-13.1	-15.6	-11.7	-14.2	-16.7	-14.2	-16.7	-19.2
65	-9.6	-12.1	-14.5	-10.4	-12.9	-15.4	-12.3	-14.8	-17.3
60	-8.5	-11.0	-13.5	-9.2	-11.7	-14.2	-10.7	-13.2	-15.7
55	-7.6	-10.1	-12.6	-8.1	-10.6	-13.1	-9.2	-11.7	-14.2
50	-6.6	-9.1	-11.6	-7.0	-9.5	-12.0	-7.9	-10.4	-12.9
45	-5.7	-8.2	-10.7	-6.0	-8.5	-11.0	-6.7	-9.2	-11.7
40	-4.8	-7.3	-9.8	-5.1	-7.6	-10.1	-5.7	-8.2	-10.7

V1(MCG) Limit Weight (1000 KG)

ADJUSTED FIELD LENGTH (M)	SLUSH/STANDING WATER DEPTH								
	3 mm (0.12 INCHES)			6 mm (0.25 INCHES)			13 mm (0.50 INCHES)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
1800							43.4		
2000				43.2			69.3	41.4	
2200	58.6			77.0	40.7		95.7	67.4	39.5
2400	98.8	55.6			74.5	38.2		93.7	65.4
2600		95.7	52.7			71.9			91.7
2800			92.7						

1. **Enter Weight Adjustment table with slush/standing water depth and dry field/obstacle limit weight to obtain slush/standing water weight adjustment.**
2. **Adjust field length available by -50 m/+50 m for every 5°C above/below 4°C.**
3. **Find V1(MCG) limit weight for adjusted field length and pressure altitude.**
4. **Max allowable slush/standing water limited weight is lesser of weights from 1 and 3.**

V1 Adjustment (KIAS)

WEIGHT (1000 KG)	SLUSH/STANDING WATER DEPTH								
	3 mm (0.12 INCHES)			6 mm (0.25 INCHES)			13 mm (0.50 INCHES)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
90	-23	-16	-8	-12	-5	0	0	0	0
85	-25	-18	-10	-16	-8	-1	0	0	0
80	-27	-20	-12	-19	-11	-4	0	0	0
75	-29	-22	-14	-22	-14	-7	-2	0	0
70	-31	-24	-16	-25	-17	-10	-8	0	0
65	-33	-26	-18	-28	-20	-13	-13	-6	0
60	-35	-28	-20	-30	-23	-15	-18	-11	-3
55	-37	-29	-22	-33	-26	-18	-23	-16	-8
50	-39	-31	-24	-36	-28	-21	-28	-20	-13
45	-41	-33	-26	-38	-31	-23	-32	-25	-17
40	-42	-35	-27	-41	-33	-26	-37	-29	-22

1. **Obtain V1, VR and V2 for the actual weight using the Dry Runway Takeoff Speeds table.**
2. **If V1(MCG) limited, set V1 = V1(MCG). If not V1(MCG) limited, enter V1 Adjustment table with the actual weight to obtain V1 speed adjustment. If adjusted V1 is less than V1(MCG), set V1 = V1(MCG). V1 not to exceed VR.**

ADVISORY INFORMATION

Slippery Runway Takeoff
Maximum Reverse Thrust
Weight Adjustment (1000 KG)

DRY FIELD/OBSTACLE LIMIT WEIGHT (1000 KG)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
95	-0.8	-0.8	-0.8	-6.5	-6.5	-6.5	-11.6	-11.6	-11.6
90	-1.0	-1.0	-1.0	-6.3	-6.3	-6.3	-11.1	-11.1	-11.1
85	-1.2	-1.2	-1.2	-6.2	-6.2	-6.2	-10.6	-10.6	-10.6
80	-1.3	-1.3	-1.3	-6.0	-6.0	-6.0	-10.1	-10.1	-10.1
75	-1.5	-1.5	-1.5	-5.8	-5.8	-5.8	-9.5	-9.5	-9.5
70	-1.6	-1.6	-1.6	-5.6	-5.6	-5.6	-9.0	-9.0	-9.0
65	-1.6	-1.6	-1.6	-5.3	-5.3	-5.3	-8.4	-8.4	-8.4
60	-1.6	-1.6	-1.6	-5.0	-5.0	-5.0	-7.8	-7.8	-7.8
55	-1.5	-1.5	-1.5	-4.7	-4.7	-4.7	-7.2	-7.2	-7.2
50	-1.4	-1.4	-1.4	-4.3	-4.3	-4.3	-6.5	-6.5	-6.5
45	-1.3	-1.3	-1.3	-4.0	-4.0	-4.0	-5.9	-5.9	-5.9
40	-1.2	-1.2	-1.2	-3.6	-3.6	-3.6	-5.2	-5.2	-5.2

V1(MCG) Limit Weight (1000 KG)

ADJUSTED FIELD LENGTH (M)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
1000	39.0								
1200	72.3	57.4	41.9						
1400	103.3	89.3	75.0	46.0	30.2				
1600				69.9	53.4	37.4			
1800				95.2	77.7	60.9	41.3		
2000					103.3	85.7	55.8	40.3	
2200							71.5	54.8	39.3
2400							88.7	70.4	53.8
2600								87.5	69.3
2800									86.3
3000									104.5

1. **Enter Weight Adjustment table with reported braking action and dry field/obstacle limit weight to obtain slippery runway weight adjustment.**
2. **Adjust “Good” field length available by -20 m/+20 m for every 5°C above/below 4°C.
Adjust “Medium” field length available by -20 m/+20 m for every 5°C above/below 4°C.
Adjust “Poor” field length available by -40 m/+40 m for every 5°C above/below 4°C.**
3. **Find V1(MCG) limit weight for adjusted field length and pressure altitude.**
4. **Max allowable slippery runway limited weight is lesser of weights from 1 and 3.**

ADVISORY INFORMATION

Slippery Runway Takeoff
Maximum Reverse Thrust
V1 Adjustment (KIAS)

WEIGHT (1000 KG)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
90	-4	-2	0	-13	-10	-8	-24	-21	-19
85	-6	-3	-1	-15	-12	-10	-26	-24	-21
80	-7	-4	-2	-17	-14	-12	-29	-26	-24
75	-8	-5	-3	-18	-16	-13	-31	-28	-26
70	-9	-6	-4	-20	-17	-15	-33	-30	-28
65	-9	-7	-4	-21	-19	-16	-35	-32	-30
60	-10	-8	-5	-22	-20	-17	-37	-34	-32
55	-11	-9	-6	-24	-21	-19	-38	-36	-33
50	-12	-9	-7	-25	-22	-20	-40	-37	-35
45	-13	-10	-8	-26	-24	-21	-41	-39	-36
40	-14	-11	-9	-27	-25	-22	-42	-40	-37

1. **Obtain V1, VR and V2 for the actual weight using the Dry Runway Takeoff Speeds table.**
2. **If V1(MCG) limited, set V1 = V1(MCG). If not V1(MCG) limited, enter V1 Adjustment table with the actual weight to obtain V1 speed adjustment. If adjusted V1 is less than V1(MCG), set V1 = V1(MCG).V1 not to exceed VR.**

ADVISORY INFORMATION

Slippery Runway Takeoff
No Reverse Thrust
Weight Adjustments (1000 KG)

DRY FIELD/OBSTACLE LIMIT WEIGHT (1000 KG)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
90	-2.6	-2.6	-2.6	-9.3	-9.3	-9.3	-15.0	-15.0	-15.0
85	-2.8	-2.8	-2.8	-9.1	-9.1	-9.1	-14.4	-14.4	-14.4
80	-2.9	-2.9	-2.9	-9.0	-9.0	-9.0	-13.7	-13.7	-13.7
75	-3.1	-3.1	-3.1	-8.7	-8.7	-8.7	-13.1	-13.1	-13.1
70	-3.1	-3.1	-3.1	-8.4	-8.4	-8.4	-12.3	-12.3	-12.3
65	-3.2	-3.2	-3.2	-8.0	-8.0	-8.0	-11.4	-11.4	-11.4
60	-3.1	-3.1	-3.1	-7.5	-7.5	-7.5	-10.5	-10.5	-10.5
55	-3.0	-3.0	-3.0	-7.0	-7.0	-7.0	-9.5	-9.5	-9.5
50	-2.8	-2.8	-2.8	-6.4	-6.4	-6.4	-8.4	-8.4	-8.4
45	-2.6	-2.6	-2.6	-5.7	-5.7	-5.7	-7.3	-7.3	-7.3
40	-2.3	-2.3	-2.3	-5.0	-5.0	-5.0	-6.0	-6.0	-6.0

V1(MCG) Limit Weight (1000 KG)

ADJUSTED FIELD LENGTH (M)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
1200	34.7								
1300	65.5								
1400	84.9	52.6							
1500		75.9	34.7						
1600		93.4	65.5						
1700			84.9						
1900				45.2					
2000				72.7					
2100				94.6	52.9				
2200					78.5				
2300					99.9	60.0			
2400						84.0			
3100							53.6		
3200							74.6		
3300							93.5	35.6	
3400								59.1	
3500								79.5	
3600								98.2	41.8
3700									64.5
3800									84.2

1. **Enter Weight Adjustment table with reported braking action and dry field/obstacle limit weight to obtain slippery runway weight adjustment.**
2. **Adjust "Good" field length available by -30 m/+30 m for every 5°C above/below 4°C.**
   Adjust "Medium" field length available by -30 m/+30 m for every 5°C above/below 4°C.
   Adjust "Poor" field length available by -50 m/+50 m for every 5°C above/below 4°C.
3. **Find V1(MCG) limit weight for adjusted field length and pressure altitude.**
4. **Max allowable slippery runway limited weight is lesser of weights from 1 and 3.**

ADVISORY INFORMATION

Slippery Runway Takeoff
No Reverse Thrust
V1 Adjustment (KIAS)

WEIGHT (1000 KG)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
90	-7	0	0	-19	-11	-4	-38	-30	-23
85	-8	-1	0	-21	-14	-6	-41	-34	-26
80	-9	-2	0	-23	-16	-8	-45	-38	-30
75	-11	-3	0	-26	-18	-11	-49	-41	-34
70	-12	-5	0	-28	-21	-13	-52	-45	-37
65	-14	-6	0	-31	-24	-16	-56	-48	-41
60	-15	-8	0	-34	-26	-19	-59	-52	-44
55	-17	-9	-2	-37	-29	-22	-63	-55	-48
50	-19	-11	-4	-40	-32	-25	-66	-59	-51
45	-21	-13	-6	-43	-36	-28	-69	-62	-54
40	-23	-15	-8	-47	-39	-32	-73	-65	-58

1. **Obtain V1, VR and V2 for the actual weight using the Dry Runway Takeoff Speeds table.**
2. **If V1(MCG) limited, set V1 = V1(MCG). If not V1(MCG) limited, enter V1 Adjustment table with the actual weight to obtain V1 speed adjustment. If adjusted V1 is less than V1(MCG), set V1 = V1(MCG). V1 not to exceed VR.**

Takeoff %N1

Based on engine bleeds for packs on, engine and wing anti-ice on or off

OAT (°C)	AIRPORT PRESSURE ALTITUDE (FT)												
	-2000	-1000	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
60	94.8	95.4	95.8	95.9	96.0	96.1	96.2	96.3	96.2	95.9	95.8	95.7	95.7
55	95.4	96.0	96.5	96.6	96.7	96.8	96.9	97.1	96.9	96.6	96.3	95.7	95.0
50	96.0	96.6	97.1	97.3	97.4	97.6	97.7	97.8	97.7	97.4	97.1	96.6	96.1
45	96.8	97.4	97.8	98.0	98.1	98.3	98.4	98.5	98.4	98.1	97.8	97.5	97.1
40	97.4	98.1	98.6	98.7	98.8	98.9	99.0	99.2	99.1	98.8	98.5	98.4	98.1
35	98.0	98.7	99.4	99.5	99.6	99.7	99.8	99.9	99.8	99.5	99.2	99.1	99.0
30	97.6	98.8	100.3	100.3	100.4	100.4	100.5	100.5	100.4	100.3	100.0	99.9	99.9
25	96.8	98.1	99.5	100.1	100.7	100.8	100.7	100.7	100.7	100.7	100.6	100.6	100.7
20	96.0	97.3	98.8	99.3	99.9	100.2	100.5	100.8	100.8	100.9	100.8	100.8	100.8
15	95.2	96.5	98.0	98.6	99.2	99.5	99.8	100.1	100.5	100.9	101.1	101.1	101.1
10	94.5	95.8	97.2	97.8	98.4	98.7	99.0	99.4	99.7	100.1	100.5	101.0	101.5
5	93.7	95.0	96.4	97.0	97.6	98.0	98.3	98.6	99.0	99.4	99.8	100.3	100.7
0	92.9	94.2	95.6	96.3	96.9	97.2	97.5	97.9	98.2	98.6	99.0	99.5	100.0
-5	92.0	93.4	94.8	95.5	96.1	96.4	96.7	97.1	97.5	97.9	98.3	98.7	99.2
-10	91.2	92.6	94.0	94.7	95.3	95.6	96.0	96.3	96.7	97.1	97.5	98.0	98.4
-15	90.4	91.7	93.2	93.9	94.5	94.8	95.2	95.6	95.9	96.3	96.7	97.2	97.6
-20	89.6	90.9	92.4	93.0	93.7	94.0	94.4	94.8	95.2	95.6	95.9	96.4	96.8
-25	88.7	90.1	91.6	92.2	92.9	93.2	93.6	94.0	94.4	94.8	95.2	95.6	96.0
-30	87.9	89.2	90.7	91.4	92.0	92.4	92.8	93.2	93.6	94.0	94.3	94.8	95.2
-35	87.0	88.4	89.9	90.5	91.2	91.6	91.9	92.4	92.8	93.1	93.5	94.0	94.4
-40	86.1	87.5	89.0	89.7	90.3	90.7	91.1	91.5	91.9	92.3	92.7	93.1	93.6
-45	85.3	86.6	88.2	88.8	89.5	89.9	90.3	90.7	91.1	91.5	91.9	92.3	92.7
-50	84.4	85.7	87.3	87.9	88.6	89.0	89.4	89.9	90.3	90.6	91.0	91.5	91.9

%N1 Adjustments for Engine Bleeds

BLEED CONFIGURATION	AIRPORT PRESSURE ALTITUDE (FT)												
	-2000	-1000	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
PACKS OFF	0.7	0.7	0.7	0.7	0.7	0.7	0.8	0.8	0.8	0.8	0.8	0.9	1.0

Assumed Temperature Reduced Thrust

Maximum Assumed Temperature (Table 1 of 3)

Based on 25% Takeoff Thrust Reduction

OAT (°C)	AIRPORT PRESSURE ALTITUDE (FT)											
	-1000	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
55	73	71	69	67								
50	73	71	69	67	65	63						
45	73	71	69	67	65	63	61	59	57			
40	73	71	69	67	65	63	61	59	57	55		
35	71	71	69	67	65	63	61	59	57	55	53	
30	69	67	67	67	65	63	61	59	57	55	53	51
25	69	67	66	64	65	63	61	59	57	55	53	51
20	69	67	66	64	64	63	61	59	57	55	53	51
15	69	67	66	64	64	63	61	59	57	55	53	51
10 & BELOW	69	67	66	64	64	63	61	59	57	55	53	51

Takeoff %N1 (Table 2 of 3)

Based on engine bleed for packs on, engine and wing anti-ice on or off

ASSUMED TEMP (°C)	AIRPORT PRESSURE ALTITUDE (FT)											
	-1000	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
75	93.4	93.7	94.2	94.7	95.4	96.1	96.9	97.3	97.6	97.8	97.8	97.7
70	94.1	94.4	94.4	94.4	94.7	95.4	96.2	96.6	96.9	97.1	97.1	97.1
65	94.8	95.1	95.2	95.2	95.3	95.4	95.5	96.0	96.2	96.5	96.4	96.4
60	95.4	95.8	95.9	96.0	96.1	96.2	96.3	96.2	95.9	95.8	95.7	95.7
55	96.0	96.5	96.6	96.7	96.8	96.9	97.1	96.9	96.6	96.3	95.7	95.0
50	96.6	97.1	97.3	97.4	97.6	97.7	97.8	97.7	97.4	97.1	96.6	96.1
45	97.4	97.8	98.0	98.1	98.3	98.4	98.5	98.4	98.1	97.8	97.5	97.1
40	98.1	98.6	98.7	98.8	98.9	99.0	99.2	99.1	98.8	98.5	98.4	98.1
35	98.7	99.4	99.5	99.6	99.7	99.8	99.9	99.8	99.5	99.2	99.1	99.0
30	98.8	100.3	100.3	100.4	100.4	100.5	100.5	100.4	100.3	100.0	99.9	99.9
25	98.1	99.5	100.1	100.7	100.8	100.7	100.7	100.7	100.7	100.6	100.6	100.7
20	97.3	98.8	99.3	99.9	100.2	100.5	100.8	100.8	100.9	100.8	100.8	100.8
15	96.5	98.0	98.6	99.2	99.5	99.8	100.1	100.5	100.9	101.1	101.1	101.1
10	95.8	97.2	97.8	98.4	98.7	99.0	99.4	99.7	100.1	100.5	101.0	101.5
MINIMUM ASSUMED TEMP (°C)	32	30	28	26	24	22	20	18	16	15	12	10

With engine bleed for packs off, increase %N1 by 1.0.

Assumed Temperature Reduced Thrust

%N1 Adjustment for Temperature Difference (Table 3 of 3)

ASSUMED TEMP MINUS OAT (°C)	OUTSIDE AIR TEMPERATURE (°C)													
	-40	-20	0	5	10	15	20	25	30	35	40	45	50	55
110	14.9													
100	14.9	10.9												
90	14.0	11.7												
80	12.9	11.6	7.8											
70	11.2	10.7	8.6	7.8	6.3									
60	9.2	9.5	8.5	8.4	7.1	6.3	4.9							
50	7.8	7.8	7.5	7.1	6.9	7.0	5.6	4.9	3.4					
40		6.0	6.2	6.1	5.9	5.8	5.7	5.6	4.7	4.4	5.3			
30		4.6	4.6	4.6	4.6	4.5	4.4	4.3	4.3	4.2	4.1	4.0	3.9	
20			2.9	3.0	3.0	3.0	3.0	3.0	2.9	2.9	2.8	2.8	2.7	2.6
10			1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.4	1.4	1.4	1.4
0			0	0	0	0	0	0	0	0	0	0	0	0

1. **Determine Maximum Assumed Temperature allowed from Table 1.**
2. **Find Maximum %N1 from Table 2 using the desired assumed temperature (no greater than temperature from Table 1).**
3. **Use the difference between assumed temperature and OAT to determine the %N1 adjustment from Table 3.**
4. **Subtract %N1 adjustment from Maximum %N1 in Table 2.**

Takeoff Speeds - Dry Runway (24K Derate)

V1, VR, V2

WEIGHT (1000 KG)	FLAPS 1			FLAPS 5			FLAPS 10			FLAPS 15			FLAPS 25		
	V1	VR	V2	V1	VR	V2	V1	VR	V2	V1	VR	V2	V1	VR	V2
90	172	172	174												
85	166	167	170	159	160	163									
80	160	162	166	154	155	159									
75	155	156	161	149	150	155	148	148	153	145	145	150	142	142	148
70	149	150	157	143	144	151	142	143	149	139	140	146	137	137	144
65	143	144	152	137	138	147	136	137	145	133	134	142	131	131	139
60	137	138	147	131	132	142	130	131	140	127	128	137	125	125	135
55	130	131	142	124	125	136	123	124	135	121	121	132	118	119	130
50	122	123	136	118	118	131	116	117	129	114	115	127	112	112	125
45	115	116	130	110	111	125	109	110	124	107	107	121	105	105	119
40	107	108	124	103	103	119	102	102	118	99	100	116	97	98	114

Check V1(MCG).

V1, VR, V2 Adjustments*

TEMP		V1							VR							V2						
		PRESS ALT (1000 FT)							PRESS ALT (1000 FT)							PRESS ALT (1000 FT)						
°C	°F	-2	0	2	4	6	8	10	-2	0	2	4	6	8	10	-2	0	2	4	6	8	10
70	158	5	6						5	5						-3	-4					
60	140	4	5	5	6				3	4	5	6				-2	-3	-3	-4			
50	122	2	3	4	5	6	7	8	2	3	4	5	6	7	8	-2	-2	-3	-3	-4	-4	-5
40	104	1	2	3	4	5	6	7	1	2	3	4	5	6	7	-1	-1	-2	-2	-3	-4	-4
30	86	0	0	1	3	4	5	6	0	0	1	2	4	5	6	0	0	-1	-1	-2	-3	-4
20	68	0	0	1	1	2	4	5	0	0	1	1	2	4	5	0	0	0	-1	-1	-2	-3
-60	-76	0	0	1	1	2	3	4	0	0	1	1	2	3	4	0	0	0	-1	-1	-1	-2

Slope and Wind V1 Adjustments*

WEIGHT (1000 KG)	SLOPE (%)					WIND (KTS)							
	-2	-1	0	1	2	-15	-10	-5	0	10	20	30	40
90	-4	-2	0	0	0	-2	-1	-1	0	0	0	0	0
80	-3	-2	0	1	1	-2	-1	-1	0	0	0	1	1
70	-2	-1	0	1	1	-1	-1	0	0	0	1	1	1
60	-1	-1	0	1	1	-1	-1	0	0	0	1	1	1
50	-1	0	0	0	0	-2	-1	0	0	0	0	0	0
40	0	0	0	0	0	-2	-1	0	0	0	0	0	0

***V1 not to exceed VR.**

V1(MCG)

TEMP		PRESSURE ALTITUDE (FT)						
°C	°F	-2000	0	2000	4000	6000	8000	10000
70	158	90	88					
60	140	90	88	87	85			
50	122	92	90	87	85	83	81	79
40	104	97	95	91	88	84	81	79
30	86	100	99	95	92	88	85	81
20	68	100	99	97	95	92	88	85
-60	-76	101	101	98	96	94	91	89

Takeoff Speeds - Wet Runway (24K Derate)

V1, VR, V2

WEIGHT (1000 KG)	FLAPS 1			FLAPS 5			FLAPS 10			FLAPS 15			FLAPS 25		
	V1	VR	V2	V1	VR	V2	V1	VR	V2	V1	VR	V2	V1	VR	V2
90	167	172	174												
85	161	167	170	154	160	163									
80	155	162	166	148	155	159									
75	149	156	161	142	150	155	142	148	153	139	145	150	137	142	148
70	142	150	157	136	144	151	136	143	149	133	140	146	131	137	144
65	136	144	152	130	138	147	129	137	145	127	134	142	125	131	139
60	129	138	147	123	132	142	123	131	140	120	128	137	118	125	135
55	122	131	142	116	125	136	116	124	135	113	121	132	111	119	130
50	114	123	136	109	118	131	109	117	129	106	115	127	104	112	125
45	107	116	130	102	111	125	101	110	124	99	107	121	97	105	119
40	98	108	124	94	103	119	93	102	118	92	100	115	90	98	114

Check V1(MCG).

V1, VR, V2 Adjustment*

TEMP		V1							VR							V2						
		PRESS ALT (1000 FT)							PRESS ALT (1000 FT)							PRESS ALT (1000 FT)						
°C	°F	-2	0	2	4	6	8	10	-2	0	2	4	6	8	10	-2	0	2	4	6	8	10
70	158	8	8						5	5						-3	-4					
60	140	5	6	8	9				3	4	5	6				-2	-3	-3	-4			
50	122	3	4	5	7	8	10	11	2	3	4	5	6	7	8	-2	-2	-3	-3	-4	-4	-5
40	104	1	2	3	5	6	7	9	1	2	3	4	5	6	7	-1	-1	-2	-2	-3	-4	-4
30	86	0	0	1	3	4	6	7	0	0	1	3	4	5	6	0	0	-1	-1	-2	-3	-4
20	68	0	0	1	1	2	4	5	0	0	1	1	2	4	5	0	0	0	-1	-1	-2	-3
-60	-76	0	0	1	1	2	3	4	0	0	1	1	2	3	4	0	0	0	-1	-1	-1	-2

Slope and Wind V1 Adjustment*

WEIGHT (1000 KG)	SLOPE (%)					WIND (KTS)							
	-2	-1	0	1	2	-15	-10	-5	0	10	20	30	40
90	-6	-3	0	3	6	-3	-2	-1	0	1	1	2	2
80	-5	-3	0	3	5	-3	-2	-1	0	1	1	2	2
70	-4	-2	0	2	4	-3	-2	-1	0	1	1	2	2
60	-3	-2	0	2	3	-4	-2	-1	0	1	1	2	3
50	-2	-1	0	1	3	-4	-3	-1	0	1	2	3	3
40	-1	0	0	1	2	-5	-3	-1	0	1	2	3	4

***V1 not to exceed VR.**

V1(MCG)

TEMP		PRESSURE ALTITUDE (FT)						
°C	°F	-2000	0	2000	4000	6000	8000	10000
70	158	90	88					
60	140	90	88	87	85			
50	122	92	90	87	85	83	81	79
40	104	97	95	91	88	84	81	79
30	86	100	99	95	92	88	85	81
20	68	100	99	97	95	92	88	85
-60	-76	101	101	98	96	94	91	89

Stab Trim Setting (24K Derate)

Flaps 1 and 5

WEIGHT (1000 KG)	C.G. (%MAC)									
	6	8	10	14	18	22	26	33	34	36
80	8 1/2	8 1/2	8 1/2	7 3/4	7	6 1/4	5 3/4	4 1/2	4 1/4	4
70	8 1/2	8 1/4	8	7 1/4	6 1/2	6	5 1/4	4	4	3 1/2
60	7 3/4	7 1/2	7	6 1/2	6	5 1/4	4 3/4	3 1/2	3 1/2	3 1/4
50	7	6 1/2	6 1/4	5 3/4	5 1/4	4 1/2	4	3	2 3/4	2 3/4
45	6 1/2	6 1/4	6	5 1/4	4 3/4	4 1/4	3 3/4	2 3/4	2 3/4	2 3/4
35	6 1/2	6 1/4	6	5 1/4	43/4	4 1/4	3 3/4	2 3/4	2 3/4	2 3/4

Flaps 10, 15 and 25

WEIGHT (1000 KG)	C.G. (%MAC)									
	6	8	9	10	16	26	29	32	34	36
80	8 1/2	8 1/2	8 1/2	8 1/2	7	4 3/4	4 1/4	3 1/2	3 1/4	2 3/4
70	8 1/2	8 1/4	8	7 3/4	6 1/4	4 1/4	3 1/2	3	2 3/4	2 3/4
60	7 3/4	7 1/4	7	6 3/4	5 1/2	3 1/2	3	2 3/4	2 3/4	2 3/4
50	6 1/4	6	5 3/4	5 3/4	4 3/4	3	2 3/4	2 3/4	2 3/4	2 3/4
45	5 3/4	5 1/2	5 1/4	5	4 1/4	2 3/4	2 3/4	2 3/4	2 3/4	2 3/4
35	5 3/4	5 1/2	5 1/4	5	4 1/4	2 3/4	2 3/4	2 3/4	2 3/4	2 3/4

ADVISORY INFORMATION

Slush/Standing Water Takeoff (24K Derate)

Maximum Reverse Thrust

Weight Adjustments (1000 KG)

24K DERATE DRY FIELD/OBSTACLE LIMIT WEIGHT (1000 KG)	SLUSH/STANDING WATER DEPTH								
	3 mm (0.12 INCHES)			6 mm (0.25 INCHES)			13 mm (0.50 INCHES)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
95	-13.2	-15.4	-17.7	-16.5	-18.7	-21.0	-25.2	-27.5	-29.8
90	-12.1	-14.4	-16.6	-15.0	-17.2	-19.5	-22.3	-24.6	-26.9
85	-11.0	-13.3	-15.6	-13.5	-15.7	-18.0	-19.5	-21.8	-24.0
80	-10.0	-12.3	-14.5	-12.0	-14.3	-16.5	-16.8	-19.1	-21.3
75	-9.0	-11.3	-13.5	-10.6	-12.9	-15.2	-14.4	-16.6	-18.9
70	-8.0	-10.3	-12.6	-9.3	-11.6	-13.9	-12.2	-14.4	-16.7
65	-7.1	-9.4	-11.6	-8.1	-10.4	-12.7	-10.2	-12.5	-14.8
60	-6.2	-8.5	-10.7	-7.0	-9.2	-11.5	-8.6	-10.8	-13.1
55	-5.3	-7.6	-9.9	-5.9	-8.2	-10.5	-7.1	-9.4	-11.7
50	-4.5	-6.8	-9.1	-4.9	-7.2	-9.5	-5.9	-8.2	-10.5
45	-3.7	-6.0	-8.2	-3.9	-6.2	-8.5	-4.7	-7.0	-9.3
40	-2.9	-5.1	-7.4	-3.0	-5.2	-7.5	-3.5	-5.8	-8.1

V1(MCG) Limit Weight (1000 KG)

ADJUSTED FIELD LENGTH (M)	SLUSH/STANDING WATER DEPTH								
	3 mm (0.12 INCHES)			6 mm (0.25 INCHES)			13 mm (0.50 INCHES)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
1200				32.5			39.1		
1400	50.5	33.8		53.8	37.5		58.9	43.8	
1600	72.4	55.7		75.1	58.8	32.9	78.6	63.6	39.5
1800	94.4	77.6	50.9	96.4	80.2	54.2	98.4	83.3	59.3
2000		99.6	72.9		101.5	75.5		103.1	79.0
2200			94.8			96.8			98.8

1. **Enter Weight Adjustment table with slush/standing water depth and 24K Derate dry field/obstacle limit weight to obtain slush/standing water weight adjustment.**
2. **Adjust field length available by -30 m/+30 m for every 5°C above/below 4°C.**
3. **Find V1(MCG) limit weight for adjusted field length and pressure altitude.**
4. **Max allowable slush/standing water limited weight is lesser of weights from 1 and 3.**

ADVISORY INFORMATION

Slush/Standing Water Takeoff (24K Derate)
Maximum Reverse Thrust
V1 Adjustment (KIAS)

WEIGHT (1000 KG)	SLUSH/STANDING WATER DEPTH								
	3 mm (0.12 INCHES)			6 mm (0.25 INCHES)			13 mm (0.50 INCHES)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
90	-13	-8	-3	-7	-2	0	0	0	0
85	-14	-9	-4	-8	-3	0	0	0	0
80	-15	-10	-5	-9	-4	0	0	0	0
75	-16	-11	-6	-11	-6	-1	0	0	0
70	-18	-13	-8	-12	-7	-2	0	0	0
65	-19	-14	-9	-14	-9	-4	-4	0	0
60	-20	-15	-10	-16	-11	-6	-7	-2	0
55	-21	-16	-11	-18	-13	-8	-11	-6	-1
50	-22	-17	-12	-20	-15	-10	-15	-10	-5
45	-23	-18	-13	-21	-16	-11	-17	-12	-7
40	-23	-18	-13	-21	-16	-11	-18	-13	-8

1. **Obtain V1, VR and V2 for the actual weight using the 24K Derate Dry Runway Takeoff Speeds table.**
2. **If V1(MCG) limited, set V1 = V1(MCG). If not V1(MCG) limited, enter V1 Adjustment table with the actual weight to obtain V1 speed adjustment. If adjusted V1 is less than V1(MCG), set V1 = V1(MCG). V1 not to exceed VR.**

ADVISORY INFORMATION

Slush/Standing Water Takeoff (24K Derate)

No Reverse Thrust

Weight Adjustments (1000 KG)

24K DERATE DRY FIELD/OBSTACLE LIMIT WEIGHT (1000 KG)	SLUSH/STANDING WATER DEPTH								
	3 mm (0.12 INCHES)			6 mm (0.25 INCHES)			13 mm (0.50 INCHES)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
90	-15.0	-17.5	-20.1	-18.1	-20.6	-23.1	-24.6	-27.1	-29.6
85	-14.0	-16.5	-19.0	-16.5	-19.1	-21.6	-22.0	-24.5	-27.0
80	-12.9	-15.4	-18.0	-15.0	-17.5	-20.0	-19.4	-22.0	-24.5
75	-11.8	-14.4	-16.9	-13.5	-16.0	-18.6	-17.1	-19.6	-22.1
70	-10.8	-13.3	-15.9	-12.1	-14.6	-17.2	-14.9	-17.5	-20.0
65	-9.8	-12.3	-14.8	-10.8	-13.3	-15.8	-13.0	-15.5	-18.0
60	-8.7	-11.3	-13.8	-9.5	-12.0	-14.6	-11.2	-13.7	-16.2
55	-7.7	-10.2	-12.8	-8.3	-10.8	-13.3	-9.6	-12.1	-14.6
50	-6.7	-9.2	-11.7	-7.1	-9.7	-12.2	-8.2	-10.7	-13.2
45	-5.7	-8.2	-10.7	-6.1	-8.6	-11.1	-7.0	-9.5	-12.0
40	-4.7	-7.2	-9.7	-5.0	-7.6	-10.1	-6.0	-8.5	-11.0

V1(MCG) Limit Weight (1000 KG)

ADJUSTED FIELD LENGTH (M)	SLUSH/STANDING WATER DEPTH								
	3 mm (0.12 INCHES)			6 mm (0.25 INCHES)			13 mm (0.50 INCHES)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
1600							32.3		
1700							46.2		
1800				33.4			60.1		
1900	30.7			52.9			74.1	39.9	
2000	54.1			70.9			88.2	53.8	
2100	75.7			87.8	44.3			67.8	33.7
2200	95.8	43.7			63.0			81.8	47.6
2300		66.2			80.3	35.4		95.9	61.5
2400		86.8	33.1		96.9	54.7			75.5
2500			56.4			72.6			89.6
2600			77.7			89.4			
2700			97.8						

1. **Enter Weight Adjustment table with slush/standing water depth and 24K Derate dry field/obstacle limit weight to obtain slush/standing water weight adjustment.**
2. **Adjust field length available by -40 m/+40 m for every 5°C above/below 4°C.**
3. **Find V1(MCG) limit weight for adjusted field length and pressure altitude.**
4. **Max allowable slush/standing water limited weight is lesser of weights from 1 and 3.**

ADVISORY INFORMATION

Slush/Standing Water Takeoff (24K Derate)
No Reverse Thrust
V1 Adjustment (KIAS)

WEIGHT (1000 KG)	SLUSH/STANDING WATER DEPTH								
	3 mm (0.12 INCHES)			6 mm (0.25 INCHES)			13 mm (0.50 INCHES)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
90	-20	-10	0	-9	0	0	0	0	0
85	-22	-12	-2	-12	-2	0	0	0	0
80	-24	-14	-4	-14	-4	0	0	0	0
75	-26	-16	-6	-17	-7	0	0	0	0
70	-28	-18	-8	-20	-10	0	0	0	0
65	-30	-20	-10	-23	-13	-3	-6	0	0
60	-32	-22	-12	-26	-16	-6	-12	-2	0
55	-34	-24	-14	-29	-19	-9	-18	-8	0
50	-36	-26	-16	-32	-22	-12	-24	-14	-4
45	-38	-28	-18	-35	-25	-15	-29	-19	-9
40	-40	-30	-20	-38	-28	-18	-34	-24	-14

1. **Obtain V1, VR and V2 for the actual weight using the 24K Derate Dry Runway Takeoff Speeds table.**
2. **If V1(MCG) limited, set V1 = V1(MCG). If not V1(MCG) limited, enter V1 Adjustment table with the actual weight to obtain V1 speed adjustment. If adjusted V1 is less than V1(MCG), set V1 = V1(MCG). V1 not to exceed VR.**

ADVISORY INFORMATION

Slippery Runway Takeoff (24K Derate)
Maximum Reverse Thrust
Weight Adjustment (1000 KG)

24K DERATE DRY FIELD/OBSTACLE LIMIT WEIGHT (1000 KG)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
95	-0.4	-0.4	-0.4	-5.8	-5.8	-5.8	-11.0	-11.0	-11.0
90	-0.6	-0.6	-0.6	-5.8	-5.8	-5.8	-10.6	-10.6	-10.6
85	-0.9	-0.9	-0.9	-5.7	-5.7	-5.7	-10.2	-10.2	-10.2
80	-1.1	-1.1	-1.1	-5.7	-5.7	-5.7	-9.8	-9.8	-9.8
75	-1.3	-1.3	-1.3	-5.6	-5.6	-5.6	-9.3	-9.3	-9.3
70	-1.5	-1.5	-1.5	-5.4	-5.4	-5.4	-8.9	-8.9	-8.9
65	-1.5	-1.5	-1.5	-5.2	-5.2	-5.2	-8.3	-8.3	-8.3
60	-1.5	-1.5	-1.5	-5.0	-5.0	-5.0	-7.8	-7.8	-7.8
55	-1.5	-1.5	-1.5	-4.7	-4.7	-4.7	-7.2	-7.2	-7.2
50	-1.4	-1.4	-1.4	-4.3	-4.3	-4.3	-6.5	-6.5	-6.5
45	-1.3	-1.3	-1.3	-4.0	-4.0	-4.0	-5.9	-5.9	-5.9
40	-1.3	-1.3	-1.3	-3.6	-3.6	-3.6	-5.3	-5.3	-5.3

V1(MCG) Limit Weight (1000 KG)

ADJUSTED FIELD LENGTH (M)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
1000	47.2								
1200	80.2	62.9	45.0	30.7					
1400		95.1	78.2	54.0	34.5				
1600				79.3	57.9	38.2	33.5		
1800					83.7	61.9	47.5	30.4	
2000						88.2	62.9	44.4	
2200							80.6	59.4	41.3
2400							101.0	76.4	55.9
2600								96.4	72.5
2800									91.8

1. **Enter Weight Adjustment table with reported braking action and 24K Derate dry field/obstacle limit weight to obtain slippery runway weight adjustment.**
2. **Adjust “Good” field length available by -20 m/+20 m for every 5°C above/below 4°C.**
   Adjust “Medium” field length available by -20 m/+20 m for every 5°C above/below 4°C.
   Adjust “Poor” field length available by -35 m/+35 m for every 5°C above/below 4°C.
3. **Find V1(MCG) limit weight for adjusted field length and pressure altitude.**
4. **Max allowable slippery runway limited weight is lesser of weights from 1 and 3.**

ADVISORY INFORMATION

Slippery Runway Takeoff (24K Derate)
Maximum Reverse Thrust
V1 Adjustment (KIAS)

WEIGHT (1000 KG)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
90	-4	-2	0	-13	-10	-8	-23	-21	-18
85	-5	-3	0	-14	-11	-9	-24	-22	-19
80	-6	-3	-1	-15	-12	-10	-26	-23	-21
75	-7	-4	-2	-16	-13	-11	-27	-25	-22
70	-8	-5	-3	-17	-15	-12	-29	-27	-24
65	-9	-6	-4	-19	-17	-14	-32	-29	-27
60	-9	-7	-4	-21	-18	-16	-34	-31	-29
55	-10	-8	-5	-22	-20	-17	-36	-33	-31
50	-11	-9	-6	-23	-21	-18	-37	-35	-32
45	-12	-9	-7	-24	-22	-19	-39	-36	-34
40	-12	-10	-7	-25	-22	-20	-39	-37	-34

1. **Obtain V1, VR and V2 for the actual weight using the 24K Derate Dry Runway Takeoff Speeds table.**
2. **If V1(MCG) limited, set V1 = V1(MCG). If not V1(MCG) limited, enter V1 Adjustment table with the actual weight to obtain V1 speed adjustment. If adjusted V1 is less than V1(MCG), set V1 = V1(MCG). V1 not to exceed VR.**

ADVISORY INFORMATION

Slippery Runway Takeoff (24K Derate)

No Reverse Thrust

Weight Adjustments (1000 KG)

24K DERATE DRY FIELD/OBSTACLE LIMIT WEIGHT (1000 KG)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
95	-1.0	-1.0	-1.0	-7.9	-7.9	-7.9	-14.4	-14.4	-14.4
90	-1.5	-1.5	-1.5	-8.1	-8.1	-8.1	-14.1	-14.1	-14.1
85	-2.0	-2.0	-2.0	-8.2	-8.2	-8.2	-13.8	-13.8	-13.8
80	-2.4	-2.4	-2.4	-8.4	-8.4	-8.4	-13.4	-13.4	-13.4
75	-2.8	-2.8	-2.8	-8.4	-8.4	-8.4	-12.9	-12.9	-12.9
70	-3.0	-3.0	-3.0	-8.2	-8.2	-8.2	-12.3	-12.3	-12.3
65	-3.1	-3.1	-3.1	-7.9	-7.9	-7.9	-11.5	-11.5	-11.5
60	-3.1	-3.1	-3.1	-7.5	-7.5	-7.5	-10.5	-10.5	-10.5
55	-3.0	-3.0	-3.0	-6.9	-6.9	-6.9	-9.4	-9.4	-9.4
50	-2.8	-2.8	-2.8	-6.3	-6.3	-6.3	-8.2	-8.2	-8.2
45	-2.4	-2.4	-2.4	-5.4	-5.4	-5.4	-6.8	-6.8	-6.8
40	-2.0	-2.0	-2.0	-4.5	-4.5	-4.5	-5.4	-5.4	-5.4

V1(MCG) Limit Weight (1000 KG)

ADJUSTED FIELD LENGTH (M)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
1200	57.1								
1300	79.2	35.6							
1400	97.5	64.5							
1500		84.8	45.6						
1600		102.9	71.1						
1700			90.2						
1800				49.7					
1900				75.5					
2000				95.7	44.7				
2100					72.2				
2200					92.7	39.3			
2300						68.7			
2400						89.7			
2900							51.7		
3000							73.3		
3100							93.4		
3200								43.7	
3300								66.0	
3400								86.4	
3500									35.6
3600									58.4
3700									79.5
3800									99.4

1. **Enter Weight Adjustment table with reported braking action and 24K Derate dry field/obstacle limit weight to obtain slippery runway weight adjustment.**
2. **Adjust "Good" field length available by -30 m/+30 m for every 5°C above/below 4°C.**
   Adjust "Medium" field length available by -30 m/+30 m for every 5°C above/below 4°C.
   Adjust "Poor" field length available by -45 m/+45 m for every 5°C above/below 4°C.
3. **Find V1(MCG) limit weight for adjusted field length and pressure altitude.**
4. **Max allowable slippery runway limited weight is lesser of weights from 1 and 3.**

ADVISORY INFORMATION

Slippery Runway Takeoff (24K Derate)
No Reverse Thrust
V1 Adjustment (KIAS)

WEIGHT (1000 KG)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
95	-5	0	0	-14	-9	-4	-31	-26	-21
90	-6	-1	0	-16	-11	-6	-34	-29	-24
85	-7	-2	0	-18	-13	-8	-37	-32	-27
80	-8	-3	0	-20	-15	-10	-40	-35	-30
75	-9	-4	0	-23	-18	-13	-43	-38	-33
70	-11	-6	-1	-25	-20	-15	-47	-42	-37
65	-12	-7	-2	-28	-23	-18	-50	-45	-40
60	-14	-9	-4	-31	-26	-21	-54	-49	-44
55	-15	-10	-5	-33	-28	-23	-59	-54	-49
50	-17	-12	-7	-37	-32	-27	-63	-58	-53
45	-19	-14	-9	-40	-35	-30	-67	-62	-57
40	-21	-16	-11	-43	-38	-33	-72	-67	-62

1. **Obtain V1, VR and V2 for the actual weight using the 24K Derate Dry Runway Takeoff Speeds table.**
2. **If V1(MCG) limited, set V1 = V1(MCG). If not V1(MCG) limited, enter V1 Adjustment table with the actual weight to obtain V1 speed adjustment. If adjusted V1 is less than V1(MCG), set V1 = V1(MCG). V1 not to exceed VR.**

Takeoff %N1 - (24K Derate)

Based on engine bleeds for packs on, engine and wing anti-ice on or off

OAT (°C)	AIRPORT PRESSURE ALTITUDE (FT)												
	-2000	-1000	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
60	90.3	90.8	91.2	91.2	91.1	91.1	91.0	91.1	91.2	91.0	91.2	91.3	91.4
55	91.0	91.6	92.0	92.0	92.0	91.9	91.9	91.9	92.0	91.9	91.7	91.3	90.8
50	91.8	92.4	92.8	92.8	92.8	92.7	92.7	92.7	92.7	92.6	92.6	92.2	91.8
45	92.6	93.2	93.6	93.6	93.6	93.6	93.5	93.5	93.5	93.4	93.3	93.1	92.8
40	93.4	94.0	94.4	94.4	94.4	94.3	94.3	94.2	94.2	94.1	94.1	94.0	93.8
35	94.2	94.8	95.2	95.2	95.2	95.1	95.1	95.0	95.0	94.9	94.8	94.8	94.7
30	93.8	95.0	96.1	96.0	96.0	96.0	95.9	95.8	95.8	95.7	95.7	95.6	95.6
25	93.1	94.3	95.4	95.9	96.4	96.7	96.7	96.6	96.6	96.5	96.4	96.4	96.3
20	92.3	93.5	94.6	95.1	95.7	96.3	96.9	97.6	97.5	97.5	97.4	97.3	97.2
15	91.6	92.7	93.8	94.3	94.9	95.5	96.1	96.8	97.5	98.2	98.6	98.6	98.5
10	90.8	92.0	93.0	93.6	94.1	94.7	95.3	96.0	96.7	97.5	98.2	99.1	100.0
5	90.0	91.2	92.2	92.8	93.3	93.9	94.5	95.2	95.9	96.7	97.4	98.4	99.3
0	89.2	90.4	91.4	92.0	92.5	93.1	93.7	94.4	95.1	95.9	96.7	97.6	98.5
-5	88.4	89.6	90.6	91.2	91.7	92.3	92.9	93.6	94.3	95.1	95.9	96.8	97.7
-10	87.6	88.8	89.8	90.4	90.9	91.5	92.1	92.8	93.5	94.3	95.1	96.1	97.0
-15	86.8	88.0	89.0	89.5	90.0	90.6	91.3	92.0	92.7	93.5	94.3	95.3	96.2
-20	86.0	87.1	88.2	88.7	89.2	89.8	90.5	91.2	91.9	92.6	93.5	94.5	95.4
-25	85.2	86.3	87.3	87.9	88.4	89.0	89.6	90.3	91.0	91.8	92.6	93.7	94.6
-30	84.4	85.5	86.5	87.0	87.5	88.1	88.8	89.5	90.2	91.0	91.8	92.9	93.8
-35	83.5	84.6	85.6	86.2	86.6	87.3	87.9	88.6	89.3	90.1	91.0	92.1	93.0
-40	82.7	83.8	84.8	85.3	85.8	86.4	87.0	87.8	88.5	89.3	90.1	91.2	92.2
-45	81.8	82.9	83.9	84.4	84.9	85.5	86.2	86.9	87.6	88.4	89.3	90.4	91.4
-50	81.0	82.0	83.0	83.5	84.0	84.6	85.3	86.0	86.7	87.5	88.4	89.5	90.5

%N1 Adjustments for Engine Bleeds

BLEED CONFIGURATION	AIRPORT PRESSURE ALTITUDE (FT)												
	-2000	-1000	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
PACKS OFF	0.7	0.7	0.7	0.7	0.7	0.7	0.8	0.8	0.8	0.8	0.8	0.9	1.0

Assumed Temperature Reduced Thrust (24K Derate)
Maximum Assumed Temperature (Table 1 of 3)
Based on 25% Takeoff Thrust Reduction

OAT (°C)	AIRPORT PRESSURE ALTITUDE (FT)											
	-1000	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
55	73	71	69	67								
50	73	71	69	67	65	63						
45	73	71	69	67	65	63	61	59	57			
40	73	71	69	67	65	63	61	59	57	55		
35	67	67	67	67	65	63	61	59	57	55	53	
30	64	61	62	61	61	61	61	59	57	55	53	51
25	64	61	59	57	56	56	57	57	57	55	53	51
20	64	61	59	57	56	54	53	53	53	53	52	51
15	64	61	59	57	56	54	53	52	50	49	48	47
10 & BELOW	64	61	59	57	56	54	53	52	50	48	45	43

Takeoff %N1 (Table 2 of 3)
Based on engine bleed for packs on, engine and wing anti-ice on or off

ASSUMED TEMP (°C)	AIRPORT PRESSURE ALTITUDE (FT)											
	-1000	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
75	88.3	88.6	89.1	89.6	90.2	90.8	91.5	92.2	92.7	93.1	93.3	93.4
70	89.1	89.5	89.4	89.3	89.6	90.1	90.8	91.6	92.0	92.5	92.6	92.7
65	90.0	90.4	90.3	90.2	90.2	90.1	90.2	90.9	91.4	91.8	91.9	92.1
60	90.8	91.2	91.2	91.1	91.1	91.0	91.1	91.2	91.0	91.2	91.3	91.4
55	91.6	92.0	92.0	92.0	91.9	91.9	91.9	92.0	91.9	91.7	91.3	90.8
50	92.4	92.8	92.8	92.8	92.7	92.7	92.7	92.7	92.6	92.6	92.2	91.8
45	93.2	93.6	93.6	93.6	93.6	93.5	93.5	93.5	93.4	93.3	93.1	92.8
40	94.0	94.4	94.4	94.4	94.3	94.3	94.2	94.2	94.1	94.1	94.0	93.8
35	94.8	95.2	95.2	95.2	95.1	95.1	95.0	95.0	94.9	94.8	94.8	94.7
30	95.0	96.1	96.0	96.0	96.0	95.9	95.8	95.8	95.7	95.7	95.6	95.6
25	94.3	95.4	95.9	96.4	96.7	96.7	96.6	96.6	96.5	96.4	96.4	96.3
20	93.5	94.6	95.1	95.7	96.3	96.9	97.6	97.5	97.5	97.4	97.3	97.2
15	92.7	93.8	94.3	94.9	95.5	96.1	96.8	97.5	98.2	98.6	98.6	98.5
10	92.0	93.0	93.6	94.1	94.7	95.3	96.0	96.7	97.5	98.2	99.1	100.0
MINIMUM ASSUMED TEMP (°C)	32	30	28	26	24	22	20	18	16	15	12	10

With engine bleed for packs off, increase %N1 by 1.0

Assumed Temperature Reduced Thrust (24K Derate)
%N1 Adjustment for Temperature Difference (Table 3 of 3)

ASSUMED TEMP MINUS OAT (°C)	OUTSIDE AIR TEMPERATURE (°C)													
	-40	-20	0	5	10	15	20	25	30	35	40	45	50	55
110	12.1													
100	11.3	8.5												
90	11.7	8.9												
80	12.5	8.0	5.5											
70	11.3	8.4	5.9	5.6	4.0									
60	9.7	9.2	4.8	4.7	4.4	4.2	2.6							
50	7.8	7.9	5.3	3.5	3.3	3.6	3.0	2.7	1.2					
40		6.4	6.0	5.5	3.7	3.2	3.7	3.0	2.8	3.0	3.7			
30		4.6	4.6	4.6	4.5	4.3	4.2	4.0	4.1	4.0	3.9	3.8	3.7	
20			3.1	3.1	3.1	3.0	2.9	2.9	2.8	2.7	2.7	2.6	2.6	2.5
10			1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.4	1.4	1.4	1.3	1.3
0			0	0	0	0	0	0	0	0	0	0	0	0

1. **Determine Maximum Assumed Temperature allowed from Table 1.**
2. **Find Maximum %N1 from Table 2 using the desired assumed temperature (no greater than temperature from Table 1).**
3. **Use the difference between assumed temperature and OAT to determine the %N1 adjustment from Table 3.**
4. **Subtract %N1 adjustment from Maximum %N1 in Table 2.**

Takeoff Speeds - Dry Runway (22K Derate)

V1, VR, V2

WEIGHT (1000 KG)	FLAPS 1			FLAPS 5			FLAPS 10			FLAPS 15			FLAPS 25		
	V1	VR	V2	V1	VR	V2	V1	VR	V2	V1	VR	V2	V1	VR	V2
80	162	163	165	156	156	159									
76	158	158	162	152	152	156									
72	153	154	158	147	147	152	146	146	150	142	142	147			
68	148	149	155	142	143	149	141	141	147	138	138	144			
64	143	144	151	138	138	145	136	137	143	134	134	140	131	131	138
60	138	139	147	132	133	141	131	132	139	128	129	136	126	126	134
56	132	133	142	127	128	137	126	126	135	123	124	132	121	121	130
52	127	127	138	122	122	132	121	121	131	118	118	128	116	116	126
48	121	121	133	116	116	128	115	115	126	112	113	124	110	110	122
44	115	115	128	110	111	123	109	109	122	107	107	119	105	105	117
40	108	108	123	104	104	118	103	103	117	100	101	115	98	99	113

Check V1(MCG).

V1, VR, V2 Adjustments*

TEMP		V1							VR							V2						
		PRESS ALT (1000 FT)							PRESS ALT (1000 FT)							PRESS ALT (1000 FT)						
°C	°F	-2	0	2	4	6	8	10	-2	0	2	4	6	8	10	-2	0	2	4	6	8	10
70	158	5	5						5	5						-3	-3					
60	140	4	4	5	6				4	4	5	6				-2	-3	-3	-4			
50	122	2	3	4	5	6	7	8	2	3	4	5	6	7	8	-1	-2	-2	-3	-3	-4	-5
40	104	1	2	3	4	5	6	7	1	2	3	4	5	6	7	-1	-1	-1	-2	-3	-3	-4
30	86	0	0	1	2	3	5	6	0	0	1	2	3	5	6	0	0	-1	-1	-2	-3	-3
20	68	0	0	0	1	2	3	5	0	0	1	1	2	3	5	0	0	0	-1	-1	-2	-3
-60	-76	0	0	0	1	2	2	3	0	0	1	1	2	3	3	0	0	0	-1	-1	-1	-2

Slope and Wind V1 Adjustments*

WEIGHT (1000 KG)	SLOPE (%)					WIND (KTS)							
	-2	-1	0	1	2	-15	-10	-5	0	10	20	30	40
80	-3	-2	0	1	1	-1	-1	0	0	0	1	1	1
76	-3	-1	0	1	1	-1	-1	0	0	0	1	1	1
72	-2	-1	0	1	1	-1	-1	0	0	0	1	1	1
68	-2	-1	0	1	1	-1	-1	0	0	0	1	1	1
64	-2	-1	0	1	1	-1	-1	0	0	0	1	1	1
60	-1	-1	0	1	1	-1	-1	0	0	0	1	1	1
56	-1	0	0	1	1	-1	-1	0	0	0	1	1	1
52	-1	0	0	1	1	-1	-1	0	0	0	1	1	1
48	-1	0	0	0	1	-1	-1	0	0	0	1	1	1
44	0	0	0	0	1	-1	-1	0	0	0	1	1	1
40	0	0	0	0	1	-1	-1	0	0	0	1	1	1

***V1 not to exceed VR.**

V1(MCG)

TEMP		PRESSURE ALTITUDE (FT)						
°C	°F	-2000	0	2000	4000	6000	8000	10000
70	158	87	85					
60	140	87	85	84	83			
50	122	89	87	84	83	81	79	77
40	104	94	91	88	85	82	79	77
30	86	96	96	93	89	86	82	79
20	68	97	96	94	93	90	86	82
-60	-76	98	98	96	94	91	89	87

Takeoff Speeds - Wet Runway (22K Derate)

V1, VR, V2

WEIGHT (1000 KG)	FLAPS 1			FLAPS 5			FLAPS 10			FLAPS 15			FLAPS 25		
	V1	VR	V2	V1	VR	V2	V1	VR	V2	V1	VR	V2	V1	VR	V2
80	157	163	165	150	156	159									
76	152	158	162	146	152	156									
72	147	154	158	141	147	152	141	146	150	138	142	147			
68	142	149	155	136	143	149	136	141	147	133	138	144			
64	136	144	151	131	138	145	130	137	143	127	134	140	126	131	138
60	131	139	147	125	133	141	125	132	139	122	129	136	120	126	134
56	125	133	142	120	128	137	119	126	135	116	124	132	115	121	130
52	119	127	138	114	122	132	113	121	131	111	118	128	109	116	126
48	113	121	133	108	116	128	108	115	126	105	113	124	103	110	122
44	107	115	128	102	111	123	102	109	122	99	107	119	98	105	117
40	100	108	123	96	104	118	95	103	117	93	101	115	92	99	113

Check V1(MCG).

V1, VR, V2 Adjustments*

TEMP		V1							VR							V2						
		PRESS ALT (1000 FT)							PRESS ALT (1000 FT)							PRESS ALT (1000 FT)						
°C	°F	-2	0	2	4	6	8	10	-2	0	2	4	6	8	10	-2	0	2	4	6	8	10
70	158	8	8						5	5						-3	-3					
60	140	6	6	7	9				4	4	5	6				-2	-3	-3	-4			
50	122	4	4	5	6	8	10	11	2	3	4	5	6	7	8	-1	-2	-2	-3	-3	-4	-5
40	104	1	2	3	4	6	8	9	1	2	3	4	5	6	7	-1	-1	-1	-2	-3	-3	-4
30	86	0	0	1	2	4	6	7	0	0	1	2	3	5	6	0	0	-1	-1	-2	-3	-3
20	68	0	0	0	1	2	4	5	0	0	1	1	2	3	5	0	0	0	-1	-1	-2	-3
-60	-76	0	0	0	1	2	3	4	0	0	1	1	2	3	3	0	0	0	-1	-1	-1	-2

Slope and Wind V1 Adjustments*

WEIGHT (1000 KG)	SLOPE (%)					WIND (KTS)							
	-2	-1	0	1	2	-15	-10	-5	0	10	20	30	40
80	-5	-3	0	3	5	-3	-2	-1	0	1	1	2	2
76	-5	-2	0	3	5	-3	-2	-1	0	1	1	2	2
72	-4	-2	0	2	5	-3	-2	-1	0	1	1	2	2
68	-4	-2	0	2	4	-3	-2	-1	0	1	1	2	3
64	-3	-2	0	2	4	-3	-2	-1	0	1	1	2	3
60	-3	-2	0	2	4	-3	-2	-1	0	1	1	2	3
56	-3	-1	0	2	3	-4	-2	-1	0	1	2	2	3
52	-3	-1	0	1	3	-4	-3	-1	0	1	2	2	3
48	-2	-1	0	1	2	-4	-3	-1	0	1	2	2	3
44	-2	-1	0	1	2	-4	-3	-1	0	1	2	3	3
40	-2	-1	0	1	2	-5	-3	-2	0	1	2	3	4

***V1 not to exceed VR.**

V1(MCG)

TEMP		PRESSURE ALTITUDE (FT)						
°C	°F	-2000	0	2000	4000	6000	8000	10000
70	158	87	85					
60	140	87	85	84	83			
50	122	89	87	84	83	81	79	77
40	104	94	91	88	85	82	79	77
30	86	96	96	93	89	86	82	79
20	68	97	96	94	93	90	86	82
-60	-76	98	98	96	94	91	89	87

Stab Trim Setting (22K Derate)

Flaps 1 and 5

WEIGHT (1000 KG)	C.G. (%MAC)									
	6	9	11	14	18	21	24	28	32	36
80	8 1/2	8 1/2	8 1/2	8	7 1/4	6 3/4	6 1/4	5 3/4	5	4 1/2
70	8 1/2	8 1/4	8	7 1/2	6 3/4	6 1/4	5 3/4	5 1/4	4 1/2	3 3/4
60	8 1/4	7 3/4	7 1/2	7	6 1/4	5 3/4	5 1/4	4 3/4	4	3 1/4
50	7 1/4	6 3/4	6 1/2	6	5 1/2	5	4 3/4	4	3 1/2	3
45	6 1/2	6 1/4	6	5 3/4	5	4 3/4	4 1/4	3 3/4	3 1/4	2 3/4
35	6 1/2	6 1/4	6	5 3/4	5	4 3/4	4 1/4	3 3/4	3 1/4	2 3/4

Flaps 10, 15 and 25

WEIGHT (1000 KG)	C.G. (%MAC)									
	6	8	9	10	16	26	27	31	34	36
80	8 1/2	8 1/2	8 1/2	8 1/2	7	5	4 3/4	4	3 1/4	3
70	8 1/2	8 1/4	8	8	6 1/2	4 1/2	4 1/4	3 1/2	3	2 3/4
60	7 3/4	7 1/4	7	7	5 3/4	4	3 3/4	3	2 3/4	2 3/4
50	6 1/2	6 1/4	6	5 3/4	4 3/4	3	3	2 3/4	2 3/4	2 3/4
45	6	5 3/4	5 1/2	5 1/2	4 1/4	2 3/4	2 3/4	2 3/4	2 3/4	2 3/4
35	6	5 3/4	5 1/2	5 1/2	4 1/4	2 3/4	2 3/4	2 3/4	2 3/4	2 3/4

ADVISORY INFORMATION

Slush/Standing Water Takeoff (22K Derate)

Maximum Reverse Thrust

Weight Adjustments (1000 KG)

22K DERATE DRY FIELD/OBSTACLE LIMIT WEIGHT (1000 KG)	SLUSH/STANDING WATER DEPTH								
	3 mm (0.12 INCHES)			6 mm (0.25 INCHES)			13 mm (0.50 INCHES)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
95	-12.7	-15.2	-17.7	-16.3	-18.8	-21.3	-23.1	-25.5	-28.0
90	-11.7	-14.2	-16.7	-14.9	-17.4	-19.9	-20.9	-23.4	-25.9
85	-10.8	-13.3	-15.8	-13.5	-16.0	-18.5	-18.7	-21.2	-23.7
80	-9.8	-12.3	-14.8	-12.1	-14.6	-17.1	-16.6	-19.1	-21.6
75	-8.9	-11.4	-13.9	-10.8	-13.2	-15.7	-14.5	-17.0	-19.5
70	-8.0	-10.5	-13.0	-9.5	-12.0	-14.5	-12.6	-15.1	-17.6
65	-7.1	-9.6	-12.1	-8.3	-10.8	-13.3	-10.8	-13.3	-15.8
60	-6.3	-8.8	-11.3	-7.2	-9.7	-12.2	-9.1	-11.6	-14.1
55	-5.5	-8.0	-10.5	-6.1	-8.6	-11.1	-7.6	-10.1	-12.6
50	-4.7	-7.2	-9.7	-5.2	-7.7	-10.2	-6.2	-8.7	-11.2
45	-3.9	-6.4	-8.9	-4.3	-6.8	-9.3	-4.9	-7.4	-9.9
40	-3.2	-5.7	-8.2	-3.5	-5.9	-8.4	-3.7	-6.2	-8.7

V1(MCG) Limit Weight (1000 KG)

ADJUSTED FIELD LENGTH (M)	SLUSH/STANDING WATER DEPTH								
	3 mm (0.12 INCHES)			6 mm (0.25 INCHES)			13 mm (0.50 INCHES)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
1200	36.3			39.3			44.3		
1400	57.8	38.1		60.6	41.0		65.5	46.0	
1600	81.2	59.7	39.8	83.4	62.5	42.7	92.4	67.4	47.7
1800	104.8	83.2	61.7		85.4	64.4		94.9	69.5
2000			85.2			87.3			97.4

1. **Enter Weight Adjustment table with slush/standing water depth and 22K Derate dry field/obstacle limit weight to obtain slush/standing water weight adjustment.**
2. **Adjust field length available by -20 m/+20 m for every 5°C above/below 4°C.**
3. **Find V1(MCG) limit weight for adjusted field length and pressure altitude.**
4. **Max allowable slush/standing water limited weight is lesser of weights from 1 and 3.**

ADVISORY INFORMATION

Slush/Standing Water Takeoff (22K Derate)
Maximum Reverse Thrust
V1 Adjustment (KIAS)

WEIGHT (1000 KG)	SLUSH/STANDING WATER DEPTH								
	3 mm (0.12 INCHES)			6 mm (0.25 INCHES)			13 mm (0.50 INCHES)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
90	-13	-8	-3	-8	-3	0	0	0	0
85	-13	-8	-3	-8	-3	0	0	0	0
80	-14	-9	-4	-7	-2	0	0	0	0
75	-14	-9	-4	-8	-3	0	0	0	0
70	-15	-10	-5	-10	-5	0	0	0	0
65	-17	-12	-7	-12	-7	-2	-1	0	0
60	-19	-14	-9	-14	-9	-4	-5	0	0
55	-20	-15	-10	-17	-12	-7	-9	-4	0
50	-21	-16	-11	-18	-13	-8	-12	-7	-2
45	-21	-16	-11	-19	-14	-9	-15	-10	-5
40	-21	-16	-11	-19	-14	-9	-16	-11	-6

1. **Obtain V1, VR and V2 for the actual weight using the 22K Derate Dry Runway Takeoff Speeds table.**
2. **If V1(MCG) limited, set V1 = V1(MCG). If not V1(MCG) limited, enter V1 Adjustment table with the actual weight to obtain V1 speed adjustment. If adjusted V1 is less than V1(MCG), set V1 = V1(MCG). V1 not to exceed VR.**

ADVISORY INFORMATION

Slush/Standing Water Takeoff (22K Derate)

No Reverse Thrust

Weight Adjustments (1000 KG)

22K DERATE DRY FIELD/OBSTACLE LIMIT WEIGHT (1000 KG)	SLUSH/STANDING WATER DEPTH								
	3 mm (0.12 INCHES)			6 mm (0.25 INCHES)			13 mm (0.50 INCHES)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
95	-15.6	-17.8	-20.1	-19.5	-21.8	-24.0	-26.3	-28.6	-30.9
90	-14.4	-16.7	-18.9	-17.8	-20.1	-22.3	-23.9	-26.1	-28.4
85	-13.2	-15.5	-17.7	-16.1	-18.3	-20.6	-21.4	-23.6	-25.9
80	-12.0	-14.3	-16.5	-14.4	-16.6	-18.9	-18.9	-21.2	-23.4
75	-10.8	-13.1	-15.4	-12.8	-15.0	-17.3	-16.6	-18.8	-21.1
70	-9.7	-12.0	-14.3	-11.3	-13.5	-15.8	-14.4	-16.7	-18.9
65	-8.7	-11.0	-13.2	-9.9	-12.1	-14.4	-12.4	-14.7	-16.9
60	-7.7	-10.0	-12.2	-8.6	-10.9	-13.1	-10.6	-12.8	-15.1
55	-6.8	-9.0	-11.3	-7.4	-9.7	-12.0	-8.9	-11.2	-13.4
50	-5.9	-8.2	-10.4	-6.4	-8.7	-10.9	-7.4	-9.7	-12.0
45	-5.0	-7.3	-9.6	-5.5	-7.7	-10.0	-6.1	-8.4	-10.6
40	-4.2	-6.5	-8.8	-4.6	-6.8	-9.1	-4.9	-7.1	-9.4

V1(MCG) Limit Weight (1000 KG)

ADJUSTED FIELD LENGTH (M)	SLUSH/STANDING WATER DEPTH								
	3 mm (0.12 INCHES)			6 mm (0.25 INCHES)			13 mm (0.50 INCHES)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
1400				31.5			44.2		
1600	50.9			58.2			69.4	42.6	
1800	80.4	49.0		85.5	56.3		95.9	67.5	41.0
2000		78.5	47.0		83.7	54.5		94.2	65.7
2200			76.7			81.9			92.4
2400			103.2						

1. **Enter Weight Adjustment table with slush/standing water depth and 22K Derate dry field/obstacle limit weight to obtain slush/standing water weight adjustment.**
2. **Adjust field length available by -35 m/+30 m for every 5°C above/below 4°C.**
3. **Find V1(MCG) limit weight for available field length and pressure altitude.**
4. **Max allowable slush/standing water limited weight is lesser of weights from 1 and 3.**

ADVISORY INFORMATION

Slush/Standing Water Takeoff (22K Derate)

No Reverse Thrust

V1 Adjustment (KIAS)

WEIGHT (1000 KG)	SLUSH/STANDING WATER DEPTH								
	3 mm (0.12 INCHES)			6 mm (0.25 INCHES)			13 mm (0.50 INCHES)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
95	-18	-13	-8	-11	-6	-1	0	0	0
90	-18	-13	-8	-11	-6	-1	0	0	0
85	-18	-13	-8	-11	-6	-1	0	0	0
80	-19	-14	-9	-10	-5	0	0	0	0
75	-19	-14	-9	-11	-6	-1	0	0	0
70	-21	-16	-11	-13	-8	-3	0	0	0
65	-23	-18	-13	-16	-11	-6	-1	0	0
60	-25	-20	-15	-19	-14	-9	-7	-2	0
55	-26	-21	-16	-22	-17	-12	-12	-7	-2
50	-27	-22	-17	-24	-19	-14	-16	-11	-6
45	-28	-23	-18	-26	-21	-16	-20	-15	-10
40	-27	-22	-17	-25	-20	-15	-22	-17	-12

1. **Obtain V1, VR and V2 for the actual weight using the 22K Derate Dry Runway Takeoff Speeds table.**
2. **If V1(MCG) limited, set V1 = V1(MCG). If not V1(MCG) limited, enter V1 Adjustment table with the actual weight to obtain V1 speed adjustment. If adjusted V1 is less than V1(MCG), set V1 = V1(MCG). V1 not to exceed VR.**

ADVISORY INFORMATION

Slippery Runway Takeoff (22K Derate)

Maximum Reverse Thrust

Weight Adjustment (1000 KG)

22K DERATE DRY FIELD/OBSTACLE LIMIT WEIGHT (1000 KG)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
95	0.0	0.0	0.0	-5.4	-5.4	-5.4	-11.0	-11.0	-11.0
90	-0.3	-0.3	-0.3	-5.4	-5.4	-5.4	-10.5	-10.5	-10.5
85	-0.6	-0.6	-0.6	-5.4	-5.4	-5.4	-10.0	-10.0	-10.0
80	-0.8	-0.8	-0.8	-5.4	-5.4	-5.4	-9.5	-9.5	-9.5
75	-1.0	-1.0	-1.0	-5.2	-5.2	-5.2	-9.0	-9.0	-9.0
70	-1.1	-1.1	-1.1	-5.1	-5.1	-5.1	-8.5	-8.5	-8.5
65	-1.2	-1.2	-1.2	-4.8	-4.8	-4.8	-8.0	-8.0	-8.0
60	-1.3	-1.3	-1.3	-4.6	-4.6	-4.6	-7.5	-7.5	-7.5
55	-1.3	-1.3	-1.3	-4.4	-4.4	-4.4	-7.0	-7.0	-7.0
50	-1.3	-1.3	-1.3	-4.2	-4.2	-4.2	-6.5	-6.5	-6.5
45	-1.4	-1.4	-1.4	-4.0	-4.0	-4.0	-6.1	-6.1	-6.1
40	-1.4	-1.4	-1.4	-3.9	-3.9	-3.9	-5.6	-5.6	-5.6

V1(MCG) Limit Weight (1000 KG)

ADJUSTED FIELD LENGTH (M)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
1000	53.3	32.6							
1200	85.3	66.1	45.9	36.5					
1400		97.2	78.5	60.3	40.2				
1600				86.1	64.4	43.9	37.8		
1800					90.3	68.5	52.4	33.7	
2000						94.6	68.9	47.9	
2200							87.6	63.8	43.6
2400								81.9	58.9
2600								101.3	76.3
2800									95.6

1. **Enter Weight Adjustment table with reported braking action and 22K Derate dry field/obstacle limit weight to obtain slippery runway weight adjustment.**
2. **Adjust “Good” field length available by -20 m/+20 m for every 5°C above/below 4°C.**
   Adjust “Medium” field length available by -20 m/+20 m for every 5°C above/below 4°C.
   Adjust “Poor” field length available by -30 m/+30 m for every 5°C above/below 4°C.
3. **Find V1(MCG) limit weight for adjusted field length and pressure altitude.**
4. **Max allowable slippery runway limited weight is lesser of weights from 1 and 3.**

ADVISORY INFORMATION

Slippery Runway Takeoff (22K Derate)
Maximum Reverse Thrust
V1 Adjustment (KIAS)

WEIGHT (1000 KG)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
90	-4	-2	0	-12	-9	-7	-21	-18	-16
85	-5	-2	0	-12	-10	-7	-22	-20	-17
80	-5	-3	0	-13	-11	-8	-23	-21	-18
75	-6	-4	-1	-14	-12	-9	-25	-22	-20
70	-7	-4	-2	-16	-13	-11	-27	-24	-22
65	-8	-5	-3	-17	-15	-12	-29	-26	-24
60	-9	-6	-4	-19	-17	-14	-31	-29	-26
55	-10	-7	-5	-21	-18	-16	-33	-31	-28
50	-10	-8	-5	-22	-19	-17	-35	-33	-30
45	-11	-8	-6	-23	-20	-18	-37	-34	-32
40	-11	-8	-6	-23	-21	-18	-37	-35	-32

1. **Obtain V1, VR and V2 for the actual weight using the 22K Derate Dry Runway Takeoff Speeds table.**
2. **If V1(MCG) limited, set V1 = V1(MCG). If not V1(MCG) limited, enter V1 Adjustment table with the actual weight to obtain V1 speed adjustment. If adjusted V1 is less than V1(MCG), set V1 = V1(MCG). V1 not to exceed VR.**

ADVISORY INFORMATION

Slippery Runway Takeoff (22K Derate)

No Reverse Thrust

Weight Adjustments (1000 KG)

22K DERATE DRY FIELD/OBSTACLE LIMIT WEIGHT (1000 KG)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
95	-1.0	-1.0	-1.0	-7.8	-7.8	-7.8	-14.2	-14.2	-14.2
90	-1.2	-1.2	-1.2	-7.6	-7.6	-7.6	-13.5	-13.5	-13.5
85	-1.4	-1.4	-1.4	-7.3	-7.3	-7.3	-12.8	-12.8	-12.8
80	-1.6	-1.6	-1.6	-7.1	-7.1	-7.1	-12.1	-12.1	-12.1
75	-1.7	-1.7	-1.7	-6.8	-6.8	-6.8	-11.4	-11.4	-11.4
70	-1.8	-1.8	-1.8	-6.5	-6.5	-6.5	-10.7	-10.7	-10.7
65	-1.9	-1.9	-1.9	-6.2	-6.2	-6.2	-10.0	-10.0	-10.0
60	-1.9	-1.9	-1.9	-5.9	-5.9	-5.9	-9.4	-9.4	-9.4
55	-1.9	-1.9	-1.9	-5.6	-5.6	-5.6	-8.8	-8.8	-8.8
50	-2.0	-2.0	-2.0	-5.4	-5.4	-5.4	-8.1	-8.1	-8.1
45	-2.0	-2.0	-2.0	-5.2	-5.2	-5.2	-7.5	-7.5	-7.5
40	-2.1	-2.1	-2.1	-5.0	-5.0	-5.0	-6.9	-6.9	-6.9

V1(MCG) Limit Weight (1000 KG)

ADJUSTED FIELD LENGTH (M)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
1000	41.9								
1200	78.9	57.3	32.6						
1400		91.7	71.4						
1600			104.4	62.1	30.5				
1800				94.3	64.9	33.4			
2000					97.0	67.8			
2200						99.7	35.7		
2400							57.0		
2600							82.0	45.5	
2800								68.4	34.7
3000								94.8	55.9
3200									80.6

1. **Enter Weight Adjustment table with reported braking action and 22K Derate dry field/obstacle limit weight to obtain slippery runway weight adjustment.**
2. **Adjust “Good” field length available by -25 m/+20 m for every 5°C above/below 4°C.**
   Adjust “Medium” field length available by -25 m/+20 m for every 5°C above/below 4°C.
   Adjust “Poor” field length available by -40 m/+35 m for every 5°C above/below 4°C.
3. **Find V1(MCG) limit weight for adjusted field length and pressure altitude.**
4. **Max allowable slippery runway limited weight is lesser of weights from 1 and 3.**

ADVISORY INFORMATION

Slippery Runway Takeoff (22K Derate)
No Reverse Thrust
V1 Adjustment (KIAS)

WEIGHT (1000 KG)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
95	-5	-2	0	-14	-11	-9	-27	-25	-22
90	-5	-3	0	-15	-12	-10	-29	-26	-24
85	-6	-3	-1	-16	-13	-11	-30	-28	-25
80	-7	-4	-2	-17	-14	-12	-32	-29	-27
75	-7	-5	-2	-18	-16	-13	-34	-32	-29
70	-8	-6	-3	-20	-17	-15	-37	-34	-32
65	-10	-7	-5	-22	-20	-17	-40	-37	-35
60	-11	-8	-6	-24	-22	-19	-43	-40	-38
55	-12	-9	-7	-26	-24	-21	-45	-43	-40
50	-13	-10	-8	-28	-26	-23	-48	-45	-43
45	-14	-11	-9	-30	-27	-25	-49	-47	-44
40	-14	-11	-9	-31	-28	-26	-50	-48	-45

1. **Obtain V1, VR and V2 for the actual weight using the 22K Derate Dry Runway Takeoff Speeds table.**
2. **If V1(MCG) limited, set V1 = V1(MCG). If not V1(MCG) limited, enter V1 Adjustment table with the actual weight to obtain V1 speed adjustment. If adjusted V1 is less than V1(MCG), set V1 = V1(MCG). V1 not to exceed VR.**

Takeoff %N1 (22K Derate)

Based on engine bleeds for packs on, engine and wing anti-ice on or off

OAT (°C)	AIRPORT PRESSURE ALTITUDE (FT)												
	-2000	-1000	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
60	87.7	88.3	88.7	88.8	88.9	89.1	89.2	89.2	89.1	88.6	88.3	88.7	89.2
55	88.5	89.1	89.5	89.7	89.8	89.9	90.0	90.0	90.0	89.5	89.0	88.8	88.6
50	89.3	89.8	90.4	90.5	90.6	90.7	90.9	90.8	90.8	90.4	89.9	89.7	89.6
45	90.2	90.7	91.2	91.3	91.4	91.5	91.7	91.6	91.6	91.2	90.8	90.7	90.5
40	91.1	91.6	92.1	92.2	92.3	92.4	92.5	92.4	92.4	92.1	91.7	91.6	91.5
35	91.9	92.5	93.0	93.1	93.2	93.2	93.3	93.3	93.2	92.9	92.5	92.5	92.4
30	91.5	92.6	93.8	93.9	94.0	94.0	94.1	94.0	93.9	93.7	93.4	93.3	93.2
25	90.8	91.9	93.1	93.7	94.4	94.8	94.9	94.8	94.8	94.4	94.0	94.0	94.0
20	90.0	91.1	92.3	93.0	93.6	94.3	95.0	95.6	95.6	95.3	94.9	94.8	94.7
15	89.3	90.4	91.6	92.2	92.8	93.6	94.3	94.8	95.3	95.9	96.1	95.9	95.5
10	88.5	89.6	90.8	91.4	92.1	92.8	93.5	94.0	94.5	95.1	95.7	96.4	97.1
5	87.8	88.9	90.0	90.7	91.3	92.0	92.7	93.2	93.7	94.3	94.9	95.6	96.3
0	87.0	88.1	89.2	89.9	90.5	91.2	91.9	92.4	92.9	93.5	94.1	94.8	95.5
-5	86.2	87.3	88.4	89.1	89.7	90.4	91.1	91.6	92.1	92.7	93.3	94.0	94.7
-10	85.4	86.5	87.6	88.3	88.9	89.6	90.3	90.8	91.3	91.9	92.5	93.2	93.9
-15	84.6	85.7	86.8	87.5	88.1	88.8	89.4	90.0	90.5	91.1	91.7	92.4	93.1
-20	83.8	84.9	86.0	86.6	87.3	87.9	88.6	89.1	89.7	90.3	90.8	91.6	92.3
-25	83.0	84.1	85.2	85.8	86.4	87.1	87.8	88.3	88.8	89.4	90.0	90.7	91.5
-30	82.2	83.3	84.4	85.0	85.6	86.3	86.9	87.4	88.0	88.6	89.2	89.9	90.6
-35	81.4	82.4	83.5	84.1	84.7	85.4	86.1	86.6	87.1	87.7	88.3	89.0	89.8
-40	80.6	81.6	82.7	83.3	83.9	84.5	85.2	85.7	86.2	86.8	87.4	88.2	88.9
-45	79.7	80.7	81.8	82.4	83.0	83.7	84.3	84.8	85.3	86.0	86.6	87.3	88.0
-50	78.9	79.9	80.9	81.5	82.1	82.8	83.4	83.9	84.5	85.1	85.7	86.4	87.2

%N1 Adjustments for Engine Bleeds

BLEED CONFIGURATION	AIRPORT PRESSURE ALTITUDE (FT)												
	-2000	-1000	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
PACKS OFF	0.7	0.7	0.7	0.7	0.7	0.7	0.8	0.8	0.8	0.8	0.9	0.9	0.9

Assumed Temperature Reduced Thrust (22K Derate)

Maximum Assumed Temperature (Table 1 of 3)

Based on 25% Takeoff Thrust Reduction

OAT (°C)	AIRPORT PRESSURE ALTITUDE (FT)											
	-1000	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
55	73	71	69	67								
50	73	71	69	67	65	63						
45	73	71	69	67	65	63	61	59	57			
40	72	71	69	67	65	63	61	59	57	55		
35	66	66	66	66	65	63	61	59	57	55	53	
30	63	61	61	61	61	61	61	59	57	55	53	51
25	63	61	59	57	56	56	56	56	56	55	53	51
20	63	61	59	57	55	53	51	51	51	50	50	50
15	63	61	59	57	55	53	51	50	47	45	45	45
10 & BELOW	63	61	59	57	55	53	51	50	47	45	43	41

Takeoff %N1 (Table 2 of 3)

Based on engine bleeds for packs on, engine and wing anti-ice on or off

ASSUMED TEMP (°C)	AIRPORT PRESSURE ALTITUDE (FT)											
	-1000	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
75	85.7	86.0	86.7	87.4	88.2	88.9	89.5	90.1	90.2	90.2	90.6	91.1
70	86.6	87.0	87.1	87.1	87.5	88.3	88.9	89.4	89.5	89.6	90.0	90.4
65	87.4	87.8	88.0	88.0	88.2	88.3	88.3	88.8	88.9	88.9	89.4	89.8
60	88.3	88.7	88.8	88.9	89.1	89.2	89.2	89.1	88.6	88.3	88.7	89.2
55	89.1	89.5	89.7	89.8	89.9	90.0	90.0	90.0	89.5	89.0	88.8	88.6
50	89.8	90.4	90.5	90.6	90.7	90.9	90.8	90.8	90.4	89.9	89.7	89.6
45	90.7	91.2	91.3	91.4	91.5	91.7	91.6	91.6	91.2	90.8	90.7	90.5
40	91.6	92.1	92.2	92.3	92.4	92.5	92.4	92.4	92.1	91.7	91.6	91.5
35	92.5	93.0	93.1	93.2	93.2	93.3	93.3	93.2	92.9	92.5	92.5	92.4
30	92.6	93.8	93.9	94.0	94.0	94.1	94.0	93.9	93.7	93.4	93.3	93.2
25	91.9	93.1	93.7	94.4	94.8	94.9	94.8	94.8	94.4	94.0	94.0	94.0
20	91.1	92.3	93.0	93.6	94.3	95.0	95.6	95.6	95.3	94.9	94.8	94.7
15	90.4	91.6	92.2	92.8	93.6	94.3	94.8	95.3	95.9	96.1	95.9	95.5
10	89.6	90.8	91.4	92.1	92.8	93.5	94.0	94.5	95.1	95.7	96.4	97.1
MINIMUM ASSUMED TEMP (°C)	32	30	28	26	24	22	20	18	16	15	12	10

With engine bleed for packs off, increase %N1 by 0.9.

Assumed Temperature Reduced Thrust (22K Derate)
%N1 Adjustment for Temperature Difference (Table 3 of 3)

ASSUMED TEMP MINUS OAT (°C)	OUTSIDE AIR TEMPERATURE (°C)													
	-40	-20	0	5	10	15	20	25	30	35	40	45	50	55
110	11.6													
100	10.3	7.9												
90	10.8	8.4												
80	12.2	7.1	5.0											
70	11.0	7.6	5.4	5.2	3.5									
60	9.6	9.0	4.1	4.0	3.9	3.8	2.1							
50	8.0	7.7	4.5	2.8	2.6	2.7	2.6	2.4	0.8					
40		6.2	5.9	4.7	3.0	2.6	2.7	2.8	2.6	2.5	2.9			
30		4.7	4.6	4.5	4.4	4.2	4.1	4.0	4.0	3.9	3.8	3.7	3.6	
20			3.1	3.0	3.0	3.0	2.9	2.8	2.7	2.7	2.6	2.6	2.5	2.4
10			1.5	1.5	1.5	1.5	1.5	1.5	1.4	1.4	1.4	1.3	1.3	1.3
0			0	0	0	0	0	0	0	0	0	0	0	0

1. **Determine Maximum Assumed Temperature allowed from Table 1.**
2. **Find Maximum %N1 from Table 2 using the desired assumed temperature (no greater than temperature from Table 1).**
3. **Use the difference between assumed temperature and OAT to determine the %N1 adjustment from Table 3.**
4. **Subtract %N1 adjustment from Maximum %N1 in Table 2.**

Max Climb %N1

Based on engine bleed for packs on or off and anti-ice off

TAT (°C)	PRESSURE ALTITUDE (FT)/SPEED (KIAS/MACH)									
	0	5000	10000	15000	20000	25000	30000	35000	37000	41000
	280	280	280	280	280	280	280	.78	.78	.78
60	90.2	90.5	90.4	90.6	90.4	92.1	93.8	95.1	95.2	93.5
55	91.0	91.2	91.3	91.4	90.8	91.5	93.1	94.4	94.5	92.8
50	91.7	92.0	92.1	92.2	91.7	91.5	92.4	93.7	93.8	92.1
45	92.4	92.6	92.8	93.0	92.6	92.4	92.4	93.0	93.1	91.4
40	93.1	93.3	93.6	93.8	93.4	93.2	93.2	92.3	92.4	90.7
35	93.6	94.0	94.3	94.5	94.3	94.0	94.0	93.0	92.4	90.8
30	92.9	94.8	95.0	95.2	95.1	94.8	94.7	93.9	93.3	91.8
25	92.2	94.8	95.7	95.9	95.9	95.5	95.4	94.7	94.1	92.8
20	91.4	94.0	96.5	96.7	96.6	96.2	96.1	95.4	94.9	93.7
15	90.6	93.2	95.9	97.5	97.4	96.9	96.7	96.2	95.7	94.6
10	89.9	92.5	95.1	97.8	98.3	97.7	97.4	96.9	96.5	95.6
5	89.1	91.7	94.3	97.0	99.2	98.6	98.1	97.7	97.3	96.5
0	88.3	90.9	93.5	96.2	98.6	99.6	99.1	98.5	98.2	97.5
-5	87.6	90.1	92.7	95.4	97.8	99.6	100.0	99.2	99.0	98.4
-10	86.8	89.3	91.9	94.6	97.1	98.8	100.3	100.2	99.8	99.4
-15	86.0	88.5	91.0	93.8	96.3	98.0	99.6	101.1	100.8	100.4
-20	85.2	87.6	90.2	93.0	95.5	97.2	98.7	100.8	101.3	101.0
-25	84.3	86.8	89.4	92.2	94.7	96.4	97.9	100.0	100.5	100.1
-30	83.5	86.0	88.5	91.3	93.9	95.6	97.1	99.1	99.6	99.3
-35	82.7	85.1	87.7	90.5	93.1	94.8	96.3	98.3	98.8	98.4
-40	81.8	84.3	86.8	89.6	92.3	93.9	95.4	97.4	97.9	97.6

%N1 Adjustments for Engine Bleeds

BLEED CONFIGURATION	PRESSURE ALTITUDE (1000 FT)					
	0	10	20	30	35	41
ENGINE ANTI-ICE	-0.6	-0.8	-0.9	-0.9	-0.8	-0.8
ENGINE & WING ANTI-ICE*	-1.8	-2.1	-2.5	-2.7	-3.0	-3.0

***Dual bleed sources**

Go-around %N1

Based on engine bleed for packs on, engine and wing anti-ice on or off

AIRPORT OAT		TAT (°C)	AIRPORT PRESSURE ALTITUDE (FT)											
°C	°F		-2000	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
57	134	60	95.0	96.2	96.8									
52	125	55	95.9	96.7	96.6	96.8	97.5							
47	116	50	96.6	97.6	97.8	97.8	97.7	97.5	98.2	98.8				
42	108	45	97.4	98.4	98.5	98.6	98.7	98.8	98.7	98.5	98.5	99.0		
37	99	40	98.0	99.1	99.2	99.3	99.4	99.5	99.6	99.5	99.1	98.9	98.8	99.1
32	90	35	98.1	99.9	100.0	100.1	100.1	100.3	100.3	100.2	99.9	99.6	99.6	99.5
27	81	30	97.3	99.8	100.4	100.7	100.7	100.7	100.7	100.7	100.6	100.4	100.4	100.3
22	72	25	96.6	99.1	99.7	100.2	100.6	100.9	100.9	100.9	100.9	100.9	100.9	100.8
17	63	20	95.8	98.3	98.9	99.5	99.8	100.2	100.5	100.9	101.0	101.1	101.0	101.0
12	54	15	95.0	97.5	98.1	98.7	99.1	99.4	99.8	100.1	100.5	100.9	101.3	101.2
7	45	10	94.2	96.8	97.4	98.0	98.3	98.7	99.0	99.4	99.8	100.2	100.5	100.9
2	36	5	93.4	96.0	96.6	97.2	97.6	97.9	98.3	98.7	99.0	99.4	99.8	100.2
-3	27	0	92.6	95.2	95.8	96.4	96.8	97.2	97.5	97.9	98.3	98.7	99.0	99.4
-8	18	-5	91.8	94.4	95.0	95.6	96.0	96.4	96.8	97.2	97.5	97.9	98.3	98.6
-13	9	-10	91.0	93.6	94.2	94.8	95.2	95.6	96.0	96.4	96.8	97.1	97.5	97.9
-17	1	-15	90.2	92.8	93.4	94.0	94.4	94.8	95.2	95.6	96.0	96.4	96.7	97.1
-22	-8	-20	89.3	92.0	92.6	93.2	93.6	94.0	94.4	94.8	95.2	95.6	95.9	96.3
-27	-17	-25	88.5	91.1	91.8	92.4	92.8	93.2	93.6	94.0	94.4	94.8	95.1	95.5
-32	-26	-30	87.6	90.3	90.9	91.6	92.0	92.4	92.8	93.3	93.6	94.0	94.3	94.7
-37	-35	-35	86.8	89.4	90.1	90.7	91.1	91.6	92.0	92.4	92.8	93.2	93.5	93.9
-42	-44	-40	85.9	88.6	89.2	89.9	90.3	90.7	91.2	91.6	92.0	92.4	92.7	93.0
-47	-53	-45	85.0	87.7	88.4	89.0	89.4	89.9	90.3	90.8	91.2	91.5	91.9	92.2
-52	-62	-50	84.1	86.8	87.5	88.2	88.6	89.0	89.5	90.0	90.3	90.7	91.0	91.4

%N1 Adjustments for Engine Bleeds

BLEED CONFIGURATION	PRESSURE ALTITUDE (FT)											
	-2000	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
PACKS OFF	0.7	0.8	0.8	0.8	0.8	0.9	0.9	0.9	0.9	0.9	0.9	0.9
A/C HIGH	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1

Flight With Unreliable Airspeed/ Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

CLIMB (280/.76)

Flaps Up, Set Max Climb Thrust

PRESSURE ALTITUDE (FT)		WEIGHT (1000 KG)				
		40	50	60	70	80
40000	**PITCH ATT**	**4.0**	**4.0**	**4.0**		
	V/S (FT/MIN)	1700	1100	600		
30000	**PITCH ATT**	**4.0**	**4.0**	**3.5**	**4.0**	**4.0**
	V/S (FT/MIN)	2500	1900	1500	1100	800
20000	**PITCH ATT**	**7.0**	**6.5**	**6.0**	**6.0**	**6.0**
	V/S (FT/MIN)	4200	3300	2600	2100	1700
10000	**PITCH ATT**	**11.0**	**9.5**	**8.5**	**8.0**	**8.0**
	V/S (FT/MIN)	5600	4400	3600	3000	2500
SEA LEVEL	**PITCH ATT**	**14.5**	**12.5**	**11.0**	**10.0**	**9.5**
	V/S (FT/MIN)	6700	5300	4400	3700	3100

CRUISE (.76/280)

Flaps Up, %N1 for Level Flight

PRESSURE ALTITUDE (FT)		WEIGHT (1000 KG)				
		40	50	60	70	80
40000	**PITCH ATT**	**2.0**	**2.5**	**3.5**		
	%N1	**82.9**	**85.4**	**88.9**		
35000	**PITCH ATT**	**1.0**	**2.0**	**2.5**	**3.0**	**3.5**
	%N1	**81.2**	**82.6**	**84.4**	**86.8**	**90.4**
30000	**PITCH ATT**	**1.0**	**1.5**	**2.0**	**2.5**	**3.0**
	%N1	**80.7**	**81.5**	**82.7**	**84.2**	**86.1**
25000	**PITCH ATT**	**1.0**	**1.5**	**2.0**	**2.5**	**3.0**
	%N1	**77.2**	**77.9**	**79.0**	**80.5**	**82.3**
20000	**PITCH ATT**	**1.0**	**1.5**	**2.0**	**2.5**	**3.5**
	%N1	**73.6**	**74.2**	**75.3**	**76.6**	**78.2**
15000	**PITCH ATT**	**1.0**	**1.5**	**2.0**	**3.0**	**3.5**
	%N1	**69.8**	**70.6**	**71.6**	**72.9**	**74.4**

Flight With Unreliable Airspeed/ Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

DESCENT (.76/280)

Flaps Up, Set Idle Thrust

PRESSURE ALTITUDE (FT)		WEIGHT (1000 KG)				
		40	50	60	70	80
40000	**PITCH ATT**	**-1.5**	**-0.5**	**0.5**	**1.0**	**1.5**
	V/S (FT/MIN)	-2700	-2400	-2300	-2500	-2700
30000	**PITCH ATT**	**-3.5**	**-2.0**	**-1.0**	**-0.5**	**0.5**
	V/S (FT/MIN)	-3100	-2600	-2300	-2100	-2000
20000	**PITCH ATT**	**-3.5**	**-2.0**	**-1.0**	**0.0**	**0.5**
	V/S (FT/MIN)	-2800	-2300	-2000	-1900	-1700
10000	**PITCH ATT**	**-3.5**	**-2.0**	**-1.0**	**0.0**	**0.5**
	V/S (FT/MIN)	-2500	-2100	-1800	-1700	-1500
SEA LEVEL	**PITCH ATT**	**-3.5**	**-2.5**	**-1.0**	**-0.5**	**0.5**
	V/S (FT/MIN)	-2300	-1900	-1700	-1500	-1400

HOLDING (VREF40 + 70)

Flaps Up, %N1 for Level Flight

PRESSURE ALTITUDE (FT)		WEIGHT (1000 KG)				
		40	50	60	70	80
15000	**PITCH ATT**	**5.0**	**5.0**	**5.0**	**5.0**	**5.0**
	%N1	**56.1**	**61.7**	**65.9**	**69.8**	**73.2**
	KIAS	178	193	212	229	246
10000	**PITCH ATT**	**5.0**	**5.0**	**5.0**	**5.0**	**5.0**
	%N1	**52.5**	**57.5**	**62.1**	**65.9**	**69.1**
	KIAS	178	192	211	228	244
5000	**PITCH ATT**	**5.0**	**5.5**	**5.0**	**5.0**	**5.0**
	%N1	**48.9**	**53.9**	**58.1**	**62.0**	**65.5**
	KIAS	178	192	210	227	243

Flight With Unreliable Airspeed/ Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

TERMINAL AREA (5000 FT)
%N1 for Level Flight
Airport Altitude = -2000 FT

FLAP POSITION (VREF + INCREMENT)		WEIGHT (1000 KG) 40	50	60	70	80
FLAPS UP (GEAR UP) VREF40+70	**PITCH ATT**	**4.5**	**5.0**	**5.5**	**6.0**	**6.5**
	%N1	**47.6**	**52.3**	**56.3**	**60.0**	**63.6**
	KIAS	178	192	204	215	225
FLAPS 1 (GEAR UP) VREF40+50	**PITCH ATT**	**5.0**	**5.0**	**5.5**	**6.0**	**6.0**
	%N1	**49.7**	**54.5**	**58.6**	**62.4**	**65.8**
	KIAS	158	172	184	195	205
FLAPS 5 (GEAR UP) VREF40+30	**PITCH ATT**	**5.5**	**6.0**	**6.0**	**6.5**	**6.5**
	%N1	**49.4**	**54.5**	**59.0**	**63.1**	**66.7**
	KIAS	138	152	164	175	185
FLAPS 10 (GEAR UP) VREF40+30	**PITCH ATT**	**5.0**	**5.0**	**5.5**	**5.5**	**6.0**
	%N1	**53.2**	**58.6**	**63.4**	**67.5**	**71.1**
	KIAS	138	152	164	175	185
FLAPS 15 (GEAR UP) VREF40+20	**PITCH ATT**	**5.5**	**5.5**	**6.0**	**6.0**	**6.5**
	%N1	**53.3**	**58.7**	**63.7**	**67.9**	**71.6**
	KIAS	128	142	154	165	175
FLAPS 25 (GEAR UP) VREF40+10	**PITCH ATT**	**6.5**	**6.5**	**6.5**	**7.0**	**7.0**
	%N1	**54.0**	**59.7**	**64.8**	**69.0**	**72.9**
	KIAS	118	132	144	155	165
FLAPS 15 (GEAR DOWN) VREF40+20	**PITCH ATT**	**5.5**	**6.0**	**6.0**	**6.0**	**6.5**
	%N1	**57.5**	**63.3**	**68.2**	**72.6**	**76.3**
	KIAS	128	142	154	165	175

Flight With Unreliable Airspeed/ Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

TERMINAL AREA (5000 FT)

%N1 for Level Flight

Airport Altitude = -1000 FT

FLAP POSITION (VREF + INCREMENT)		WEIGHT (1000 KG)				
		40	50	60	70	80
FLAPS UP (GEAR UP) VREF40+70	**PITCH ATT**	**4.5**	**5.0**	**5.5**	**6.0**	**6.5**
	%N1	**48.3**	**52.9**	**57.0**	**60.8**	**64.5**
	KIAS	178	192	204	215	225
FLAPS 1 (GEAR UP) VREF40+50	**PITCH ATT**	**5.0**	**5.0**	**5.5**	**6.0**	**6.0**
	%N1	**50.4**	**55.2**	**59.4**	**63.3**	**66.6**
	KIAS	158	172	184	195	205
FLAPS 5 (GEAR UP) VREF40+30	**PITCH ATT**	**5.5**	**6.0**	**6.0**	**6.5**	**6.5**
	%N1	**50.0**	**55.2**	**59.8**	**64.0**	**67.6**
	KIAS	138	152	164	175	185
FLAPS 10 (GEAR UP) VREF40+30	**PITCH ATT**	**5.0**	**5.5**	**5.5**	**5.5**	**6.0**
	%N1	**53.9**	**59.4**	**64.2**	**68.3**	**72.0**
	KIAS	138	152	164	175	185
FLAPS 15 (GEAR UP) VREF40+20	**PITCH ATT**	**5.5**	**5.5**	**6.0**	**6.0**	**6.5**
	%N1	**54.0**	**59.5**	**64.5**	**68.7**	**72.5**
	KIAS	128	142	154	165	175
FLAPS 25 (GEAR UP) VREF40+10	**PITCH ATT**	**6.5**	**6.5**	**6.5**	**7.0**	**7.0**
	%N1	**54.7**	**60.6**	**65.6**	**69.8**	**73.7**
	KIAS	118	132	144	155	165
FLAPS 15 (GEAR DOWN) VREF40+20	**PITCH ATT**	**5.5**	**6.0**	**6.0**	**6.0**	**6.5**
	%N1	**58.3**	**64.1**	**69.0**	**73.4**	**77.1**
	KIAS	128	142	154	165	175

Flight With Unreliable Airspeed/ Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

TERMINAL AREA (5000 FT)

%N1 for Level Flight

Airport Altitude = SEA LEVEL

FLAP POSITION (VREF + INCREMENT)		WEIGHT (1000 KG)				
		40	50	60	70	80
FLAPS UP (GEAR UP) VREF40+70	**PITCH ATT**	**4.5**	**5.0**	**5.5**	**6.0**	**6.5**
	%N1	**49.0**	**53.6**	**57.7**	**61.6**	**65.2**
	KIAS	178	192	204	215	225
FLAPS 1 (GEAR UP) VREF40+50	**PITCH ATT**	**5.0**	**5.0**	**5.5**	**6.0**	**6.0**
	%N1	**51.1**	**55.9**	**60.2**	**64.1**	**67.3**
	KIAS	158	172	184	195	205
FLAPS 5 (GEAR UP) VREF40+30	**PITCH ATT**	**5.5**	**6.0**	**6.0**	**6.5**	**6.5**
	%N1	**50.7**	**56.0**	**60.6**	**64.7**	**68.3**
	KIAS	138	152	164	175	185
FLAPS 10 (GEAR UP) VREF40+30	**PITCH ATT**	**5.0**	**5.5**	**5.5**	**5.5**	**6.0**
	%N1	**54.7**	**60.2**	**65.0**	**69.1**	**72.9**
	KIAS	138	152	164	175	185
FLAPS 15 (GEAR UP) VREF40+20	**PITCH ATT**	**5.5**	**5.5**	**6.0**	**6.0**	**6.5**
	%N1	**54.7**	**60.4**	**65.3**	**69.5**	**73.4**
	KIAS	128	142	154	165	175
FLAPS 25 (GEAR UP) VREF40+10	**PITCH ATT**	**6.5**	**6.5**	**6.5**	**7.0**	**7.0**
	%N1	**55.5**	**61.4**	**66.3**	**70.6**	**74.6**
	KIAS	118	132	144	155	165
FLAPS 15 (GEAR DOWN) VREF40+20	**PITCH ATT**	**5.5**	**6.0**	**6.0**	**6.0**	**6.5**
	%N1	**59.1**	**65.0**	**69.9**	**74.3**	**77.9**
	KIAS	128	142	154	165	175

Flight With Unreliable Airspeed/ Turbulent Air Penetration
Altitude and/or vertical speed indications may also be unreliable.

TERMINAL AREA (5000 FT)
%N1 for Level Flight
Airport Altitude = 1000 FT

FLAP POSITION (VREF + INCREMENT)		WEIGHT (1000 KG)				
		40	50	60	70	80
FLAPS UP (GEAR UP) VREF40+70	**PITCH ATT**	**4.5**	**5.0**	**5.5**	**6.0**	**6.5**
	%N1	**49.8**	**54.3**	**58.4**	**62.5**	**66.0**
	KIAS	178	192	204	215	225
FLAPS 1 (GEAR UP) VREF40+50	**PITCH ATT**	**5.0**	**5.0**	**5.5**	**6.0**	**6.0**
	%N1	**51.8**	**56.7**	**61.0**	**64.8**	**68.1**
	KIAS	158	172	184	195	205
FLAPS 5 (GEAR UP) VREF40+30	**PITCH ATT**	**5.5**	**6.0**	**6.0**	**6.5**	**6.5**
	%N1	**51.4**	**56.7**	**61.4**	**65.5**	**69.1**
	KIAS	138	152	164	175	185
FLAPS 10 (GEAR UP) VREF40+30	**PITCH ATT**	**5.0**	**5.5**	**5.5**	**5.5**	**6.0**
	%N1	**55.4**	**61.0**	**65.8**	**69.9**	**73.7**
	KIAS	138	152	164	175	185
FLAPS 15 (GEAR UP) VREF40+20	**PITCH ATT**	**5.5**	**5.5**	**6.0**	**6.0**	**6.5**
	%N1	**55.4**	**61.2**	**66.1**	**70.3**	**74.2**
	KIAS	128	142	154	165	175
FLAPS 25 (GEAR UP) VREF40+10	**PITCH ATT**	**6.5**	**6.5**	**6.5**	**7.0**	**7.0**
	%N1	**56.3**	**62.2**	**67.1**	**71.5**	**75.4**
	KIAS	118	132	144	155	165
FLAPS 15 (GEAR DOWN) VREF40+20	**PITCH ATT**	**5.5**	**6.0**	**6.0**	**6.0**	**6.5**
	%N1	**59.9**	**65.8**	**70.7**	**75.1**	**78.8**
	KIAS	128	142	154	165	175

Flight With Unreliable Airspeed/ Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

TERMINAL AREA (5000 FT)
%N1 for Level Flight
Airport Altitude = 2000 FT

FLAP POSITION (VREF + INCREMENT)		WEIGHT (1000 KG)				
		40	50	60	70	80
FLAPS UP (GEAR UP) VREF40+70	**PITCH ATT**	**4.5**	**5.0**	**5.5**	**6.0**	**6.5**
	%N1	**50.4**	**55.1**	**59.2**	**63.3**	**66.7**
	KIAS	178	192	204	215	225
FLAPS 1 (GEAR UP) VREF40+50	**PITCH ATT**	**5.0**	**5.0**	**5.5**	**6.0**	**6.0**
	%N1	**52.5**	**57.4**	**61.8**	**65.6**	**68.9**
	KIAS	158	172	184	195	205
FLAPS 5 (GEAR UP) VREF40+30	**PITCH ATT**	**5.5**	**6.0**	**6.0**	**6.5**	**6.5**
	%N1	**52.2**	**57.5**	**62.3**	**66.3**	**69.9**
	KIAS	138	152	164	175	185
FLAPS 10 (GEAR UP) VREF40+30	**PITCH ATT**	**5.0**	**5.5**	**5.5**	**5.5**	**6.0**
	%N1	**56.1**	**61.8**	**66.6**	**70.8**	**74.5**
	KIAS	138	152	164	175	185
FLAPS 15 (GEAR UP) VREF40+20	**PITCH ATT**	**5.5**	**5.5**	**6.0**	**6.0**	**6.5**
	%N1	**56.2**	**62.0**	**66.9**	**71.2**	**75.1**
	KIAS	128	142	154	165	175
FLAPS 25 (GEAR UP) VREF40+10	**PITCH ATT**	**6.5**	**6.5**	**6.5**	**7.0**	**7.0**
	%N1	**57.0**	**63.0**	**67.9**	**72.4**	**76.2**
	KIAS	118	132	144	155	165
FLAPS 15 (GEAR DOWN) VREF40+20	**PITCH ATT**	**5.5**	**6.0**	**6.0**	**6.0**	**6.5**
	%N1	**60.7**	**66.5**	**71.6**	**75.9**	**79.7**
	KIAS	128	142	154	165	175

Flight With Unreliable Airspeed/ Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

TERMINAL AREA (5000 FT)

%N1 for Level Flight

Airport Altitude = 3000 FT

FLAP POSITION (VREF + INCREMENT)		WEIGHT (1000 KG) 40	50	60	70	80
FLAPS UP	**PITCH ATT**	**4.5**	**5.0**	**5.5**	**6.0**	**6.5**
(GEAR UP)	**%N1**	**51.1**	**55.8**	**60.0**	**64.1**	**67.4**
VREF40+70	KIAS	178	192	205	216	225
FLAPS 1	**PITCH ATT**	**5.0**	**5.0**	**5.5**	**6.0**	**6.0**
(GEAR UP)	**%N1**	**53.3**	**58.1**	**62.6**	**66.3**	**69.7**
VREF40+50	KIAS	158	172	185	196	205
FLAPS 5	**PITCH ATT**	**5.5**	**6.0**	**6.0**	**6.5**	**6.5**
(GEAR UP)	**%N1**	**52.9**	**58.2**	**63.1**	**67.1**	**70.7**
VREF40+30	KIAS	138	152	165	176	185
FLAPS 10	**PITCH ATT**	**5.0**	**5.5**	**5.5**	**5.5**	**6.0**
(GEAR UP)	**%N1**	**56.9**	**62.6**	**67.4**	**71.6**	**75.3**
VREF40+30	KIAS	138	152	165	176	185
FLAPS 15	**PITCH ATT**	**5.5**	**5.5**	**6.0**	**6.0**	**6.5**
(GEAR UP)	**%N1**	**56.9**	**62.8**	**67.7**	**72.1**	**75.9**
VREF40+20	KIAS	128	142	155	166	175
FLAPS 25	**PITCH ATT**	**6.5**	**6.5**	**6.5**	**7.0**	**7.0**
(GEAR UP)	**%N1**	**57.8**	**63.8**	**68.7**	**73.2**	**77.0**
VREF40+10	KIAS	118	132	145	156	165
FLAPS 15	**PITCH ATT**	**5.5**	**6.0**	**6.0**	**6.0**	**6.5**
(GEAR DOWN)	**%N1**	**61.5**	**67.3**	**72.5**	**76.7**	**80.5**
VREF40+20	KIAS	128	142	155	166	175

Flight With Unreliable Airspeed/ Turbulent Air Penetration
Altitude and/or vertical speed indications may also be unreliable.

TERMINAL AREA (5000 FT)
%N1 for Level Flight
Airport Altitude = 4000 FT

FLAP POSITION (VREF + INCREMENT)		WEIGHT (1000 KG) 40	50	60	70	80
FLAPS UP (GEAR UP) VREF40+70	**PITCH ATT**	**4.5**	**5.0**	**5.5**	**6.0**	**6.5**
	%N1	**51.7**	**56.5**	**60.8**	**64.9**	**68.2**
	KIAS	178	192	205	216	225
FLAPS 1 (GEAR UP) VREF40+50	**PITCH ATT**	**5.0**	**5.0**	**5.5**	**6.0**	**6.0**
	%N1	**54.0**	**58.9**	**63.4**	**67.1**	**70.5**
	KIAS	158	172	185	196	205
FLAPS 5 (GEAR UP) VREF40+30	**PITCH ATT**	**5.5**	**6.0**	**6.0**	**6.5**	**6.5**
	%N1	**53.6**	**59.0**	**63.9**	**67.9**	**71.6**
	KIAS	138	152	165	176	185
FLAPS 10 (GEAR UP) VREF40+30	**PITCH ATT**	**5.0**	**5.5**	**5.5**	**5.5**	**6.0**
	%N1	**57.7**	**63.4**	**68.2**	**72.5**	**76.1**
	KIAS	138	152	165	176	185
FLAPS 15 (GEAR UP) VREF40+20	**PITCH ATT**	**5.5**	**5.5**	**6.0**	**6.0**	**6.5**
	%N1	**57.7**	**63.6**	**68.5**	**73.0**	**76.6**
	KIAS	128	142	155	166	175
FLAPS 25 (GEAR UP) VREF40+10	**PITCH ATT**	**6.5**	**6.5**	**6.5**	**7.0**	**7.0**
	%N1	**58.6**	**64.6**	**69.6**	**74.1**	**77.9**
	KIAS	118	132	145	156	165
FLAPS 15 (GEAR DOWN) VREF40+20	**PITCH ATT**	**5.5**	**6.0**	**6.0**	**6.0**	**6.5**
	%N1	**62.3**	**68.1**	**73.3**	**77.6**	**81.4**
	KIAS	128	142	155	166	175

Flight With Unreliable Airspeed/ Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

TERMINAL AREA (5000 FT)
%N1 for Level Flight
Airport Altitude = 5000 FT

FLAP POSITION (VREF + INCREMENT)		WEIGHT (1000 KG)				
		40	50	60	70	80
FLAPS UP (GEAR UP)	**PITCH ATT**	**4.5**	**5.0**	**5.5**	**6.0**	**6.5**
	%N1	**52.4**	**57.3**	**61.6**	**65.7**	**69.0**
VREF40+70	KIAS	178	192	205	216	225
FLAPS 1 (GEAR UP)	**PITCH ATT**	**5.0**	**5.0**	**5.5**	**6.0**	**6.0**
	%N1	**54.7**	**59.7**	**64.2**	**67.9**	**71.4**
VREF40+50	KIAS	158	172	185	196	205
FLAPS 5 (GEAR UP)	**PITCH ATT**	**5.5**	**6.0**	**6.0**	**6.5**	**6.5**
	%N1	**54.4**	**59.9**	**64.7**	**68.7**	**72.5**
VREF40+30	KIAS	138	152	165	176	185
FLAPS 10 (GEAR UP)	**PITCH ATT**	**5.0**	**5.5**	**5.5**	**5.5**	**6.0**
	%N1	**58.5**	**64.2**	**69.1**	**73.3**	**76.9**
VREF40+30	KIAS	138	152	165	176	185
FLAPS 15 (GEAR UP)	**PITCH ATT**	**5.5**	**5.5**	**6.0**	**6.0**	**6.5**
	%N1	**58.5**	**64.4**	**69.4**	**73.8**	**77.5**
VREF40+20	KIAS	128	142	155	166	175
FLAPS 25 (GEAR UP)	**PITCH ATT**	**6.5**	**6.5**	**6.5**	**7.0**	**7.0**
	%N1	**59.4**	**65.4**	**70.5**	**74.9**	**78.8**
VREF40+10	KIAS	118	132	145	156	165
FLAPS 15 (GEAR DOWN)	**PITCH ATT**	**5.5**	**6.0**	**6.0**	**6.0**	**6.5**
	%N1	**63.1**	**69.0**	**74.2**	**78.5**	**82.3**
VREF40+20	KIAS	128	142	155	166	175

Flight With Unreliable Airspeed/ Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

TERMINAL AREA (5000 FT)
%N1 for Level Flight
Airport Altitude = 6000 FT

FLAP POSITION (VREF + INCREMENT)		WEIGHT (1000 KG)				
		40	50	60	70	80
FLAPS UP (GEAR UP) VREF40+70	**PITCH ATT**	**4.5**	**5.0**	**5.5**	**6.0**	**6.5**
	%N1	**53.1**	**58.0**	**62.5**	**66.4**	**69.8**
	KIAS	178	192	205	216	225
FLAPS 1 (GEAR UP) VREF40+50	**PITCH ATT**	**5.0**	**5.0**	**5.5**	**6.0**	**6.0**
	%N1	**55.5**	**60.5**	**64.9**	**68.7**	**72.3**
	KIAS	158	172	185	196	205
FLAPS 5 (GEAR UP) VREF40+30	**PITCH ATT**	**5.5**	**6.0**	**6.0**	**6.5**	**6.5**
	%N1	**55.1**	**60.7**	**65.5**	**69.5**	**73.3**
	KIAS	138	152	165	176	185
FLAPS 10 (GEAR UP) VREF40+30	**PITCH ATT**	**5.0**	**5.5**	**5.5**	**5.5**	**6.0**
	%N1	**59.3**	**65.1**	**69.9**	**74.1**	**77.7**
	KIAS	138	152	165	176	185
FLAPS 15 (GEAR UP) VREF40+20	**PITCH ATT**	**5.5**	**5.5**	**6.0**	**6.0**	**6.5**
	%N1	**59.4**	**65.2**	**70.3**	**74.7**	**78.3**
	KIAS	128	142	155	166	175
FLAPS 25 (GEAR UP) VREF40+10	**PITCH ATT**	**6.5**	**6.5**	**6.5**	**7.0**	**7.0**
	%N1	**60.3**	**66.2**	**71.4**	**75.7**	**79.6**
	KIAS	118	132	145	156	165
FLAPS 15 (GEAR DOWN) VREF40+20	**PITCH ATT**	**5.5**	**6.0**	**6.0**	**6.0**	**6.5**
	%N1	**64.0**	**69.9**	**75.0**	**79.3**	**83.2**
	KIAS	128	142	155	166	175

Flight With Unreliable Airspeed/ Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

TERMINAL AREA (5000 FT)
%N1 for Level Flight
Airport Altitude = 7000 FT

FLAP POSITION (VREF + INCREMENT)		WEIGHT (1000 KG) 40	50	60	70	80
FLAPS UP (GEAR UP) VREF40+70	**PITCH ATT**	**4.5**	**5.0**	**5.5**	**6.0**	**6.5**
	%N1	**53.9**	**58.8**	**63.4**	**67.1**	**70.6**
	KIAS	178	192	205	216	226
FLAPS 1 (GEAR UP) VREF40+50	**PITCH ATT**	**5.0**	**5.0**	**5.5**	**6.0**	**6.0**
	%N1	**56.3**	**61.4**	**65.7**	**69.5**	**73.1**
	KIAS	158	172	185	196	206
FLAPS 5 (GEAR UP) VREF40+30	**PITCH ATT**	**5.5**	**6.0**	**6.0**	**6.5**	**6.5**
	%N1	**55.9**	**61.6**	**66.3**	**70.4**	**74.1**
	KIAS	138	152	165	176	186
FLAPS 10 (GEAR UP) VREF40+30	**PITCH ATT**	**5.0**	**5.5**	**5.5**	**5.5**	**6.0**
	%N1	**60.1**	**65.9**	**70.8**	**75.0**	**78.6**
	KIAS	138	152	165	176	186
FLAPS 15 (GEAR UP) VREF40+20	**PITCH ATT**	**5.5**	**5.5**	**6.0**	**6.0**	**6.5**
	%N1	**60.2**	**66.0**	**71.2**	**75.4**	**79.2**
	KIAS	128	142	155	166	176
FLAPS 25 (GEAR UP) VREF40+10	**PITCH ATT**	**6.5**	**6.5**	**6.5**	**7.0**	**7.0**
	%N1	**61.1**	**67.0**	**72.2**	**76.6**	**80.5**
	KIAS	118	132	145	156	166
FLAPS 15 (GEAR DOWN) VREF40+20	**PITCH ATT**	**5.5**	**6.0**	**6.0**	**6.0**	**6.5**
	%N1	**64.8**	**70.8**	**75.8**	**80.2**	**84.1**
	KIAS	128	142	155	166	176

Flight With Unreliable Airspeed/ Turbulent Air Penetration
Altitude and/or vertical speed indications may also be unreliable.

TERMINAL AREA (5000 FT)
%N1 for Level Flight
Airport Altitude = 8000 FT

FLAP POSITION (VREF + INCREMENT)		WEIGHT (1000 KG)				
		40	50	60	70	80
FLAPS UP (GEAR UP) VREF40+70	**PITCH ATT**	**4.5**	**5.0**	**5.5**	**6.0**	**6.5**
	%N1	**54.6**	**59.6**	**64.1**	**67.9**	**71.4**
	KIAS	178	192	205	216	226
FLAPS 1 (GEAR UP) VREF40+50	**PITCH ATT**	**5.0**	**5.0**	**5.5**	**6.0**	**6.0**
	%N1	**57.0**	**62.2**	**66.5**	**70.4**	**74.0**
	KIAS	158	172	185	196	206
FLAPS 5 (GEAR UP) VREF40+30	**PITCH ATT**	**5.5**	**6.0**	**6.0**	**6.5**	**6.5**
	%N1	**56.7**	**62.4**	**67.0**	**71.2**	**74.9**
	KIAS	138	152	165	176	186
FLAPS 10 (GEAR UP) VREF40+30	**PITCH ATT**	**5.0**	**5.5**	**5.5**	**5.5**	**6.0**
	%N1	**61.0**	**66.7**	**71.7**	**75.8**	**79.6**
	KIAS	138	152	165	176	186
FLAPS 15 (GEAR UP) VREF40+20	**PITCH ATT**	**5.5**	**5.5**	**6.0**	**6.0**	**6.0**
	%N1	**61.0**	**66.9**	**72.1**	**76.2**	**80.1**
	KIAS	128	142	155	166	176
FLAPS 25 (GEAR UP) VREF40+10	**PITCH ATT**	**6.5**	**6.5**	**6.5**	**7.0**	**7.0**
	%N1	**61.9**	**67.9**	**73.1**	**77.5**	**81.4**
	KIAS	118	132	145	156	166
FLAPS 15 (GEAR DOWN) VREF40+20	**PITCH ATT**	**5.5**	**6.0**	**6.0**	**6.0**	**6.5**
	%N1	**65.6**	**71.6**	**76.7**	**81.1**	**85.0**
	KIAS	128	142	155	166	176

Flight With Unreliable Airspeed/ Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

TERMINAL AREA (5000 FT)

%N1 for Level Flight

Airport Altitude = 9000 FT

FLAP POSITION (VREF + INCREMENT)		WEIGHT (1000 KG) 40	50	60	70	80
FLAPS UP (GEAR UP) VREF40+70	**PITCH ATT**	**4.5**	**5.5**	**5.5**	**6.0**	**6.5**
	%N1	**55.4**	**60.5**	**64.9**	**68.6**	**72.3**
	KIAS	178	192	205	216	226
FLAPS 1 (GEAR UP) VREF40+50	**PITCH ATT**	**5.0**	**5.0**	**5.5**	**6.0**	**6.0**
	%N1	**57.7**	**63.0**	**67.3**	**71.3**	**74.8**
	KIAS	158	172	185	196	206
FLAPS 5 (GEAR UP) VREF40+30	**PITCH ATT**	**5.5**	**6.0**	**6.0**	**6.5**	**6.5**
	%N1	**57.5**	**63.2**	**67.9**	**72.1**	**75.8**
	KIAS	138	152	165	176	186
FLAPS 10 (GEAR UP) VREF40+30	**PITCH ATT**	**5.0**	**5.5**	**5.5**	**5.5**	**6.0**
	%N1	**61.8**	**67.5**	**72.5**	**76.6**	**80.4**
	KIAS	138	152	165	176	186
FLAPS 15 (GEAR UP) VREF40+20	**PITCH ATT**	**5.5**	**5.5**	**6.0**	**6.0**	**6.0**
	%N1	**61.8**	**67.7**	**72.9**	**77.1**	**81.0**
	KIAS	128	142	155	166	176
FLAPS 25 (GEAR UP) VREF40+10	**PITCH ATT**	**6.5**	**6.5**	**6.5**	**7.0**	**7.0**
	%N1	**62.8**	**68.7**	**73.9**	**78.4**	**82.3**
	KIAS	118	132	145	156	166
FLAPS 15 (GEAR DOWN) VREF40+20	**PITCH ATT**	**5.5**	**6.0**	**6.0**	**6.0**	**6.5**
	%N1	**66.4**	**72.5**	**77.6**	**82.0**	**85.9**
	KIAS	128	142	155	166	176

Flight With Unreliable Airspeed/ Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

TERMINAL AREA (5000 FT)
%N1 for Level Flight
Airport Altitude = 10000 FT

FLAP POSITION (VREF + INCREMENT)		WEIGHT (1000 KG)				
		40	50	60	70	80
FLAPS UP (GEAR UP) VREF40+70	**PITCH ATT**	**4.5**	**5.5**	**5.5**	**6.0**	**6.5**
	%N1	**56.1**	**61.3**	**65.6**	**69.5**	**73.0**
	KIAS	178	192	205	216	227
FLAPS 1 (GEAR UP) VREF40+50	**PITCH ATT**	**5.0**	**5.0**	**5.5**	**6.0**	**6.0**
	%N1	**58.5**	**63.8**	**68.1**	**72.2**	**75.6**
	KIAS	158	172	185	196	207
FLAPS 5 (GEAR UP) VREF40+30	**PITCH ATT**	**5.5**	**6.0**	**6.0**	**6.0**	**6.5**
	%N1	**58.3**	**64.0**	**68.7**	**72.9**	**76.6**
	KIAS	138	152	165	176	187
FLAPS 10 (GEAR UP) VREF40+30	**PITCH ATT**	**5.0**	**5.5**	**5.5**	**5.5**	**6.0**
	%N1	**62.6**	**68.4**	**73.3**	**77.5**	**81.4**
	KIAS	138	152	165	176	187
FLAPS 15 (GEAR UP) VREF40+20	**PITCH ATT**	**5.5**	**5.5**	**6.0**	**6.0**	**6.0**
	%N1	**62.7**	**68.6**	**73.7**	**78.0**	**81.9**
	KIAS	128	142	155	166	177
FLAPS 25 (GEAR UP) VREF40+10	**PITCH ATT**	**6.5**	**6.5**	**6.5**	**7.0**	**7.0**
	%N1	**63.6**	**69.7**	**74.8**	**79.3**	**83.2**
	KIAS	118	132	145	156	167
FLAPS 15 (GEAR DOWN) VREF40+20	**PITCH ATT**	**5.5**	**6.0**	**6.0**	**6.0**	**6.5**
	%N1	**67.2**	**73.4**	**78.5**	**82.9**	**86.9**
	KIAS	128	142	155	166	177

Flight With Unreliable Airspeed/ Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

TERMINAL AREA (5000 FT)

%N1 for Level Flight

Airport Altitude = 11000 FT

FLAP POSITION (VREF + INCREMENT)		WEIGHT (1000 KG)				
		40	50	60	70	80
FLAPS UP (GEAR UP) VREF40+70	**PITCH ATT**	**4.5**	**5.5**	**5.5**	**6.0**	**6.5**
	%N1	**56.9**	**62.3**	**66.3**	**70.3**	**73.9**
	KIAS	178	192	205	217	227
FLAPS 1 (GEAR UP) VREF40+50	**PITCH ATT**	**5.0**	**5.0**	**5.5**	**6.0**	**6.0**
	%N1	**59.5**	**64.6**	**69.1**	**73.1**	**76.4**
	KIAS	158	172	185	197	207
FLAPS 5 (GEAR UP) VREF40+30	**PITCH ATT**	**5.5**	**6.0**	**6.0**	**6.0**	**6.5**
	%N1	**59.4**	**64.9**	**69.7**	**73.8**	**77.5**
	KIAS	138	152	165	177	187
FLAPS 10 (GEAR UP) VREF40+30	**PITCH ATT**	**5.0**	**5.5**	**5.5**	**5.5**	**6.0**
	%N1	**63.6**	**69.4**	**74.2**	**78.5**	**82.3**
	KIAS	138	152	165	177	187
FLAPS 15 (GEAR UP) VREF40+20	**PITCH ATT**	**5.5**	**5.5**	**6.0**	**6.0**	**6.0**
	%N1	**63.8**	**69.7**	**74.6**	**79.0**	**82.9**
	KIAS	128	142	155	167	177
FLAPS 25 (GEAR UP) VREF40+10	**PITCH ATT**	**6.5**	**6.5**	**6.5**	**6.5**	**7.0**
	%N1	**64.7**	**70.8**	**75.8**	**80.3**	**84.2**
	KIAS	118	132	145	157	167
FLAPS 15 (GEAR DOWN) VREF40+20	**PITCH ATT**	**5.5**	**6.0**	**6.0**	**6.0**	**6.5**
	%N1	**68.4**	**74.3**	**79.5**	**84.0**	**88.0**
	KIAS	128	142	155	167	177

Flight With Unreliable Airspeed/ Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

TERMINAL AREA (5000 FT)
%N1 for Level Flight
Airport Altitude = 12000 FT

FLAP POSITION (VREF + INCREMENT)		WEIGHT (1000 KG) 40	50	60	70	80
FLAPS UP (GEAR UP) VREF40+70	**PITCH ATT**	**5.0**	**5.5**	**5.5**	**6.0**	**6.5**
	%N1	**57.7**	**63.0**	**67.1**	**71.2**	**74.6**
	KIAS	178	192	205	217	228
FLAPS 1 (GEAR UP) VREF40+50	**PITCH ATT**	**5.0**	**5.5**	**5.5**	**6.0**	**6.0**
	%N1	**60.6**	**65.4**	**70.0**	**73.8**	**77.3**
	KIAS	158	172	185	197	208
FLAPS 5 (GEAR UP) VREF40+30	**PITCH ATT**	**5.5**	**6.0**	**6.0**	**6.0**	**6.5**
	%N1	**60.5**	**65.8**	**70.7**	**74.7**	**78.5**
	KIAS	138	152	165	177	188
FLAPS 10 (GEAR UP) VREF40+30	**PITCH ATT**	**5.0**	**5.5**	**5.5**	**5.5**	**6.0**
	%N1	**64.6**	**70.4**	**75.1**	**79.5**	**83.3**
	KIAS	138	152	165	177	188
FLAPS 15 (GEAR UP) VREF40+20	**PITCH ATT**	**5.5**	**5.5**	**6.0**	**6.0**	**6.0**
	%N1	**64.7**	**70.8**	**75.6**	**80.0**	**83.9**
	KIAS	128	142	155	167	178
FLAPS 25 (GEAR UP) VREF40+10	**PITCH ATT**	**6.5**	**6.5**	**6.5**	**6.5**	**6.5**
	%N1	**65.8**	**71.8**	**76.9**	**81.3**	**85.2**
	KIAS	118	132	145	157	168
FLAPS 15 (GEAR DOWN) VREF40+20	**PITCH ATT**	**5.5**	**6.0**	**6.0**	**6.0**	**6.0**
	%N1	**69.6**	**75.3**	**80.5**	**85.0**	**89.1**
	KIAS	128	142	155	167	178

Flight With Unreliable Airspeed/ Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

TERMINAL AREA (5000 FT)

%N1 for Level Flight

Airport Altitude = 13000 FT

FLAP POSITION (VREF + INCREMENT)		WEIGHT (1000 KG) 40	50	60	70	80
FLAPS UP	**PITCH ATT**	**5.0**	**5.5**	**5.5**	**6.0**	**6.5**
(GEAR UP)	**%N1**	**58.5**	**63.7**	**67.9**	**72.0**	**75.5**
VREF40+70	KIAS	178	192	205	217	228
FLAPS 1	**PITCH ATT**	**5.0**	**5.5**	**5.5**	**6.0**	**6.0**
(GEAR UP)	**%N1**	**61.4**	**66.3**	**70.9**	**74.6**	**78.2**
VREF40+50	KIAS	158	172	185	197	208
FLAPS 5	**PITCH ATT**	**5.5**	**6.0**	**6.0**	**6.0**	**6.5**
(GEAR UP)	**%N1**	**61.5**	**66.8**	**71.7**	**75.6**	**79.4**
VREF40+30	KIAS	138	152	165	177	188
FLAPS 10	**PITCH ATT**	**5.0**	**5.5**	**5.5**	**5.5**	**6.0**
(GEAR UP)	**%N1**	**65.6**	**71.4**	**76.0**	**80.4**	**84.2**
VREF40+30	KIAS	138	152	165	177	188
FLAPS 15	**PITCH ATT**	**5.5**	**5.5**	**6.0**	**6.0**	**6.0**
(GEAR UP)	**%N1**	**65.8**	**71.7**	**76.5**	**81.0**	**84.8**
VREF40+20	KIAS	128	142	155	167	178
FLAPS 25	**PITCH ATT**	**6.5**	**6.5**	**6.5**	**6.5**	**6.5**
(GEAR UP)	**%N1**	**66.9**	**72.8**	**77.9**	**82.3**	**86.2**
VREF40+10	KIAS	118	132	145	157	168
FLAPS 15	**PITCH ATT**	**5.5**	**6.0**	**6.0**	**6.0**	**6.0**
(GEAR DOWN)	**%N1**	**70.6**	**76.4**	**81.5**	**86.0**	**90.2**
VREF40+20	KIAS	128	142	155	167	178

Flight With Unreliable Airspeed/ Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

TERMINAL AREA (5000 FT)
%N1 for Level Flight
Airport Altitude = 14000 FT

FLAP POSITION (VREF + INCREMENT)		WEIGHT (1000 KG) 40	50	60	70	80
FLAPS UP (GEAR UP) VREF40+70	**PITCH ATT**	**5.0**	**5.5**	**5.5**	**6.0**	**6.5**
	%N1	**59.4**	**64.4**	**68.7**	**72.8**	**76.3**
	KIAS	179	192	205	217	228
FLAPS 1 (GEAR UP) VREF40+50	**PITCH ATT**	**5.0**	**5.5**	**5.5**	**6.0**	**6.0**
	%N1	**62.3**	**67.1**	**71.7**	**75.4**	**79.0**
	KIAS	159	172	185	197	208
FLAPS 5 (GEAR UP) VREF40+30	**PITCH ATT**	**5.5**	**6.0**	**6.0**	**6.0**	**6.5**
	%N1	**62.3**	**67.8**	**72.5**	**76.5**	**80.3**
	KIAS	139	152	165	177	188
FLAPS 10 (GEAR UP) VREF40+30	**PITCH ATT**	**5.0**	**5.5**	**5.5**	**5.5**	**6.0**
	%N1	**66.5**	**72.3**	**77.0**	**81.3**	**85.1**
	KIAS	139	152	165	177	188
FLAPS 15 (GEAR UP) VREF40+20	**PITCH ATT**	**5.5**	**5.5**	**6.0**	**6.0**	**6.0**
	%N1	**66.9**	**72.6**	**77.6**	**81.9**	**85.8**
	KIAS	129	142	155	167	178
FLAPS 25 (GEAR UP) VREF40+10	**PITCH ATT**	**6.5**	**6.5**	**6.5**	**6.5**	**6.5**
	%N1	**68.1**	**73.8**	**78.9**	**83.3**	**87.3**
	KIAS	119	132	145	157	168
FLAPS 15 (GEAR DOWN) VREF40+20	**PITCH ATT**	**5.5**	**6.0**	**6.0**	**6.0**	**6.0**
	%N1	**71.6**	**77.5**	**82.5**	**87.1**	**91.5**
	KIAS	129	142	155	167	178

Flight With Unreliable Airspeed/ Turbulent Air Penetration
Altitude and/or vertical speed indications may also be unreliable.

TERMINAL AREA (5000 FT)
%N1 for Level Flight
Airport Altitude = 14500 FT

FLAP POSITION (VREF + INCREMENT)		WEIGHT (1000 KG) 40	50	60	70	80
FLAPS UP (GEAR UP) VREF40+70	**PITCH ATT**	**5.0**	**5.5**	**5.5**	**6.0**	**6.5**
	%N1	**59.9**	**64.8**	**69.2**	**73.2**	**76.7**
	KIAS	179	192	206	218	229
FLAPS 1 (GEAR UP) VREF40+50	**PITCH ATT**	**5.0**	**5.5**	**5.5**	**6.0**	**6.0**
	%N1	**62.7**	**67.6**	**72.1**	**75.9**	**79.5**
	KIAS	159	172	186	198	209
FLAPS 5 (GEAR UP) VREF40+30	**PITCH ATT**	**5.5**	**6.0**	**6.0**	**6.0**	**6.5**
	%N1	**62.8**	**68.3**	**72.9**	**76.9**	**80.7**
	KIAS	139	152	166	178	189
FLAPS 10 (GEAR UP) VREF40+30	**PITCH ATT**	**5.0**	**5.5**	**5.5**	**5.5**	**6.0**
	%N1	**67.1**	**72.7**	**77.5**	**81.8**	**85.5**
	KIAS	139	152	166	178	189
FLAPS 15 (GEAR UP) VREF40+20	**PITCH ATT**	**5.5**	**5.5**	**6.0**	**6.0**	**6.0**
	%N1	**67.4**	**73.1**	**78.1**	**82.4**	**86.3**
	KIAS	129	142	156	168	179
FLAPS 25 (GEAR UP) VREF40+10	**PITCH ATT**	**6.5**	**6.5**	**6.5**	**6.5**	**6.5**
	%N1	**68.6**	**74.2**	**79.4**	**83.7**	**87.8**
	KIAS	119	132	146	158	169
FLAPS 15 (GEAR DOWN) VREF40+20	**PITCH ATT**	**5.5**	**6.0**	**6.0**	**6.0**	**6.0**
	%N1	**72.1**	**78.0**	**83.0**	**87.6**	**92.3**
	KIAS	129	142	156	168	179

Flight With Unreliable Airspeed/ Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

FINAL APPROACH (1500 FT)

Gear Down, %N1 for 3° Glideslope

Airport Altitude = -2000 FT

FLAP POSITION (VREF + INCREMENT)		WEIGHT (1000 KG) 40	50	60	70	80
FLAPS 15 (VREF15 + 10)	**PITCH ATT**	**2.0**	**2.5**	**2.5**	**2.5**	**2.5**
	%N1	**42.2**	**46.7**	**50.6**	**54.1**	**57.0**
	KIAS	130	145	159	171	181
FLAPS 30 (VREF30 + 10)	**PITCH ATT**	**0.5**	**0.5**	**1.0**	**1.0**	**1.0**
	%N1	**46.3**	**51.0**	**55.3**	**59.0**	**62.3**
	KIAS	125	139	152	163	173
FLAPS 40 (VREF40 + 10)	**PITCH ATT**	**-0.5**	**-0.5**	**-0.5**	**-0.5**	**0.0**
	%N1	**50.8**	**56.2**	**60.9**	**64.9**	**68.3**
	KIAS	118	132	144	155	164

Flap placard speed exceeded in shaded area.

Airport Altitude = -1000 FT

FLAP POSITION (VREF + INCREMENT)		WEIGHT (1000 KG) 40	50	60	70	80
FLAPS 15 (VREF15 + 10)	**PITCH ATT**	**2.0**	**2.5**	**2.5**	**2.5**	**2.5**
	%N1	**42.7**	**47.3**	**51.2**	**54.8**	**57.8**
	KIAS	130	145	159	171	181
FLAPS 30 (VREF30 + 10)	**PITCH ATT**	**0.5**	**0.5**	**1.0**	**1.0**	**1.0**
	%N1	**46.9**	**51.7**	**56.0**	**59.8**	**63.1**
	KIAS	125	139	152	163	173
FLAPS 40 (VREF40 + 10)	**PITCH ATT**	**-0.5**	**-0.5**	**-0.5**	**-0.5**	**0.0**
	%N1	**51.5**	**56.9**	**61.7**	**65.7**	**69.0**
	KIAS	118	132	144	155	165

Flap placard speed exceeded in shaded area.

Flight With Unreliable Airspeed/ Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

FINAL APPROACH (1500 FT)

Gear Down, %N1 for 3° Glideslope

Airport Altitude = SEA LEVEL

FLAP POSITION (VREF + INCREMENT)		WEIGHT (1000 KG)				
		40	50	60	70	80
FLAPS 15 (VREF15 + 10)	**PITCH ATT**	**2.0**	**2.5**	**2.5**	**2.5**	**2.5**
	%N1	**43.3**	**48.0**	**51.9**	**55.5**	**58.4**
	KIAS	130	145	159	171	181
FLAPS 30 (VREF30 + 10)	**PITCH ATT**	**0.5**	**0.5**	**1.0**	**1.0**	**1.0**
	%N1	**47.5**	**52.5**	**56.7**	**60.5**	**63.9**
	KIAS	125	139	152	163	173
FLAPS 40 (VREF40 + 10)	**PITCH ATT**	**-0.5**	**-0.5**	**-0.5**	**-0.5**	**0.0**
	%N1	**52.2**	**57.6**	**62.4**	**66.5**	**69.8**
	KIAS	118	132	144	155	165

Flap placard speed exceeded in shaded area.

Airport Altitude = 1000 FT

FLAP POSITION (VREF + INCREMENT)		WEIGHT (1000 KG)				
		40	50	60	70	80
FLAPS 15 (VREF15 + 10)	**PITCH ATT**	**2.0**	**2.5**	**2.5**	**2.5**	**2.5**
	%N1	**43.9**	**48.6**	**52.6**	**56.2**	**59.2**
	KIAS	130	145	159	171	181
FLAPS 30 (VREF30 + 10)	**PITCH ATT**	**0.5**	**0.5**	**1.0**	**1.0**	**1.0**
	%N1	**48.1**	**53.2**	**57.5**	**61.3**	**64.6**
	KIAS	125	139	152	163	173
FLAPS 40 (VREF40 + 10)	**PITCH ATT**	**-0.5**	**-0.5**	**-0.5**	**-0.5**	**0.0**
	%N1	**52.9**	**58.4**	**63.2**	**67.3**	**70.6**
	KIAS	118	132	144	155	165

Flap placard speed exceeded in shaded area.

Flight With Unreliable Airspeed/ Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

FINAL APPROACH (1500 FT)

Gear Down, %N1 for 3° Glideslope

Airport Altitude = 2000 FT

FLAP POSITION (VREF + INCREMENT)		WEIGHT (1000 KG) 40	50	60	70	80
FLAPS 15 (VREF15 + 10)	**PITCH ATT**	**2.0**	**2.5**	**2.5**	**2.5**	**2.5**
	%N1	**44.5**	**49.2**	**53.3**	**56.9**	**59.9**
	KIAS	130	145	159	171	181
FLAPS 30 (VREF30 + 10)	**PITCH ATT**	**0.5**	**0.5**	**1.0**	**1.0**	**1.0**
	%N1	**48.8**	**53.8**	**58.2**	**62.1**	**65.4**
	KIAS	125	139	152	163	173
FLAPS 40 (VREF40 + 10)	**PITCH ATT**	**-0.5**	**-0.5**	**-0.5**	**-0.5**	**0.0**
	%N1	**53.6**	**59.2**	**64.0**	**68.0**	**71.5**
	KIAS	118	132	144	155	165

Flap placard speed exceeded in shaded area.

Airport Altitude = 3000 FT

FLAP POSITION (VREF + INCREMENT)		WEIGHT (1000 KG) 40	50	60	70	80
FLAPS 15 (VREF15 + 10)	**PITCH ATT**	**2.0**	**2.5**	**2.5**	**2.5**	**2.5**
	%N1	**45.1**	**49.8**	**54.1**	**57.6**	**60.7**
	KIAS	131	145	159	171	181
FLAPS 30 (VREF30 + 10)	**PITCH ATT**	**0.5**	**0.5**	**1.0**	**1.0**	**1.0**
	%N1	**49.4**	**54.5**	**59.0**	**63.0**	**66.2**
	KIAS	125	139	152	163	173
FLAPS 40 (VREF40 + 10)	**PITCH ATT**	**-0.5**	**-0.5**	**-0.5**	**-0.5**	**0.0**
	%N1	**54.4**	**59.9**	**64.9**	**68.8**	**72.3**
	KIAS	118	132	144	155	165

Flap placard speed exceeded in shaded area.

Flight With Unreliable Airspeed/ Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

FINAL APPROACH (1500 FT)

Gear Down, %N1 for 3° Glideslope

Airport Altitude = 4000 FT

FLAP POSITION (VREF + INCREMENT)		WEIGHT (1000 KG)				
		40	50	60	70	80
FLAPS 15 (VREF15 + 10)	**PITCH ATT**	**2.0**	**2.5**	**2.5**	**2.5**	**2.5**
	%N1	**45.8**	**50.5**	**54.7**	**58.3**	**61.5**
	KIAS	131	145	159	171	181
FLAPS 30 (VREF30 + 10)	**PITCH ATT**	**0.5**	**0.5**	**1.0**	**1.0**	**1.0**
	%N1	**50.1**	**55.3**	**59.8**	**63.7**	**67.0**
	KIAS	125	139	152	163	173
FLAPS 40 (VREF40 + 10)	**PITCH ATT**	**-0.5**	**-0.5**	**-0.5**	**-0.5**	**0.0**
	%N1	**55.1**	**60.7**	**65.6**	**69.6**	**73.2**
	KIAS	118	132	144	155	165

Flap placard speed exceeded in shaded area.

Airport Altitude = 5000 FT

FLAP POSITION (VREF + INCREMENT)		WEIGHT (1000 KG)				
		40	50	60	70	80
FLAPS 15 (VREF15 + 10)	**PITCH ATT**	**2.0**	**2.5**	**2.5**	**2.5**	**2.5**
	%N1	**46.5**	**51.2**	**55.4**	**59.0**	**62.3**
	KIAS	131	145	159	171	181
FLAPS 30 (VREF30 + 10)	**PITCH ATT**	**0.5**	**0.5**	**1.0**	**1.0**	**1.0**
	%N1	**50.8**	**56.0**	**60.6**	**64.5**	**67.7**
	KIAS	125	139	152	163	173
FLAPS 40 (VREF40 + 10)	**PITCH ATT**	**-0.5**	**-0.5**	**-0.5**	**-0.5**	**0.0**
	%N1	**55.8**	**61.5**	**66.4**	**70.4**	**74.0**
	KIAS	118	132	144	155	165

Flap placard speed exceeded in shaded area.

Flight With Unreliable Airspeed/ Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

FINAL APPROACH (1500 FT)

Gear Down, %N1 for 3° Glideslope

Airport Altitude = 6000 FT

FLAP POSITION (VREF + INCREMENT)		WEIGHT (1000 KG) 40	50	60	70	80
FLAPS 15 (VREF15 + 10)	**PITCH ATT**	**2.0**	**2.5**	**2.5**	**2.5**	**2.5**
	%N1	**47.1**	**51.9**	**56.1**	**59.8**	**63.0**
	KIAS	131	145	159	171	182
FLAPS 30 (VREF30 + 10)	**PITCH ATT**	**0.5**	**0.5**	**1.0**	**1.0**	**1.0**
	%N1	**51.6**	**56.7**	**61.4**	**65.2**	**68.5**
	KIAS	125	139	152	163	173
FLAPS 40 (VREF40 + 10)	**PITCH ATT**	**-0.5**	**-0.5**	**-0.5**	**-0.5**	**0.0**
	%N1	**56.6**	**62.3**	**67.1**	**71.3**	**74.8**
	KIAS	118	132	144	155	165

Flap placard speed exceeded in shaded area.

Airport Altitude = 7000 FT

FLAP POSITION (VREF + INCREMENT)		WEIGHT (1000 KG) 40	50	60	70	80
FLAPS 15 (VREF15 + 10)	**PITCH ATT**	**2.0**	**2.5**	**2.5**	**2.5**	**2.5**
	%N1	**47.7**	**52.6**	**56.8**	**60.6**	**63.8**
	KIAS	131	146	159	171	182
FLAPS 30 (VREF30 + 10)	**PITCH ATT**	**0.5**	**0.5**	**1.0**	**1.0**	**1.0**
	%N1	**52.3**	**57.4**	**62.2**	**66.0**	**69.3**
	KIAS	125	139	152	163	173
FLAPS 40 (VREF40 + 10)	**PITCH ATT**	**-0.5**	**-0.5**	**-0.5**	**-0.5**	**0.0**
	%N1	**57.3**	**63.1**	**67.9**	**72.2**	**75.6**
	KIAS	118	132	144	156	165

Flap placard speed exceeded in shaded area.

Flight With Unreliable Airspeed/ Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

FINAL APPROACH (1500 FT)

Gear Down, %N1 for 3° Glideslope

Airport Altitude = 8000 FT

FLAP POSITION (VREF + INCREMENT)		WEIGHT (1000 KG) 40	50	60	70	80
FLAPS 15 (VREF15 + 10)	**PITCH ATT**	**2.0**	**2.5**	**2.5**	**2.5**	**2.5**
	%N1	**48.4**	**53.3**	**57.6**	**61.4**	**64.5**
	KIAS	131	146	159	171	182
FLAPS 30 (VREF30 + 10)	**PITCH ATT**	**0.5**	**0.5**	**1.0**	**1.0**	**1.0**
	%N1	**52.9**	**58.2**	**62.9**	**66.8**	**70.1**
	KIAS	125	139	152	163	173
FLAPS 40 (VREF40 + 10)	**PITCH ATT**	**-0.5**	**-0.5**	**-0.5**	**-0.5**	**0.0**
	%N1	**58.1**	**64.0**	**68.7**	**73.0**	**76.4**
	KIAS	118	132	145	156	165

Flap placard speed exceeded in shaded area.

Airport Altitude = 9000 FT

FLAP POSITION (VREF + INCREMENT)		WEIGHT (1000 KG) 40	50	60	70	80
FLAPS 15 (VREF15 + 10)	**PITCH ATT**	**2.0**	**2.5**	**2.5**	**2.5**	**2.5**
	%N1	**49.0**	**54.0**	**58.3**	**62.2**	**65.2**
	KIAS	131	146	159	171	182
FLAPS 30 (VREF30 + 10)	**PITCH ATT**	**0.5**	**0.5**	**1.0**	**1.0**	**1.0**
	%N1	**53.7**	**59.0**	**63.7**	**67.6**	**70.9**
	KIAS	125	139	152	163	173
FLAPS 40 (VREF40 + 10)	**PITCH ATT**	**-0.5**	**-0.5**	**-0.5**	**-0.5**	**0.0**
	%N1	**58.9**	**64.7**	**69.6**	**73.8**	**77.2**
	KIAS	118	132	145	156	165

Flap placard speed exceeded in shaded area.

Flight With Unreliable Airspeed/ Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

FINAL APPROACH (1500 FT)

Gear Down, %N1 for 3° Glideslope

Airport Altitude = 10000 FT

FLAP POSITION (VREF + INCREMENT)		WEIGHT (1000 KG) 40	50	60	70	80
FLAPS 15 (VREF15 + 10)	**PITCH ATT**	**2.0**	**2.5**	**2.5**	**2.5**	**2.5**
	%N1	**49.7**	**54.7**	**59.1**	**62.9**	**65.9**
	KIAS	131	146	159	171	182
FLAPS 30 (VREF30 + 10)	**PITCH ATT**	**0.5**	**0.5**	**1.0**	**1.0**	**1.0**
	%N1	**54.4**	**59.8**	**64.5**	**68.3**	**71.7**
	KIAS	125	139	152	163	173
FLAPS 40 (VREF40 + 10)	**PITCH ATT**	**-0.5**	**-0.5**	**-0.5**	**-0.5**	**0.0**
	%N1	**59.8**	**65.5**	**70.5**	**74.6**	**78.1**
	KIAS	118	132	145	156	165

Flap placard speed exceeded in shaded area.

Airport Altitude = 11000 FT

FLAP POSITION (VREF + INCREMENT)		WEIGHT (1000 KG) 40	50	60	70	80
FLAPS 15 (VREF15 + 10)	**PITCH ATT**	**2.0**	**2.5**	**2.5**	**2.5**	**2.5**
	%N1	**50.4**	**55.5**	**59.9**	**63.6**	**66.6**
	KIAS	131	146	159	171	182
FLAPS 30 (VREF30 + 10)	**PITCH ATT**	**0.5**	**0.5**	**1.0**	**1.0**	**1.0**
	%N1	**55.1**	**60.7**	**65.3**	**69.1**	**72.5**
	KIAS	125	139	152	163	173
FLAPS 40 (VREF40 + 10)	**PITCH ATT**	**-0.5**	**-0.5**	**-0.5**	**-0.5**	**-0.5**
	%N1	**60.5**	**66.3**	**71.3**	**75.4**	**79.0**
	KIAS	118	132	145	156	165

Flap placard speed exceeded in shaded area.

Flight With Unreliable Airspeed/ Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

FINAL APPROACH (1500 FT)

Gear Down, %N1 for 3° Glideslope

Airport Altitude = 12000 FT

FLAP POSITION (VREF + INCREMENT)		WEIGHT (1000 KG) 40	50	60	70	80
FLAPS 15 (VREF15 + 10)	**PITCH ATT**	**2.0**	**2.5**	**2.5**	**2.5**	**2.5**
	%N1	**51.1**	**56.2**	**60.7**	**64.3**	**67.4**
	KIAS	131	146	159	172	182
FLAPS 30 (VREF30 + 10)	**PITCH ATT**	**0.5**	**0.5**	**1.0**	**1.0**	**1.0**
	%N1	**55.9**	**61.5**	**66.1**	**70.0**	**73.3**
	KIAS	125	139	152	164	173
FLAPS 40 (VREF40 + 10)	**PITCH ATT**	**-0.5**	**-0.5**	**-0.5**	**-0.5**	**-0.5**
	%N1	**61.3**	**67.1**	**72.2**	**76.2**	**79.8**
	KIAS	118	132	145	156	166

Flap placard speed exceeded in shaded area.

Airport Altitude = 13000 FT

FLAP POSITION (VREF + INCREMENT)		WEIGHT (1000 KG) 40	50	60	70	80
FLAPS 15 (VREF15 + 10)	**PITCH ATT**	**2.0**	**2.5**	**2.5**	**2.5**	**2.5**
	%N1	**51.9**	**56.9**	**61.5**	**65.1**	**68.1**
	KIAS	131	146	160	172	182
FLAPS 30 (VREF30 + 10)	**PITCH ATT**	**0.5**	**0.5**	**1.0**	**1.0**	**1.0**
	%N1	**56.6**	**62.2**	**66.8**	**70.8**	**74.1**
	KIAS	125	139	152	164	173
FLAPS 40 (VREF40 + 10)	**PITCH ATT**	**-0.5**	**-0.5**	**-0.5**	**-0.5**	**-0.5**
	%N1	**62.2**	**67.9**	**73.0**	**77.1**	**80.7**
	KIAS	118	132	145	156	166

Flap placard speed exceeded in shaded area.

Flight With Unreliable Airspeed/ Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

FINAL APPROACH (1500 FT)

Gear Down, %N1 for 3° Glideslope

Airport Altitude = 14000 FT

FLAP POSITION (VREF + INCREMENT)		WEIGHT (1000 KG) 40	50	60	70	80
FLAPS 15 (VREF15 + 10)	**PITCH ATT**	**2.0**	**2.5**	**2.5**	**2.5**	**2.5**
	%N1	**52.7**	**57.8**	**62.4**	**65.8**	**69.0**
	KIAS	131	146	160	172	182
FLAPS 30 (VREF30 + 10)	**PITCH ATT**	**0.5**	**0.5**	**1.0**	**1.0**	**1.0**
	%N1	**57.6**	**63.1**	**67.7**	**71.7**	**74.9**
	KIAS	125	139	152	164	174
FLAPS 40 (VREF40 + 10)	**PITCH ATT**	**-0.5**	**-0.5**	**-0.5**	**-0.5**	**-0.5**
	%N1	**63.2**	**68.9**	**73.9**	**78.0**	**81.7**
	KIAS	118	132	145	156	166

Flap placard speed exceeded in shaded area.

Airport Altitude = 14500 FT

FLAP POSITION (VREF + INCREMENT)		WEIGHT (1000 KG) 40	50	60	70	80
FLAPS 15 (VREF15 + 10)	**PITCH ATT**	**2.0**	**2.5**	**2.5**	**2.5**	**2.5**
	%N1	**53.1**	**58.3**	**62.8**	**66.3**	**69.4**
	KIAS	131	146	160	172	182
FLAPS 30 (VREF30 + 10)	**PITCH ATT**	**0.5**	**0.5**	**1.0**	**1.0**	**1.0**
	%N1	**58.2**	**63.6**	**68.2**	**72.1**	**75.3**
	KIAS	125	139	152	164	174
FLAPS 40 (VREF40 + 10)	**PITCH ATT**	**-0.5**	**-0.5**	**-0.5**	**-0.5**	**-0.5**
	%N1	**63.7**	**69.5**	**74.4**	**78.5**	**82.2**
	KIAS	118	132	145	156	167

Flap placard speed exceeded in shaded area.

Flight With Unreliable Airspeed/ Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

GO-AROUND

Flaps 1, Gear Up, Set Go-Around Thrust

PRESSURE ALTITUDE (FT)		WEIGHT (1000 KG) 40	50	60	70	80
14000	**PITCH ATT**	**17.5**	**14.5**	**12.5**	**11.0**	**10.5**
	V/S (FT/MIN)	4300	3400	2800	2300	1900
	KIAS	158	172	185	196	206
10000	**PITCH ATT**	**19.5**	**16.0**	**14.0**	**12.5**	**11.5**
	V/S (FT/MIN)	4800	3900	3200	2700	2200
	KIAS	158	172	185	196	205
5000	**PITCH ATT**	**23.5**	**19.0**	**16.0**	**14.0**	**13.0**
	V/S (FT/MIN)	5600	4500	3700	3100	2700
	KIAS	158	172	184	195	205
SEA LEVEL	**PITCH ATT**	**27.0**	**22.0**	**18.5**	**16.0**	**14.5**
	V/S (FT/MIN)	6300	5100	4300	3600	3100
	KIAS	158	172	184	195	205
-2000	**PITCH ATT**	**27.5**	**22.0**	**18.5**	**16.5**	**15.0**
	V/S (FT/MIN)	6100	5000	4200	3600	3100
	KIAS	158	172	184	195	204

Flaps 5, Gear Up, Set Go-Around Thrust

PRESSURE ALTITUDE (FT)		WEIGHT (1000 KG) 40	50	60	70	80
14000	**PITCH ATT**	**18.0**	**15.0**	**13.0**	**11.5**	**10.5**
	V/S (FT/MIN)	3900	3100	2500	2000	1700
	KIAS	138	152	165	176	186
10000	**PITCH ATT**	**20.5**	**17.0**	**14.5**	**13.0**	**11.5**
	V/S (FT/MIN)	4400	3500	2800	2400	2000
	KIAS	138	152	165	176	185
5000	**PITCH ATT**	**24.5**	**20.0**	**16.5**	**14.5**	**13.5**
	V/S (FT/MIN)	5000	4100	3400	2900	2400
	KIAS	138	152	164	175	185
SEA LEVEL	**PITCH ATT**	**28.5**	**23.0**	**19.0**	**17.0**	**15.0**
	V/S (FT/MIN)	5600	4600	3900	3300	2800
	KIAS	138	152	164	175	185
-2000	**PITCH ATT**	**28.5**	**23.0**	**19.5**	**17.0**	**15.5**
	V/S (FT/MIN)	5500	4500	3800	3200	2800
	KIAS	138	152	164	175	184

Only authorized operators may use Flaps 5 for a Go-Around in conjunction with the Alternate Go-Around and Missed Approach Procedure.

Flight With Unreliable Airspeed/ Turbulent Air Penetration
Altitude and/or vertical speed indications may also be unreliable.

GO-AROUND
Flaps 15, Gear Up, Set Go-Around Thrust

PRESSURE ALTITUDE (FT)		WEIGHT (1000 KG)				
		40	50	60	70	80
14000	**PITCH ATT**	**17.5**	**14.0**	**12.0**	**10.5**	**9.5**
	V/S (FT/MIN)	3400	2600	2100	1600	1200
	KIAS	128	142	155	166	176
10000	**PITCH ATT**	**20.0**	**16.0**	**13.5**	**11.5**	**10.5**
	V/S (FT/MIN)	3900	3000	2400	1900	1500
	KIAS	128	142	155	166	175
5000	**PITCH ATT**	**24.0**	**19.0**	**16.0**	**13.5**	**12.5**
	V/S (FT/MIN)	4500	3600	3000	2400	2000
	KIAS	128	142	154	165	175
SEA LEVEL	**PITCH ATT**	**28.0**	**22.0**	**18.5**	**16.0**	**14.0**
	V/S (FT/MIN)	5100	4200	3500	2900	2400
	KIAS	128	142	154	165	175
-2000	**PITCH ATT**	**28.0**	**22.0**	**18.5**	**16.0**	**14.0**
	V/S (FT/MIN)	5000	4100	3400	2800	2400
	KIAS	128	142	154	165	174

Intentionally
Blank

Performance Inflight — Chapter PI
All Engine — Section 51

Long Range Cruise Maximum Operating Altitude
Max Cruise Thrust
ISA + 10°C and Below

WEIGHT (1000 KG)	OPTIMUM ALT (FT)	TAT (°C)	MARGIN TO INITIAL BUFFET 'G' (BANK ANGLE)				
			1.20 (33°)	1.25 (36°)	1.30 (39°)	1.40 (44°)	1.50 (48°)
85	32300	-10	34300*	34300*	33800	32200	30800
80	33600	-13	35800*	35800*	35100	33500	32100
75	35000	-16	37100*	37100*	36400	34900	33500
70	36400	-18	38400*	38400*	37900	36300	35000
65	38000	-18	39800*	39800*	39400	37800	36500
60	39600	-18	41000	41000	41000	39500	38200
55	41000	-18	41000	41000	41000	41000	40000
50	41000	-18	41000	41000	41000	41000	41000
45	41000	-18	41000	41000	41000	41000	41000
40	41000	-18	41000	41000	41000	41000	41000

ISA + 15°C

WEIGHT (1000 KG)	OPTIMUM ALT (FT)	TAT (°C)	MARGIN TO INITIAL BUFFET 'G' (BANK ANGLE)				
			1.20 (33°)	1.25 (36°)	1.30 (39°)	1.40 (44°)	1.50 (48°)
85	32300	-4	33000*	33000*	33000*	32200	30800
80	33600	-7	34700*	34700*	34700*	33500	32100
75	35000	-10	36200*	36200*	36200*	34900	33500
70	36400	-12	37600*	37600*	37600*	36300	35000
65	38000	-12	38900*	38900*	38900*	37800	36500
60	39600	-12	40400*	40400*	40400*	39500	38200
55	41000	-12	41000	41000	41000	41000	40000
50	41000	-12	41000	41000	41000	41000	41000
45	41000	-12	41000	41000	41000	41000	41000
40	41000	-12	41000	41000	41000	41000	41000

ISA + 20°C

WEIGHT (1000 KG)	OPTIMUM ALT (FT)	TAT (°C)	MARGIN TO INITIAL BUFFET 'G' (BANK ANGLE)				
			1.20 (33°)	1.25 (36°)	1.30 (39°)	1.40 (44°)	1.50 (48°)
85	32300	2	29400*	29400*	29400*	29400*	29400*
80	33600	-1	32200*	32200*	32200*	32200*	32100
75	35000	-4	34700*	34700*	34700*	34700*	33500
70	36400	-7	36200*	36200*	36200*	36200*	35000
65	38000	-7	37700*	37700*	37700*	37700*	36500
60	39600	-7	39100*	39100*	39100*	39100*	38200
55	41000	-7	40500*	40500*	40500*	40500*	40000
50	41000	-7	41000	41000	41000	41000	41000
45	41000	-7	41000	41000	41000	41000	41000
40	41000	-7	41000	41000	41000	41000	41000

***Denotes altitude thrust limited in level flight, 100 fpm residual rate of climb.**

Long Range Cruise Control

WEIGHT (1000 KG)		PRESSURE ALTITUDE (1000 FT)								
		25	27	29	31	33	35	37	39	41
85	%N1	85.0	86.4	87.6	88.8	90.3				
	MACH	.735	.759	.776	.788	.792				
	KIAS	308	306	300	292	281				
	FF/ENG	1539	1536	1527	1510	1500				
80	%N1	83.7	85.1	86.4	87.6	88.8	91.1			
	MACH	.715	.743	.765	.780	.790	.790			
	KIAS	299	299	296	289	281	268			
	FF/ENG	1447	1451	1446	1432	1414	1426			
75	%N1	82.1	83.7	85.0	86.4	87.6	88.9	92.6		
	MACH	.692	.723	.750	.770	.784	.792	.788		
	KIAS	289	290	289	285	278	269	255		
	FF/ENG	1348	1362	1363	1353	1338	1321	1366		
70	%N1	80.3	82.0	83.6	85.0	86.3	87.5	89.5		
	MACH	.668	.699	.730	.755	.774	.787	.792		
	KIAS	278	280	281	279	274	267	257		
	FF/ENG	1250	1264	1275	1272	1259	1244	1244		
65	%N1	78.6	80.2	81.8	83.4	84.8	86.1	87.7	90.6	
	MACH	.645	.673	.705	.735	.760	.777	.789	.791	
	KIAS	268	269	271	271	269	263	256	245	
	FF/ENG	1155	1166	1180	1186	1180	1166	1162	1179	
60	%N1	77.0	78.3	79.9	81.6	83.1	84.5	86.2	88.2	91.6
	MACH	.627	.647	.676	.709	.739	.763	.779	.790	.790
	KIAS	260	258	259	261	261	258	252	245	233
	FF/ENG	1076	1070	1082	1093	1096	1088	1086	1085	1111
55	%N1	75.4	76.5	77.8	79.4	81.2	82.7	84.5	86.6	88.7
	MACH	.611	.627	.647	.677	.711	.741	.765	.781	.791
	KIAS	253	249	247	248	250	250	247	241	234
	FF/ENG	1007	990	985	995	1003	1005	1006	1008	1008
50	%N1	73.7	74.8	75.9	77.2	78.9	80.6	82.5	84.8	86.8
	MACH	.595	.610	.626	.646	.676	.710	.741	.765	.781
	KIAS	246	242	238	236	237	239	239	236	230
	FF/ENG	944	921	906	899	906	914	921	928	930
45	%N1	71.5	72.9	74.0	75.2	76.4	78.1	80.2	82.6	84.8
	MACH	.569	.591	.607	.624	.643	.673	.707	.739	.763
	KIAS	235	234	231	227	224	225	227	227	224
	FF/ENG	868	857	838	823	825	828	839	852	859
40	%N1	68.8	70.5	71.9	73.1	74.2	75.4	77.3	79.9	82.3
	MACH	.538	.561	.584	.602	.619	.637	.665	.699	.732
	KIAS	222	222	222	219	215	212	212	214	214
	FF/ENG	801	796	787	769	751	739	742	757	771

Shaded area approximates optimum altitude.

Long Range Cruise Enroute Fuel and Time - Low Altitudes

Ground to Air Miles Conversions

AIR DISTANCE (NM)					GROUND DISTANCE (NM)	AIR DISTANCE (NM)				
HEADWIND COMPONENT (KTS)						TAILWIND COMPONENT (KTS)				
100	80	60	40	20		20	40	60	80	100
295	270	248	230	214	200	190	181	173	165	158
444	406	373	345	321	300	285	272	259	248	238
594	543	498	461	429	400	380	362	346	331	318
744	680	623	576	536	500	476	453	432	414	397
894	817	749	692	643	600	571	544	519	496	476
1045	954	874	808	751	700	666	634	605	579	556
1197	1092	1000	924	858	800	761	725	692	662	635
1349	1230	1126	1039	966	900	856	816	778	745	714
1502	1369	1252	1155	1073	1000	951	906	865	827	793
1655	1508	1379	1272	1181	1100	1046	996	951	909	872
1809	1647	1505	1388	1288	1200	1141	1086	1037	992	951
1963	1787	1632	1505	1396	1300	1236	1177	1123	1074	1030
2118	1927	1760	1621	1504	1400	1331	1268	1210	1157	1109
2274	2068	1888	1738	1612	1500	1426	1358	1296	1239	1188
2430	2209	2015	1856	1720	1600	1521	1448	1381	1321	1267
2587	2350	2143	1972	1828	1700	1616	1538	1467	1403	1346
2744	2492	2271	2090	1936	1800	1711	1628	1553	1486	1425
2902	2634	2400	2207	2044	1900	1805	1719	1639	1568	1504
3060	2777	2529	2325	2153	2000	1900	1809	1725	1650	1582

Reference Fuel And Time Required at Check Point

AIR DIST (NM)	PRESSURE ALTITUDE (1000 FT)									
	10		14		20		24		28	
	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)
200	1.4	0:42	1.3	0:40	1.1	0:38	0.9	0:37	0.9	0:36
300	2.2	1:02	2.0	0:59	1.7	0:54	1.5	0:53	1.4	0:51
400	3.0	1:22	2.7	1:17	2.3	1:11	2.1	1:09	1.9	1:07
500	3.7	1:42	3.4	1:36	3.0	1:28	2.7	1:25	2.5	1:22
600	4.5	2:02	4.1	1:55	3.6	1:45	3.2	1:42	3.0	1:38
700	5.2	2:22	4.8	2:14	4.2	2:02	3.8	1:58	3.5	1:54
800	6.0	2:43	5.5	2:33	4.8	2:19	4.4	2:14	4.1	2:09
900	6.7	3:03	6.2	2:52	5.5	2:37	4.9	2:31	4.6	2:25
1000	7.5	3:24	6.9	3:11	6.1	2:54	5.5	2:47	5.1	2:41
1100	8.2	3:45	7.6	3:31	6.7	3:11	6.1	3:04	5.7	2:57
1200	8.9	4:06	8.2	3:50	7.3	3:29	6.6	3:20	6.2	3:12
1300	9.7	4:27	8.9	4:10	7.9	3:47	7.2	3:37	6.7	3:28
1400	10.4	4:48	9.6	4:30	8.5	4:04	7.7	3:53	7.2	3:44
1500	11.1	5:10	10.3	4:50	9.1	4:22	8.3	4:10	7.7	4:01
1600	11.8	5:31	10.9	5:10	9.7	4:40	8.8	4:27	8.2	4:17
1700	12.5	5:53	11.6	5:30	10.3	4:58	9.4	4:43	8.7	4:33
1800	13.2	6:15	12.2	5:50	10.9	5:16	9.9	5:00	9.2	4:49
1900	13.9	6:37	12.9	6:11	11.5	5:34	10.4	5:17	9.7	5:05
2000	14.6	6:59	13.6	6:31	12.1	5:53	11.0	5:34	10.2	5:22

Long Range Cruise Enroute Fuel and Time - Low Altitudes

Fuel Required Adjustments (1000 KG)

REFERENCE FUEL REQUIRED (1000 KG)	WEIGHT AT CHECK POINT (1000 KG)				
	40	50	60	70	80
1	-0.1	0.0	0.0	0.1	0.1
2	-0.2	-0.1	0.0	0.1	0.3
3	-0.4	-0.2	0.0	0.2	0.5
4	-0.5	-0.2	0.0	0.3	0.6
5	-0.6	-0.3	0.0	0.4	0.8
6	-0.7	-0.4	0.0	0.5	1.0
7	-0.9	-0.4	0.0	0.6	1.2
8	-1.0	-0.5	0.0	0.7	1.4
9	-1.1	-0.6	0.0	0.8	1.6
10	-1.2	-0.6	0.0	0.9	1.8
11	-1.3	-0.7	0.0	1.0	1.9
12	-1.5	-0.8	0.0	1.1	2.1
13	-1.6	-0.9	0.0	1.2	2.3
14	-1.7	-0.9	0.0	1.3	2.5
15	-1.8	-1.0	0.0	1.4	2.7

Long Range Cruise Enroute Fuel and Time - High Altitudes

Ground to Air Miles Conversions

AIR DISTANCE (NM)					GROUND DISTANCE (NM)	AIR DISTANCE (NM)				
HEADWIND COMPONENT (KTS)						TAILWIND COMPONENT (KTS)				
100	80	60	40	20		20	40	60	80	100
540	505	474	446	422	400	382	366	351	337	324
808	757	710	669	633	600	574	549	527	506	488
1078	1009	947	892	844	800	765	733	703	676	651
1348	1262	1184	1116	1055	1000	956	916	879	845	814
1619	1515	1421	1339	1266	1200	1148	1099	1055	1014	977
1890	1768	1658	1562	1477	1400	1339	1283	1231	1183	1140
2162	2023	1897	1786	1689	1600	1531	1466	1406	1352	1302
2435	2277	2135	2011	1900	1800	1722	1649	1582	1521	1465
2708	2532	2374	2235	2112	2000	1913	1832	1757	1689	1627
2982	2788	2612	2459	2324	2200	2104	2015	1933	1858	1789
3256	3044	2851	2684	2535	2400	2295	2198	2109	2026	1951
3532	3300	3091	2909	2747	2600	2486	2381	2283	2194	2113
3808	3557	3331	3133	2959	2800	2677	2563	2458	2362	2274
4085	3815	3571	3359	3171	3000	2868	2746	2633	2529	2435
4362	4072	3811	3584	3383	3200	3059	2928	2807	2697	2596
4639	4330	4051	3809	3595	3400	3250	3111	2982	2864	2757
4917	4588	4292	4035	3807	3600	3441	3293	3156	3031	2917
5196	4847	4533	4260	4019	3800	3631	3474	3330	3197	3077
5476	5107	4775	4487	4231	4000	3821	3656	3503	3364	3237
5757	5368	5017	4713	4444	4200	4012	3837	3677	3530	3396
6040	5629	5260	4939	4656	4400	4202	4019	3850	3695	3556
6322	5891	5503	5166	4869	4600	4392	4200	4023	3861	3714
6606	6153	5746	5393	5082	4800	4583	4381	4196	4026	3873
6892	6417	5990	5621	5295	5000	4773	4562	4368	4191	4031

Long Range Cruise Enroute Fuel and Time - High Altitudes
Reference Fuel And Time Required at Check Point

AIR DIST (NM)	PRESSURE ALTITUDE (1000 FT)									
	29		31		33		35		37	
	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)
400	1.9	1:06	1.8	1:04	1.8	1:02	1.7	1:01	1.7	1:01
600	3.0	1:37	2.9	1:34	2.8	1:31	2.7	1:29	2.6	1:28
800	4.0	2:07	3.9	2:03	3.8	1:59	3.6	1:57	3.5	1:55
1000	5.1	2:38	4.9	2:33	4.7	2:28	4.6	2:24	4.5	2:22
1200	6.1	3:10	5.9	3:03	5.7	2:57	5.5	2:53	5.4	2:49
1400	7.1	3:41	6.9	3:34	6.7	3:26	6.5	3:21	6.3	3:17
1600	8.1	4:13	7.9	4:05	7.6	3:56	7.4	3:49	7.2	3:44
1800	9.1	4:45	8.8	4:36	8.6	4:26	8.3	4:18	8.1	4:12
2000	10.1	5:17	9.8	5:07	9.5	4:56	9.2	4:47	9.0	4:40
2200	11.1	5:50	10.8	5:39	10.4	5:26	10.1	5:16	9.9	5:08
2400	12.0	6:22	11.7	6:11	11.4	5:57	11.0	5:45	10.8	5:36
2600	13.0	6:55	12.6	6:43	12.3	6:28	11.9	6:15	11.6	6:04
2800	13.9	7:28	13.6	7:15	13.2	6:59	12.8	6:45	12.5	6:33
3000	14.9	8:01	14.5	7:47	14.1	7:31	13.7	7:15	13.3	7:02
3200	15.8	8:35	15.4	8:20	14.9	8:03	14.5	7:46	14.1	7:31
3400	16.8	9:09	16.3	8:53	15.8	8:35	15.4	8:16	15.0	8:00
3600	17.7	9:42	17.2	9:26	16.7	9:07	16.2	8:48	15.8	8:30
3800	18.6	10:17	18.1	10:00	17.6	9:40	17.1	9:19	16.6	9:00
4000	19.5	10:51	19.0	10:33	18.4	10:12	17.9	9:51	17.4	9:30
4200	20.4	11:25	19.8	11:07	19.3	10:45	18.7	10:23	18.2	10:01
4400	21.3	12:00	20.7	11:41	20.1	11:19	19.5	10:55	19.0	10:31
4600	22.2	12:36	21.6	12:15	21.0	11:52	20.4	11:28	19.8	11:03
4800	23.1	13:11	22.4	12:49	21.8	12:26	21.2	12:01	20.6	11:34
5000	24.0	13:47	23.3	13:24	22.6	12:59	22.0	12:33	21.4	12:06

Fuel Required Adjustments (1000 KG)

REFERENCE FUEL REQUIRED (1000 KG)	WEIGHT AT CHECK POINT (1000 KG)				
	40	50	60	70	80
2	-0.3	-0.2	0.0	0.2	0.7
4	-0.5	-0.3	0.0	0.4	1.3
6	-0.8	-0.5	0.0	0.6	1.8
8	-1.1	-0.6	0.0	0.9	2.3
10	-1.4	-0.8	0.0	1.1	2.7
12	-1.7	-0.9	0.0	1.3	3.2
14	-2.0	-1.0	0.0	1.5	3.6
16	-2.4	-1.2	0.0	1.7	4.0
18	-2.7	-1.4	0.0	1.9	4.4
20	-3.0	-1.5	0.0	2.0	4.8
22	-3.4	-1.7	0.0	2.2	5.1
24	-3.8	-1.8	0.0	2.4	5.4
26	-4.1	-2.0	0.0	2.6	5.7
28	-4.5	-2.2	0.0	2.7	6.0
30	-4.9	-2.4	0.0	2.9	6.3

Long Range Cruise Wind-Altitude Trade

PRESSURE ALTITUDE (1000 FT)	CRUISE WEIGHT (1000 KG)									
	85	80	75	70	65	60	55	50	45	40
41					30	7	0	4	16	33
39				22	4	0	4	15	30	45
37		37	14	2	0	5	15	28	43	56
35	23	7	0	0	6	16	28	41	54	64
33	2	0	2	8	18	29	41	53	62	68
31	0	4	11	21	31	42	52	61	67	70
29	7	15	24	34	43	53	61	67	70	70
27	19	27	36	45	54	61	66	70	70	68
25	31	40	48	55	62	67	70	70	69	64

The above wind factor tables are for calculation of wind required to maintain present range capability at new pressure altitude, i.e., break-even wind.

Method:

1. **Read wind factors for present and new altitudes from table.**
2. **Determine difference (new altitude wind factor minus present altitude wind factor); This difference may be negative or positive.**
3. **Break-even wind at new altitude is present altitude wind plus difference from step 2.**

Descent

.78/280/250

PRESSURE ALTITUDE (FT)	TIME (MIN)	FUEL (KG)	DISTANCE (NM)			
			LANDING WEIGHT (1000 KG)			
			40	50	60	70
41000	27	340	102	119	133	142
39000	26	340	97	114	127	136
37000	25	330	92	108	121	130
35000	24	330	88	103	116	125
33000	24	320	84	99	111	120
31000	23	320	80	94	105	113
29000	22	310	75	88	98	106
27000	21	300	70	82	92	99
25000	20	300	66	77	86	92
23000	19	290	61	71	79	85
21000	18	280	57	66	73	78
19000	17	270	52	61	67	72
17000	15	250	48	55	61	65
15000	14	240	44	50	55	58
10000	11	200	30	34	37	39
5000	7	150	18	19	20	21
1500	4	110	9	9	9	9

Allowances for a straight-in approach are included.

Holding

Flaps Up

WEIGHT (1000 KG)		PRESSURE ALTITUDE (FT)								
		1500	5000	10000	15000	20000	25000	30000	35000	41000
85	%N1	64.3	67.0	70.7	74.7	78.9	83.0	87.0		
	KIAS	250	251	252	253	255	257	260		
	FF/ENG	1500	1470	1460	1450	1430	1430	1460		
80	%N1	62.6	65.5	69.1	73.2	77.3	81.6	85.5		
	KIAS	242	243	244	245	247	249	252		
	FF/ENG	1420	1390	1380	1370	1340	1340	1360		
75	%N1	60.9	63.9	67.5	71.6	75.6	80.0	83.9	88.2	
	KIAS	235	236	236	238	239	241	243	247	
	FF/ENG	1340	1310	1300	1290	1260	1250	1270	1300	
70	%N1	59.2	62.0	65.9	69.8	73.9	78.3	82.3	86.5	
	KIAS	227	227	228	229	231	232	235	238	
	FF/ENG	1260	1240	1220	1200	1180	1160	1180	1200	
65	%N1	57.4	60.0	64.2	67.8	72.1	76.4	80.5	84.7	
	KIAS	219	219	220	221	222	224	226	228	
	FF/ENG	1180	1160	1140	1120	1100	1080	1090	1110	
60	%N1	55.6	58.1	62.1	65.9	70.1	74.3	78.6	82.7	
	KIAS	210	210	211	212	213	214	216	219	
	FF/ENG	1110	1080	1060	1040	1020	990	1010	1020	
55	%N1	53.6	56.1	59.8	64.0	67.9	72.2	76.5	80.7	87.9
	KIAS	200	201	202	203	204	205	207	209	212
	FF/ENG	1030	1000	980	960	940	920	920	930	980
50	%N1	51.4	53.9	57.5	61.7	65.5	69.9	74.0	78.4	85.5
	KIAS	192	192	192	193	194	195	196	198	201
	FF/ENG	950	920	900	880	860	860	850	850	890
45	%N1	49.1	51.5	55.1	58.9	63.1	67.2	71.4	75.9	82.9
	KIAS	185	185	185	185	185	185	186	187	190
	FF/ENG	880	850	840	820	800	780	770	770	800
40	%N1	46.6	48.9	52.5	56.1	60.4	64.2	68.6	73.0	80.1
	KIAS	178	178	178	178	178	178	178	178	178
	FF/ENG	820	790	760	740	720	710	700	690	710

This table includes 5% additional fuel for holding in a racetrack pattern.

Intentionally
Blank

ADVISORY INFORMATION

Normal Configuration Landing Distance

Flaps 15

BRAKING CONFIGURATION	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
	65000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 65000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF15	ONE REV	NO REV

Dry Runway

MAX MANUAL	1010	70/-60	25/30	-35/125	15/-10	25/-25	35	25	50
AUTOBRAKE MAX	1300	65/-75	30/40	-45/155	0/0	30/-30	60	0	5
AUTOBRAKE 3	1870	105/-120	50/65	-80/260	0/0	55/-55	100	0	0
AUTOBRAKE 2	2385	155/-170	75/95	-105/360	30/-45	70/-70	100	70	70
AUTOBRAKE 1	2640	185/-200	90/115	-125/425	70/-85	80/-80	95	240	335

Good Reported Braking Action

MAX MANUAL	1395	80/-85	40/50	-60/210	35/-30	35/-35	50	75	175
AUTOBRAKE MAX	1485	85/-90	40/55	-65/215	30/-25	35/-40	55	85	190
AUTOBRAKE 3	1870	105/-120	50/65	-80/265	5/0	55/-55	100	5	15
AUTOBRAKE 2	2385	155/-170	75/95	-105/360	30/-45	70/-70	100	70	70
AUTOBRAKE 1	2640	185/-200	90/115	-125/425	70/-85	80/-80	95	240	335

Medium Reported Braking Action

MAX MANUAL	1930	125/-130	60/80	-95/345	90/-70	55/-55	65	215	520
AUTOBRAKE MAX	1965	130/-135	60/85	-100/350	85/-65	55/-55	75	215	520
AUTOBRAKE 3	2065	130/-140	60/85	-100/360	65/-45	60/-60	100	150	450
AUTOBRAKE 2	2440	160/-175	75/100	-115/405	65/-65	70/-75	100	115	250
AUTOBRAKE 1	2655	185/-200	90/120	-130/440	90/-90	80/-80	95	255	395

Poor Reported Braking Action

MAX MANUAL	2545	180/-185	85/120	-145/550	215/-140	70/-75	80	465	1245
AUTOBRAKE MAX	2545	185/-185	90/120	-145/550	220/-145	70/-75	80	465	1245
AUTOBRAKE 3	2560	185/-185	90/120	-145/550	210/-130	70/-75	95	465	1255
AUTOBRAKE 2	2730	190/-200	90/125	-155/565	200/-130	75/-80	100	375	1090
AUTOBRAKE 1	2855	205/-215	100/135	-160/585	205/-145	80/-85	95	440	1080

Reference distance is based on sea level, standard day, no wind or slope, VREF15, two-engine detent No. 2 reverse thrust, and auto speedbrakes.
For max manual braking and manual speedbrakes, increase reference landing distance by 60 m.
For autobrake and manual speedbrakes, increase reference landing distance by 55 m.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Actual (unfactored) distances are shown.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Normal Configuration Landing Distance

Flaps 30

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	65000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 65000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF30	ONE REV	NO REV

Dry Runway

MAX MANUAL	960	55/-55	20/30	-35/120	10/-10	20/-20	35	20	40
AUTOBRAKE MAX	1215	60/-65	30/35	-45/150	0/0	30/-30	55	0	5
AUTOBRAKE 3	1725	95/-110	45/60	-75/250	0/0	50/-50	95	0	0
AUTOBRAKE 2	2190	140/-150	65/90	-100/345	30/-40	65/-65	95	60	60
AUTOBRAKE 1	2415	165/-180	80/105	-120/405	65/-75	70/-70	85	195	290

Good Reported Braking Action

MAX MANUAL	1330	75/-80	35/45	-60/205	35/-30	35/-35	50	70	155
AUTOBRAKE MAX	1415	80/-85	40/50	-60/210	30/-25	35/-35	60	75	170
AUTOBRAKE 3	1725	95/-110	45/60	-75/250	5/0	50/-50	95	5	15
AUTOBRAKE 2	2190	140/-150	65/90	-100/345	30/-40	65/-65	95	60	60
AUTOBRAKE 1	2415	165/-180	80/105	-120/405	65/-75	70/-70	85	195	290

Medium Reported Braking Action

MAX MANUAL	1815	115/-120	55/75	-95/335	85/-65	50/-50	65	190	450
AUTOBRAKE MAX	1850	120/-125	55/75	-95/340	80/-60	50/-50	75	190	455
AUTOBRAKE 3	1925	120/-125	55/75	-95/345	65/-45	55/-55	95	140	410
AUTOBRAKE 2	2245	140/-155	70/90	-110/390	65/-60	65/-65	95	105	225
AUTOBRAKE 1	2430	165/-180	80/105	-120/420	85/-80	70/-75	85	210	350

Poor Reported Braking Action

MAX MANUAL	2365	165/-170	80/110	-140/530	205/-135	65/-70	75	400	1045
AUTOBRAKE MAX	2370	165/-170	80/110	-140/530	205/-135	65/-70	80	400	1050
AUTOBRAKE 3	2385	170/-170	80/110	-140/535	200/-125	65/-70	85	400	1055
AUTOBRAKE 2	2525	175/-180	85/115	-145/550	190/-125	70/-75	90	335	925
AUTOBRAKE 1	2630	185/-190	85/120	-150/565	195/-135	75/-80	85	380	930

Reference distance is based on sea level, standard day, no wind or slope, VREF30, two-engine detent No. 2 reverse thrust, and auto speedbrakes.
For max manual braking and manual speedbrakes, increase reference landing distance by 60 m.
For autobrake and manual speedbrakes, increase reference landing distance by 55 m.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Actual (unfactored) distances are shown.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Normal Configuration Landing Distance

Flaps 40

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	65000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 65000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF40	ONE REV	NO REV

Dry Runway

MAX MANUAL	915	55/-50	20/25	-35/115	10/-10	20/-20	35	15	35
AUTOBRAKE MAX	1135	55/-60	25/35	-40/140	0/0	25/-25	55	0	0
AUTOBRAKE 3	1590	85/-100	40/55	-70/235	0/0	45/-45	90	0	0
AUTOBRAKE 2	2030	125/-140	60/80	-95/330	20/-35	60/-60	95	35	35
AUTOBRAKE 1	2260	150/-165	75/95	-115/390	55/-65	65/-65	85	155	220

Good Reported Braking Action

MAX MANUAL	1270	70/-75	35/45	-55/200	35/-30	30/-30	50	65	140
AUTOBRAKE MAX	1350	75/-80	35/45	-60/205	30/-25	35/-35	60	70	150
AUTOBRAKE 3	1600	85/-100	40/55	-70/240	10/-5	45/-45	95	5	15
AUTOBRAKE 2	2030	125/-140	60/80	-95/330	20/-35	60/-60	95	35	35
AUTOBRAKE 1	2260	150/-165	75/95	-115/390	55/-65	65/-65	85	155	220

Medium Reported Braking Action

MAX MANUAL	1730	105/-115	50/70	-90/330	85/-65	45/-45	65	170	405
AUTOBRAKE MAX	1750	110/-120	55/70	-90/335	75/-60	45/-50	75	170	405
AUTOBRAKE 3	1800	110/-120	55/70	-95/340	70/-45	50/-50	90	150	390
AUTOBRAKE 2	2090	130/-145	60/85	-105/375	55/-55	60/-60	95	75	190
AUTOBRAKE 1	2275	150/-165	75/95	-115/405	80/-75	65/-65	85	170	275

Poor Reported Braking Action

MAX MANUAL	2245	155/-160	75/100	-140/520	200/-130	60/-65	75	360	930
AUTOBRAKE MAX	2250	155/-160	75/105	-140/520	200/-130	60/-65	75	360	930
AUTOBRAKE 3	2260	155/-165	75/105	-140/525	195/-125	60/-65	85	360	935
AUTOBRAKE 2	2370	160/-165	75/105	-140/535	185/-120	65/-70	90	290	830
AUTOBRAKE 1	2470	170/-180	80/110	-145/550	190/-130	70/-75	85	335	815

Reference distance is based on sea level, standard day, no wind or slope, VREF40, two-engine detent No. 2 reverse thrust, and auto speedbrakes.
For max manual braking and manual speedbrakes, increase reference landing distance by 55 m.
For autobrake and manual speedbrakes, increase reference landing distance by 45 m.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Actual (unfactored) distances are shown.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

Airspeed Unreliable (Flaps 15)

VREF15

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	65000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 65000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV
Dry Runway									
MAX MANUAL	1075	80/-65	25/35	-40/130	15/-10	25/-25	N/A	30	60
AUTOBRAKE MAX	1435	70/-80	35/45	-50/165	5/-5	35/-35	N/A	0	5
AUTOBRAKE 2	2550	165/-180	85/110	-110/370	50/-55	75/-75	N/A	165	180
Good Reported Braking Action									
MAX MANUAL	1475	80/-85	40/55	-60/215	35/-30	40/-40	N/A	90	205
AUTOBRAKE MAX	1600	85/-95	45/60	-65/225	30/-25	40/-40	N/A	100	230
AUTOBRAKE 2	2550	165/-180	85/110	-110/370	55/-55	75/-75	N/A	165	180
Medium Reported Braking Action									
MAX MANUAL	2025	130/-135	65/85	-100/350	90/-70	55/-55	N/A	240	595
AUTOBRAKE MAX	2080	130/-140	65/90	-100/355	85/-65	55/-60	N/A	245	605
AUTOBRAKE 3	2255	135/-145	70/90	-105/370	60/-45	65/-65	N/A	145	460
Poor Reported Braking Action									
MAX MANUAL	2635	185/-190	90/125	-145/550	210/-140	75/-80	N/A	505	1385
AUTOBRAKE MAX	2635	185/-190	90/125	-145/550	210/-135	75/-80	N/A	500	1380
AUTOBRAKE 3	2685	185/-190	90/125	-150/555	195/-125	75/-80	N/A	485	1375

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Actual (unfactored) distances are shown.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

Airspeed Unreliable (Flaps 30)

VREF30

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	65000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 65000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV
Dry Runway									
MAX MANUAL	1025	60/-60	25/30	-35/125	15/-10	25/-25	N/A	25	55
AUTOBRAKE MAX	1335	60/-70	30/40	-45/155	5/-5	30/-35	N/A	0	5
AUTOBRAKE 2	2345	150/-160	75/95	-105/355	45/-50	70/-70	N/A	140	160
Good Reported Braking Action									
MAX MANUAL	1415	75/-80	40/50	-60/210	35/-30	35/-35	N/A	80	185
AUTOBRAKE MAX	1525	80/-90	40/55	-65/220	30/-30	40/-40	N/A	90	205
AUTOBRAKE 2	2345	150/-160	75/95	-105/355	45/-50	70/-70	N/A	140	160
Medium Reported Braking Action									
MAX MANUAL	1915	120/-125	60/80	-95/340	85/-70	50/-55	N/A	215	520
AUTOBRAKE MAX	1965	120/-130	60/80	-95/345	80/-65	55/-55	N/A	215	530
AUTOBRAKE 3	2100	120/-135	60/85	-100/360	60/-50	60/-60	N/A	135	420
Poor Reported Braking Action									
MAX MANUAL	2460	170/-170	85/115	-140/535	200/-130	65/-70	N/A	435	1165
AUTOBRAKE MAX	2470	170/-175	85/115	-140/535	200/-125	70/-75	N/A	430	1160
AUTOBRAKE 3	2510	170/-175	85/115	-145/540	190/-125	70/-75	N/A	425	1165

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Actual (unfactored) distances are shown.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

Airspeed Unreliable (Flaps 40)

VREF40

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	65000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 65000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV
Dry Runway									
MAX MANUAL	985	55/-55	20/30	-35/120	15/-10	20/-20	N/A	20	45
AUTOBRAKE MAX	1245	55/-65	30/35	-45/150	5/0	30/-30	N/A	0	0
AUTOBRAKE 2	2195	135/-150	70/90	-100/340	40/-45	65/-65	N/A	105	110
Good Reported Braking Action									
MAX MANUAL	1360	70/-80	35/50	-60/205	35/-30	35/-35	N/A	75	170
AUTOBRAKE MAX	1455	75/-85	40/50	-60/215	30/-25	35/-35	N/A	85	185
AUTOBRAKE 2	2195	135/-150	70/90	-100/340	40/-45	65/-65	N/A	105	110
Medium Reported Braking Action									
MAX MANUAL	1830	110/-120	55/75	-95/335	85/-65	50/-50	N/A	195	465
AUTOBRAKE MAX	1870	115/-125	60/80	-95/340	80/-60	50/-50	N/A	195	475
AUTOBRAKE 3	1965	115/-125	60/80	-100/350	60/-50	55/-55	N/A	135	405
Poor Reported Braking Action									
MAX MANUAL	2345	160/-165	80/110	-140/525	195/-130	65/-70	N/A	395	1035
AUTOBRAKE MAX	2355	160/-165	80/110	-140/525	195/-125	65/-70	N/A	390	1035
AUTOBRAKE 3	2380	160/-165	80/110	-140/530	190/-125	65/-70	N/A	395	1045

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Actual (unfactored) distances are shown.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

All Flaps Up Landing

VREF40 + 55

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	65000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 65000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV
Dry Runway									
MAX MANUAL	1330	185/-85	50/105	-45/205	20/-15	35/-35	45	45	95
AUTOBRAKE MAX	1855	85/-90	45/70	-60/195	5/-5	50/-50	75	5	20
AUTOBRAKE 2	3360	195/-225	115/150	-130/430	75/-85	105/-105	100	280	330
Good Reported Braking Action									
MAX MANUAL	1755	85/-95	50/65	-65/230	40/-35	45/-50	45	110	255
AUTOBRAKE MAX	2000	90/-100	55/75	-75/245	30/-25	55/-55	70	85	225
AUTOBRAKE 2	3360	195/-225	115/150	-130/430	75/-85	105/-105	100	280	330
Medium Reported Braking Action									
MAX MANUAL	2495	145/-155	80/110	-110/385	105/-85	70/-75	65	315	775
AUTOBRAKE MAX	2580	150/-160	85/115	-110/390	100/-80	75/-75	75	325	800
AUTOBRAKE 3	2950	145/-170	90/120	-120/420	65/-60	90/-90	110	165	510
Poor Reported Braking Action									
MAX MANUAL	3320	220/-225	120/165	-165/605	250/-170	95/-100	80	690	1915
AUTOBRAKE MAX	3325	215/-225	120/165	-165/605	245/-160	100/-100	90	685	1905
AUTOBRAKE 3	3445	210/-225	120/165	-170/615	220/-150	100/-105	110	600	1840

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Actual (unfactored) distances are shown.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance
ANTISKID INOPERATIVE (Flaps 15)
VREF15

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	65000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 65000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV
Dry Runway									
MAX MANUAL	1795	105/-110	50/65	-80/290	55/-45	45/-45	60	145	345
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								
Good Reported Braking Action									
MAX MANUAL	2015	125/-130	60/80	-100/350	85/-65	50/-55	70	215	530
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								
Medium Reported Braking Action									
MAX MANUAL	2585	180/-180	85/120	-145/545	200/-135	70/-75	80	460	1280
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								
Poor Reported Braking Action									
MAX MANUAL	3450	260/-260	120/175	-245/1005	625/-305	85/-105	95	1100	3915
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Actual (unfactored) distances are shown.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

ANTISKID INOPERATIVE (Flaps 30)

VREF30

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	65000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 65000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	1695	95/-105	45/60	-80/280	55/-45	40/-45	60	125	300
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Good Reported Braking Action

MAX MANUAL	1895	115/-120	55/75	-95/340	80/-65	50/-50	65	185	455
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Medium Reported Braking Action

MAX MANUAL	2415	165/-165	80/105	-140/530	190/-125	65/-70	80	395	1075
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Poor Reported Braking Action

MAX MANUAL	3205	235/-235	110/155	-235/980	590/-285	75/-100	90	945	3215
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Actual (unfactored) distances are shown.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

ANTISKID INOPERATIVE (Flaps 40)

VREF40

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	65000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 65000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV
Dry Runway									
MAX MANUAL	1615	90/-100	45/60	-80/275	55/-45	40/-40	60	115	265
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								
Good Reported Braking Action									
MAX MANUAL	1805	105/-115	50/70	-95/335	80/-60	45/-45	65	170	405
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								
Medium Reported Braking Action									
MAX MANUAL	2290	150/-155	70/100	-140/520	185/-120	60/-65	80	355	950
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								
Poor Reported Braking Action									
MAX MANUAL	3040	220/-225	100/145	-230/960	575/-275	70/-95	85	860	2860
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Actual (unfactored) distances are shown.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance
Jammed or Restricted Flight Controls (Flaps 15)
VREF15

BRAKING CONFIGURATION	REF DIST 65000 KG LANDING WEIGHT	WT ADJ PER 5000 KG ABV/BLW 65000 KG	ALT ADJ PER 1000 FT STD/HIGH*	WIND ADJ PER 10 KTS HEAD/ TAIL WIND	SLOPE ADJ PER 1% DOWN/ UP HILL	TEMP ADJ PER 10°C ABV/ BLW ISA	APP SPD ADJ PER 5 KTS ABOVE VREF	REVERSE THRUST ADJ ONE REV	REVERSE THRUST ADJ NO REV
Dry Runway									
MAX MANUAL	1005	70/-60	25/30	-35/125	10/-10	20/-25	35	25	50
AUTOBRAKE MAX	1310	65/-75	30/40	-45/155	5/-5	30/-30	65	0	5
AUTOBRAKE 2	2360	155/-170	75/100	-105/355	35/-50	70/-70	95	100	100
Good Reported Braking Action									
MAX MANUAL	1380	75/-80	35/50	-60/205	35/-30	35/-35	50	80	185
AUTOBRAKE MAX	1485	85/-90	40/55	-60/215	30/-25	35/-35	55	90	205
AUTOBRAKE 2	2360	155/-170	75/100	-105/355	35/-50	70/-70	95	100	100
Medium Reported Braking Action									
MAX MANUAL	1900	125/-130	60/80	-95/340	85/-65	50/-55	65	225	550
AUTOBRAKE MAX	1935	125/-130	60/80	-95/345	80/-65	50/-55	75	225	555
AUTOBRAKE 3	2055	125/-135	60/85	-100/355	60/-40	55/-60	100	145	465
Poor Reported Braking Action									
MAX MANUAL	2480	180/-180	85/120	-145/540	205/-135	70/-75	75	475	1310
AUTOBRAKE MAX	2480	180/-180	85/120	-145/540	205/-135	70/-75	80	475	1305
AUTOBRAKE 3	2500	180/-180	85/120	-145/540	200/-120	70/-75	95	475	1310

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Actual (unfactored) distances are shown.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

LEADING EDGE FLAPS TRANSIT (Flaps 15)

VREF15 + 15

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	65000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 65000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV
Dry Runway									
MAX MANUAL	1130	80/-70	25/35	-40/135	15/-15	25/-25	35	30	70
AUTOBRAKE MAX	1500	70/-80	35/45	-50/170	5/-5	40/-40	65	0	5
AUTOBRAKE 2	2725	175/-190	90/115	-115/385	50/-60	85/-85	100	155	160
Good Reported Braking Action									
MAX MANUAL	1570	85/-95	45/60	-65/220	40/-35	40/-40	50	105	240
AUTOBRAKE MAX	1690	90/-100	45/60	-65/230	35/-30	45/-45	60	115	260
AUTOBRAKE 2	2730	175/-190	90/115	-115/385	50/-60	85/-85	100	160	160
Medium Reported Braking Action									
MAX MANUAL	2170	140/-145	70/95	-100/365	95/-75	60/-60	70	275	695
AUTOBRAKE MAX	2210	140/-150	70/95	-105/365	90/-70	60/-65	75	280	700
AUTOBRAKE 3	2375	140/-150	75/100	-110/380	65/-45	70/-70	110	175	570
Poor Reported Braking Action									
MAX MANUAL	2825	200/-205	100/140	-155/570	225/-150	80/-85	80	580	1620
AUTOBRAKE MAX	2825	200/-205	100/140	-155/570	230/-155	80/-85	85	575	1615
AUTOBRAKE 3	2855	200/-200	100/140	-155/570	215/-130	80/-85	100	565	1615

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Actual (unfactored) distances are shown.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance
LOSS OF SYSTEM A (Flaps 15)
VREF15

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	65000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 65000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	1120	70/-65	25/35	-40/135	15/-15	25/-25	45	35	60
AUTOBRAKE MAX	1300	65/-75	30/40	-45/155	0/0	30/-30	60	0	10
AUTOBRAKE 2	2465	150/-175	75/95	-110/365	0/-10	75/-75	140	0	0

Good Reported Braking Action

MAX MANUAL	1620	95/-100	45/60	-70/235	50/-40	40/-45	70	135	275
AUTOBRAKE MAX	1630	95/-105	45/65	-70/235	40/-35	45/-45	75	135	275
AUTOBRAKE 2	2465	150/-175	75/95	-110/365	0/-10	75/-75	140	0	0

Medium Reported Braking Action

MAX MANUAL	2235	150/-155	75/100	-110/380	115/-90	60/-65	90	350	840
AUTOBRAKE MAX	2220	150/-155	75/100	-105/380	120/-95	60/-65	90	345	830
AUTOBRAKE 3	2220	150/-155	75/100	-105/380	120/-85	60/-65	90	345	830

Poor Reported Braking Action

MAX MANUAL	2905	215/-215	105/145	-160/590	265/-175	80/-85	105	710	2025
AUTOBRAKE MAX	2900	215/-215	105/150	-160/590	265/-180	80/-85	105	710	2025
AUTOBRAKE 3	2900	215/-215	105/150	-160/590	265/-180	80/-85	105	710	2025

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Actual (unfactored) distances are shown.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

LOSS OF SYSTEM A (Flaps 30)

VREF30

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	65000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 65000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV
Dry Runway									
MAX MANUAL	1060	65/-55	25/35	-40/130	15/-15	25/-25	45	30	50
AUTOBRAKE MAX	1215	60/-65	30/35	-45/145	0/0	30/-30	55	10	15
AUTOBRAKE 2	2260	135/-155	65/85	-105/350	0/-10	70/-70	135	0	0
Good Reported Braking Action									
MAX MANUAL	1535	85/-95	45/60	-65/225	45/-40	40/-40	70	120	240
AUTOBRAKE MAX	1550	90/-95	45/60	-65/230	40/-35	40/-40	75	120	240
AUTOBRAKE 2	2260	135/-155	65/85	-105/350	0/-10	70/-70	135	0	0
Medium Reported Braking Action									
MAX MANUAL	2090	135/-140	65/90	-105/370	110/-85	55/-60	85	305	710
AUTOBRAKE MAX	2085	135/-140	70/90	-105/370	115/-90	55/-60	90	300	705
AUTOBRAKE 3	2085	135/-140	70/90	-105/370	115/-80	55/-60	90	300	705
Poor Reported Braking Action									
MAX MANUAL	2695	195/-195	95/130	-155/570	250/-165	75/-80	100	605	1650
AUTOBRAKE MAX	2695	195/-195	95/135	-155/570	250/-165	75/-80	100	605	1650
AUTOBRAKE 3	2695	195/-195	95/135	-155/570	250/-165	75/-80	100	605	1650

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Actual (unfactored) distances are shown.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance
LOSS OF SYSTEM A (Flaps 40)
VREF40

BRAKING CONFIGURATION	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
	65000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 65000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	1015	60/-55	25/30	-35/125	15/-15	25/-25	50	30	45
AUTOBRAKE MAX	1140	55/-60	25/35	-40/140	5/0	25/-25	55	10	20
AUTOBRAKE 2	2075	125/-140	60/80	-100/335	0/-5	60/-60	130	0	0

Good Reported Braking Action

MAX MANUAL	1460	80/-90	40/55	-65/225	45/-40	35/-40	70	105	210
AUTOBRAKE MAX	1470	85/-90	40/55	-65/225	40/-35	40/-40	75	105	210
AUTOBRAKE 2	2075	125/-140	60/80	-100/335	0/-5	60/-60	130	0	0

Medium Reported Braking Action

MAX MANUAL	1970	125/-135	60/85	-100/360	105/-85	55/-55	85	265	615
AUTOBRAKE MAX	1970	125/-135	60/85	-100/360	110/-85	55/-55	85	265	615
AUTOBRAKE 3	1970	125/-135	60/85	-100/360	110/-80	55/-55	90	265	615

Poor Reported Braking Action

MAX MANUAL	2525	180/-185	85/120	-150/560	240/-155	70/-75	95	525	1400
AUTOBRAKE MAX	2530	180/-185	90/125	-150/560	245/-160	70/-75	95	530	1405
AUTOBRAKE 3	2530	180/-185	90/125	-150/560	245/-160	70/-75	95	530	1405

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Actual (unfactored) distances are shown.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

LOSS OF SYSTEM A AND SYSTEM B (Flaps 15)

VREF15

BRAKING CONFIGURATION	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
	65000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 65000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	1570	80/-90	40/50	-60/195	35/-35	40/-40	75	-10	65
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Good Reported Braking Action

MAX MANUAL	2290	135/-145	65/90	-100/335	100/-80	60/-60	105	95	440
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Medium Reported Braking Action

MAX MANUAL	3035	200/-210	100/140	-150/525	215/-160	80/-85	120	365	1415
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Poor Reported Braking Action

MAX MANUAL	3770	275/-275	135/190	-210/785	475/-270	100/-110	130	815	3380
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Actual (unfactored) distances are shown.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance
LOSS OF SYSTEM B (Flaps 15)
VREF15

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	65000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 65000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	1140	55/-60	25/35	-45/145	20/-15	25/-25	40	40	70
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Good Reported Braking Action

MAX MANUAL	1630	95/-100	45/65	-75/255	50/-45	45/-45	60	140	285
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Medium Reported Braking Action

MAX MANUAL	2215	150/-155	70/100	-115/410	125/-95	60/-65	75	340	815
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Poor Reported Braking Action

MAX MANUAL	2835	210/-210	100/140	-170/640	295/-180	75/-85	90	665	1870
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Actual (unfactored) distances are shown.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

MANUAL REVERSION (Flaps 15)

VREF15

BRAKING CONFIGURATION	REF DIST 65000 KG LANDING WEIGHT	WT ADJ PER 5000 KG ABV/BLW 65000 KG	ALT ADJ PER 1000 FT STD/HIGH*	WIND ADJ PER 10 KTS HEAD/ TAIL WIND	SLOPE ADJ PER 1% DOWN/ UP HILL	TEMP ADJ PER 10°C ABV/ BLW ISA	APP SPD ADJ PER 5 KTS ABOVE VREF	REVERSE THRUST ADJ ONE REV	REVERSE THRUST ADJ NO REV
Dry Runway									
MAX MANUAL	1570	80/-90	40/50	-60/195	35/-35	40/-40	75	-10	65
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								
Good Reported Braking Action									
MAX MANUAL	2290	135/-145	65/90	-100/335	100/-80	60/-60	105	95	440
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								
Medium Reported Braking Action									
MAX MANUAL	3035	200/-210	100/140	-150/525	215/-160	80/-85	120	365	1415
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								
Poor Reported Braking Action									
MAX MANUAL	3770	275/-275	135/190	-210/785	475/-270	100/-110	130	815	3380
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Actual (unfactored) distances are shown.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

One Engine Inoperative Landing (Flaps 15)

VREF15

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	65000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 65000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	1020	75/-65	25/30	-35/130	15/-10	25/-25	35	0	25
AUTOBRAKE MAX	1300	70/-75	30/40	-45/155	0/0	30/-30	60	0	0
AUTOBRAKE 2	2450	150/-170	75/95	-110/365	10/-25	75/-75	120	0	0

Good Reported Braking Action

MAX MANUAL	1440	80/-85	40/50	-65/215	40/-35	40/-40	50	0	100
AUTOBRAKE MAX	1545	85/-95	40/55	-65/225	35/-30	40/-40	60	0	110
AUTOBRAKE 2	2450	150/-170	75/95	-110/365	10/-25	75/-75	120	0	0

Medium Reported Braking Action

MAX MANUAL	2075	135/-140	65/85	-105/370	110/-85	60/-60	70	0	310
AUTOBRAKE MAX	2115	135/-145	65/85	-105/375	105/-80	60/-60	80	0	315
AUTOBRAKE 3	2165	135/-150	65/85	-105/380	90/-65	60/-65	100	0	295

Poor Reported Braking Action

MAX MANUAL	2850	200/-210	95/130	-165/605	290/-185	85/-85	90	0	765
AUTOBRAKE MAX	2850	200/-210	95/130	-165/605	290/-185	85/-85	95	0	765
AUTOBRAKE 3	2875	205/-210	95/130	-165/610	280/-180	85/-85	100	0	775

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Actual (unfactored) distances are shown.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

One Engine Inoperative Landing (Flaps 30)

VREF30

BRAKING CONFIGURATION	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
	65000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 65000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV
Dry Runway									
MAX MANUAL	970	60/-55	20/30	-35/125	15/-10	20/-20	35	0	25
AUTOBRAKE MAX	1215	60/-65	30/35	-45/150	0/0	30/-30	55	0	0
AUTOBRAKE 2	2240	135/-150	65/85	-105/350	10/-25	65/-65	110	0	0
Good Reported Braking Action									
MAX MANUAL	1370	75/-80	35/50	-60/210	35/-30	35/-35	50	0	90
AUTOBRAKE MAX	1465	80/-90	40/50	-65/220	35/-30	35/-40	60	0	100
AUTOBRAKE 2	2240	135/-150	65/85	-105/350	10/-25	65/-65	110	0	0
Medium Reported Braking Action									
MAX MANUAL	1940	120/-130	60/80	-100/360	105/-80	55/-55	70	0	265
AUTOBRAKE MAX	1975	125/-135	60/80	-100/365	95/-75	55/-55	80	0	270
AUTOBRAKE 3	2015	125/-135	60/80	-105/365	90/-65	55/-60	90	0	260
Poor Reported Braking Action									
MAX MANUAL	2625	180/-190	85/115	-155/585	265/-170	75/-80	85	0	635
AUTOBRAKE MAX	2625	180/-190	85/115	-155/585	270/-165	75/-80	90	0	635
AUTOBRAKE 3	2655	185/-190	90/120	-160/585	260/-170	75/-80	90	0	640

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Actual (unfactored) distances are shown.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance
Stabilizer Trim Inoperative (Flaps 15)
VREF15

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	65000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 65000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	1005	70/-60	25/30	-35/125	10/-10	20/-25	35	25	50
AUTOBRAKE MAX	1310	65/-75	30/40	-45/155	5/-5	30/-30	65	0	5
AUTOBRAKE 2	2360	155/-170	75/100	-105/355	35/-50	70/-70	95	100	100

Good Reported Braking Action

MAX MANUAL	1380	75/-80	35/50	-60/205	35/-30	35/-35	50	80	185
AUTOBRAKE MAX	1485	85/-90	40/55	-60/215	30/-25	35/-35	55	90	205
AUTOBRAKE 2	2360	155/-170	75/100	-105/355	35/-50	70/-70	95	100	100

Medium Reported Braking Action

MAX MANUAL	1900	125/-130	60/80	-95/340	85/-65	50/-55	65	225	550
AUTOBRAKE MAX	1935	125/-130	60/80	-95/345	80/-65	50/-55	75	225	555
AUTOBRAKE 3	2055	125/-135	60/85	-100/355	60/-40	55/-60	100	145	465

Poor Reported Braking Action

MAX MANUAL	2480	180/-180	85/120	-145/540	205/-135	70/-75	75	475	1310
AUTOBRAKE MAX	2480	180/-180	85/120	-145/540	205/-135	70/-75	80	475	1305
AUTOBRAKE 3	2500	180/-180	85/120	-145/540	200/-120	70/-75	95	475	1310

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Actual (unfactored) distances are shown.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

Trailing Edge Flap Asymmetry (1 ≤ Flap Lever <15)

VREF40 + 30

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	65000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 65000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV
Dry Runway									
MAX MANUAL	1110	90/-65	25/40	-40/135	15/-15	25/-25	35	30	60
AUTOBRAKE MAX	1510	70/-75	35/45	-50/170	5/-5	40/-40	65	0	5
AUTOBRAKE 2	2730	165/-185	90/115	-115/385	55/-60	85/-85	100	165	175
Good Reported Braking Action									
MAX MANUAL	1525	80/-85	40/55	-60/215	35/-30	40/-40	45	90	210
AUTOBRAKE MAX	1665	80/-90	45/60	-65/225	30/-25	45/-45	65	95	225
AUTOBRAKE 2	2735	160/-185	90/115	-115/385	55/-65	85/-85	95	165	175
Medium Reported Braking Action									
MAX MANUAL	2125	125/-135	70/90	-100/360	90/-75	60/-60	65	255	625
AUTOBRAKE MAX	2180	130/-140	70/95	-100/360	85/-70	60/-60	75	260	640
AUTOBRAKE 3	2385	125/-140	70/95	-110/380	60/-45	70/-70	110	150	470
Poor Reported Braking Action									
MAX MANUAL	2795	190/-195	100/135	-150/565	220/-150	80/-85	80	545	1510
AUTOBRAKE MAX	2790	185/-195	100/135	-150/565	220/-145	80/-85	85	540	1500
AUTOBRAKE 3	2845	185/-190	100/135	-155/570	205/-130	80/-85	105	525	1495

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Actual (unfactored) distances are shown.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

Trailing Edge Flap Asymmetry (Flap Lever 15 or 25)

VREF15

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	65000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 65000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	1005	70/-60	25/30	-35/125	10/-10	20/-25	35	25	50
AUTOBRAKE MAX	1310	65/-75	30/40	-45/155	5/-5	30/-30	65	0	5
AUTOBRAKE 2	2360	155/-170	75/100	-105/355	35/-50	70/-70	95	100	100

Good Reported Braking Action

MAX MANUAL	1380	75/-80	35/50	-60/205	35/-30	35/-35	50	80	185
AUTOBRAKE MAX	1485	85/-90	40/55	-60/215	30/-25	35/-35	55	90	205
AUTOBRAKE 2	2360	155/-170	75/100	-105/355	35/-50	70/-70	95	100	100

Medium Reported Braking Action

MAX MANUAL	1900	125/-130	60/80	-95/340	85/-65	50/-55	65	225	550
AUTOBRAKE MAX	1935	125/-130	60/80	-95/345	80/-65	50/-55	75	225	555
AUTOBRAKE 3	2055	125/-135	60/85	-100/355	60/-40	55/-60	100	145	465

Poor Reported Braking Action

MAX MANUAL	2480	180/-180	85/120	-145/540	205/-135	70/-75	75	475	1310
AUTOBRAKE MAX	2480	180/-180	85/120	-145/540	205/-135	70/-75	80	475	1305
AUTOBRAKE 3	2500	180/-180	85/120	-145/540	200/-120	70/-75	95	475	1310

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Actual (unfactored) distances are shown.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance
Trailing Edge Flap Asymmetry (Flap Lever 30)
VREF30

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	65000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 65000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV
Dry Runway									
MAX MANUAL	960	55/-55	20/30	-35/120	10/-10	20/-20	35	20	45
AUTOBRAKE MAX	1215	60/-65	30/35	-45/150	5/0	30/-30	60	0	5
AUTOBRAKE 2	2165	140/-150	65/90	-100/340	30/-45	65/-65	90	85	85
Good Reported Braking Action									
MAX MANUAL	1315	70/-75	35/45	-60/200	30/-30	35/-35	50	75	165
AUTOBRAKE MAX	1410	75/-85	35/50	-60/210	30/-25	35/-35	60	80	185
AUTOBRAKE 2	2165	140/-150	65/90	-100/340	35/-45	65/-65	90	85	85
Medium Reported Braking Action									
MAX MANUAL	1790	115/-120	55/75	-90/330	80/-65	50/-50	65	195	480
AUTOBRAKE MAX	1820	115/-120	55/75	-95/335	75/-60	50/-50	70	200	480
AUTOBRAKE 3	1910	115/-125	55/75	-95/345	60/-40	50/-55	95	140	425
Poor Reported Braking Action									
MAX MANUAL	2315	160/-165	80/105	-140/525	195/-125	60/-65	75	410	1100
AUTOBRAKE MAX	2320	165/-165	80/110	-140/525	195/-130	65/-70	75	410	1100
AUTOBRAKE 3	2335	165/-165	80/110	-140/525	190/-115	65/-70	90	410	1110

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Actual (unfactored) distances are shown.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance
Trailing Edge Flap Disagree (1 ≤ Indicated Flaps <15)
VREF40 + 30

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	65000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 65000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	1110	90/-65	25/40	-40/135	15/-15	25/-25	35	30	60
AUTOBRAKE MAX	1510	70/-75	35/45	-50/170	5/-5	40/-40	65	0	5
AUTOBRAKE 2	2730	165/-185	90/115	-115/385	55/-60	85/-85	100	165	175

Good Reported Braking Action

MAX MANUAL	1525	80/-85	40/55	-60/215	35/-30	40/-40	45	90	210
AUTOBRAKE MAX	1665	80/-90	45/60	-65/225	30/-25	45/-45	65	95	225
AUTOBRAKE 2	2735	160/-185	90/115	-115/385	55/-65	85/-85	95	165	175

Medium Reported Braking Action

MAX MANUAL	2125	125/-135	70/90	-100/360	90/-75	60/-60	65	255	625
AUTOBRAKE MAX	2180	130/-140	70/95	-100/360	85/-70	60/-60	75	260	640
AUTOBRAKE 3	2385	125/-140	70/95	-110/380	60/-45	70/-70	110	150	470

Poor Reported Braking Action

MAX MANUAL	2795	190/-195	100/135	-150/565	220/-150	80/-85	80	545	1510
AUTOBRAKE MAX	2790	185/-195	100/135	-150/565	220/-145	80/-85	85	540	1500
AUTOBRAKE 3	2845	185/-190	100/135	-155/570	205/-130	80/-85	105	525	1495

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Actual (unfactored) distances are shown.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

Trailing Edge Flap Disagree (15 ≤ Indicated Flaps <30)

VREF15

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	65000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 65000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV
Dry Runway									
MAX MANUAL	1005	70/-60	25/30	-35/125	10/-10	20/-25	35	25	50
AUTOBRAKE MAX	1310	65/-75	30/40	-45/155	5/-5	30/-30	65	0	5
AUTOBRAKE 2	2360	155/-170	75/100	-105/355	35/-50	70/-70	95	100	100
Good Reported Braking Action									
MAX MANUAL	1380	75/-80	35/50	-60/205	35/-30	35/-35	50	80	185
AUTOBRAKE MAX	1485	85/-90	40/55	-60/215	30/-25	35/-35	55	90	205
AUTOBRAKE 2	2360	155/-170	75/100	-105/355	35/-50	70/-70	95	100	100
Medium Reported Braking Action									
MAX MANUAL	1900	125/-130	60/80	-95/340	85/-65	50/-55	65	225	550
AUTOBRAKE MAX	1935	125/-130	60/80	-95/345	80/-65	50/-55	75	225	555
AUTOBRAKE 3	2055	125/-135	60/85	-100/355	60/-40	55/-60	100	145	465
Poor Reported Braking Action									
MAX MANUAL	2480	180/-180	85/120	-145/540	205/-135	70/-75	75	475	1310
AUTOBRAKE MAX	2480	180/-180	85/120	-145/540	205/-135	70/-75	80	475	1305
AUTOBRAKE 3	2500	180/-180	85/120	-145/540	200/-120	70/-75	95	475	1310

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Actual (unfactored) distances are shown.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

Trailing Edge Flap Disagree (30 ≤ Indicated Flaps <40)

VREF30

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	65000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 65000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	960	55/-55	20/30	-35/120	10/-10	20/-20	35	20	45
AUTOBRAKE MAX	1215	60/-65	30/35	-45/150	5/0	30/-30	60	0	5
AUTOBRAKE 2	2165	140/-150	65/90	-100/340	30/-45	65/-65	90	85	85

Good Reported Braking Action

MAX MANUAL	1315	70/-75	35/45	-60/200	30/-30	35/-35	50	75	165
AUTOBRAKE MAX	1410	75/-85	35/50	-60/210	30/-25	35/-35	60	80	185
AUTOBRAKE 2	2165	140/-150	65/90	-100/340	35/-45	65/-65	90	85	85

Medium Reported Braking Action

MAX MANUAL	1790	115/-120	55/75	-90/330	80/-65	50/-50	65	195	480
AUTOBRAKE MAX	1820	115/-120	55/75	-95/335	75/-60	50/-50	70	200	480
AUTOBRAKE 3	1910	115/-125	55/75	-95/345	60/-40	50/-55	95	140	425

Poor Reported Braking Action

MAX MANUAL	2315	160/-165	80/105	-140/525	195/-125	60/-65	75	410	1100
AUTOBRAKE MAX	2320	165/-165	80/110	-140/525	195/-130	65/-70	75	410	1100
AUTOBRAKE 3	2335	165/-165	80/110	-140/525	190/-115	65/-70	90	410	1110

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Actual (unfactored) distances are shown.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

Trailing Edge Flaps Up Landing

VREF40 + 40

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	65000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 65000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV
Dry Runway									
MAX MANUAL	1185	110/-70	30/70	-40/140	15/-15	30/-30	45	30	70
AUTOBRAKE MAX	1645	75/-80	40/55	-55/180	5/-5	40/-45	70	5	10
AUTOBRAKE 2	2970	175/-195	100/130	-120/400	65/-70	90/-90	95	205	235
Good Reported Braking Action									
MAX MANUAL	1600	80/-90	45/60	-65/220	35/-30	40/-45	45	90	205
AUTOBRAKE MAX	1795	85/-95	50/65	-70/235	25/-25	45/-50	65	80	200
AUTOBRAKE 2	2970	175/-195	100/130	-120/400	65/-70	90/-90	95	205	235
Medium Reported Braking Action									
MAX MANUAL	2255	135/-140	70/95	-105/365	95/-75	65/-65	65	260	625
AUTOBRAKE MAX	2330	135/-145	75/100	-105/370	90/-75	65/-65	70	265	645
AUTOBRAKE 3	2605	135/-155	80/105	-115/395	60/-55	75/-80	105	145	435
Poor Reported Braking Action									
MAX MANUAL	2990	200/-205	105/145	-155/580	230/-155	85/-90	80	565	1530
AUTOBRAKE MAX	2995	195/-205	105/145	-155/580	230/-150	85/-90	90	560	1520
AUTOBRAKE 3	3080	190/-205	105/145	-160/585	210/-140	90/-95	100	520	1495

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Actual (unfactored) distances are shown.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Recommended Brake Cooling Schedule

Reference Brake Energy Per Brake (Millions of Foot Pounds)

		WIND CORRECTED BRAKES ON SPEED (KIAS)*																	
		80			100			120			140			160			180		
WEIGHT (1000 KG)	OAT (°C)	PRESSURE ALTITUDE (1000 FT)																	
		0	5	10	0	5	10	0	5	10	0	5	10	0	5	10	0	5	10
80	0	15.1	17.0	19.3	22.4	25.3	28.9	30.9	35.0	40.2	40.4	45.9	53.0	50.8	57.9	67.3	60.8	69.6	81.2
	10	15.6	17.6	20.0	23.1	26.1	29.8	31.9	36.2	41.5	41.8	47.5	54.8	52.5	59.9	69.5	62.8	71.9	83.9
	15	15.8	17.8	20.2	23.5	26.5	30.3	32.4	36.7	42.1	42.4	48.2	55.6	53.3	60.7	70.5	63.7	72.9	85.1
	20	16.0	18.1	20.5	23.8	26.9	30.7	32.8	37.2	42.7	42.9	48.8	56.3	54.0	61.5	71.4	64.6	73.9	86.2
	30	16.4	18.5	21.1	24.4	27.6	31.5	33.7	38.2	43.8	44.0	50.0	57.7	55.3	63.1	73.2	66.2	75.7	88.4
	40	16.6	18.7	21.3	24.7	27.9	31.9	34.1	38.7	44.4	44.7	50.9	58.8	56.3	64.3	74.8	67.5	77.4	90.5
	50	16.6	18.7	21.3	24.8	28.0	32.1	34.3	39.0	44.9	45.2	51.5	59.7	57.1	65.4	76.3	68.7	79.0	92.9
70	0	13.7	15.4	17.5	20.2	22.8	26.0	27.7	31.3	35.9	36.1	41.0	47.2	45.3	51.6	59.7	54.9	62.7	72.9
	10	14.2	15.9	18.1	20.8	23.5	26.8	28.6	32.4	37.1	37.3	42.3	48.7	46.8	53.3	61.6	56.7	64.8	75.4
	15	14.4	16.2	18.4	21.1	23.9	27.2	29.0	32.8	37.6	37.8	43.0	49.4	47.5	54.0	62.5	57.5	65.7	76.4
	20	14.6	16.4	18.6	21.4	24.2	27.6	29.4	33.3	38.1	38.4	43.5	50.1	48.1	54.8	63.4	58.3	66.5	77.4
	30	14.9	16.8	19.1	22.0	24.8	28.3	30.2	34.1	39.1	39.3	44.6	51.4	49.3	56.1	64.9	59.8	68.2	79.4
	40	15.1	17.0	19.3	22.2	25.1	28.6	30.5	34.6	39.6	39.9	45.3	52.2	50.1	57.1	66.2	60.9	69.6	81.2
	50	15.1	17.0	19.3	22.3	25.2	28.8	30.7	34.8	40.0	40.2	45.8	52.9	50.7	58.0	67.4	61.8	70.9	83.0
60	0	12.3	13.9	15.7	18.0	20.3	23.1	24.4	27.6	31.6	31.7	35.9	41.2	39.6	45.0	51.8	48.1	54.8	63.5
	10	12.7	14.3	16.3	18.5	20.9	23.8	25.2	28.5	32.6	32.7	37.1	42.6	40.9	46.5	53.6	49.7	56.6	65.6
	15	12.9	14.6	16.5	18.8	21.2	24.2	25.6	29.0	33.1	33.2	37.6	43.2	41.5	47.1	54.4	50.4	57.4	66.5
	20	13.1	14.8	16.7	19.1	21.5	24.5	26.0	29.4	33.5	33.6	38.1	43.8	42.0	47.8	55.1	51.1	58.2	67.4
	30	13.4	15.1	17.2	19.6	22.1	25.1	26.6	30.1	34.4	34.5	39.1	44.9	43.1	49.0	56.5	52.3	59.6	69.1
	40	13.6	15.3	17.3	19.8	22.3	25.4	26.9	30.5	34.9	35.0	39.7	45.6	43.8	49.8	57.5	53.2	60.7	70.5
	50	13.5	15.3	17.3	19.8	22.4	25.5	27.0	30.6	35.1	35.2	40.0	46.0	44.2	50.4	58.3	53.9	61.7	71.9
50	0	11.0	12.3	14.0	15.7	17.7	20.2	21.2	23.9	27.3	27.2	30.8	35.3	33.8	38.3	44.1	40.9	46.4	53.6
	10	11.3	12.7	14.4	16.3	18.3	20.8	21.9	24.7	28.2	28.1	31.8	36.5	34.9	39.6	45.5	42.2	48.0	55.4
	15	11.5	12.9	14.7	16.5	18.6	21.1	22.2	25.1	28.6	28.6	32.3	37.0	35.4	40.2	46.2	42.8	48.7	56.2
	20	11.6	13.1	14.9	16.7	18.9	21.4	22.5	25.4	29.0	28.9	32.8	37.5	35.9	40.7	46.8	43.4	49.3	56.9
	30	11.9	13.4	15.2	17.2	19.3	22.0	23.1	26.1	29.7	29.7	33.6	38.4	36.8	41.8	48.0	44.5	50.6	58.4
	40	12.1	13.6	15.4	17.3	19.5	22.2	23.4	26.4	30.1	30.1	34.0	39.0	37.4	42.4	48.8	45.2	51.4	59.4
	50	12.0	13.6	15.4	17.3	19.6	22.3	23.4	26.5	30.3	30.2	34.2	39.3	37.6	42.8	49.3	45.7	52.1	60.3
40	0	9.6	10.8	12.3	13.5	15.2	17.3	17.9	20.2	23.0	22.8	25.8	29.4	28.1	31.8	36.4	33.7	38.2	43.9
	10	10.0	11.2	12.7	14.0	15.8	17.9	18.5	20.9	23.8	23.6	26.6	30.4	29.0	32.8	37.6	34.8	39.5	45.4
	15	10.1	11.4	12.9	14.2	16.0	18.1	18.8	21.2	24.1	23.9	27.0	30.8	29.4	33.3	38.2	35.3	40.0	46.0
	20	10.2	11.5	13.1	14.4	16.2	18.4	19.1	21.5	24.5	24.2	27.4	31.3	29.8	33.8	38.7	35.8	40.6	46.6
	30	10.5	11.8	13.4	14.8	16.6	18.9	19.6	22.1	25.1	24.9	28.1	32.1	30.6	34.6	39.7	36.7	41.6	47.8
	40	10.6	11.9	13.5	14.9	16.8	19.1	19.8	22.3	25.4	25.2	28.4	32.5	31.0	35.1	40.2	37.2	42.2	48.6
	50	10.6	11.9	13.5	14.9	16.8	19.1	19.8	22.3	25.5	25.2	28.6	32.7	31.1	35.3	40.6	37.5	42.6	49.1

***To correct for wind, enter table with the brakes on speed minus one half the headwind or plus 1.5 times the tailwind. If ground speed is used for brakes on speed, ignore wind and enter table with sea level, 15°C.**

ADVISORY INFORMATION

Recommended Brake Cooling Schedule

Adjusted Brake Energy Per Brake (Millions of Foot Pounds)

No Reverse Thrust

		REFERENCE BRAKE ENERGY PER BRAKE (MILLIONS OF FOOT POUNDS)								
EVENT		10	20	30	40	50	60	70	80	90
RTO MAX MAN		10	20	30	40	50	60	70	80	90
LANDING	MAX MAN	7.8	16.3	25.3	34.7	44.7	55.0	65.7	76.6	87.9
	MAX AUTO	7.5	15.4	23.6	32.4	41.8	51.8	62.5	74.1	86.5
	AUTOBRAKE 3	7.3	14.7	22.3	30.2	38.6	47.6	57.4	68.1	80.0
	AUTOBRAKE 2	7.0	13.8	20.5	27.4	34.8	42.7	51.5	61.3	72.4
	AUTOBRAKE 1	6.7	13.1	19.2	25.3	31.8	38.8	46.6	55.4	65.5

Two Engine Detent Reverse Thrust

		REFERENCE BRAKE ENERGY PER BRAKE (MILLIONS OF FOOT POUNDS)								
EVENT		10	20	30	40	50	60	70	80	90
RTO MAX MAN		10	20	30	40	50	60	70	80	90
LANDING	MAX MAN	7.0	14.6	22.8	31.4	40.5	49.9	59.7	69.8	80.0
	MAX AUTO	5.8	12.3	19.5	27.2	35.6	44.5	53.9	63.7	74.1
	AUTOBRAKE 3	4.3	9.2	14.7	20.7	27.2	34.4	42.0	50.2	59.0
	AUTOBRAKE 2	2.5	5.6	9.1	13.1	17.8	23.0	28.8	35.2	42.3
	AUTOBRAKE 1	1.8	3.8	6.1	8.8	11.9	15.5	19.6	24.4	29.8

Cooling Time (Minutes) - Category C Steel Brakes

	EVENT ADJUSTED BRAKE ENERGY (MILLIONS OF FOOT POUNDS)								
	16 & BELOW	17	20	23	25	28	32	33 TO 48	49 & ABOVE
	BRAKE TEMPERATURE MONITOR SYSTEM INDICATION ON CDS								
	UP TO 2.4	2.6	3.1	3.5	3.9	4.4	4.9	5.0 TO 7.5	7.5 & ABOVE
INFLIGHT GEAR DOWN	NO SPECIAL PROCEDURE REQUIRED	1	2	3	4	5	6	CAUTION	FUSE PLUG MELT ZONE
GROUND		10	20	30	40	50	60		

Cooling Time (Minutes) - Category N Carbon Brakes

	EVENT ADJUSTED BRAKE ENERGY (MILLIONS OF FOOT POUNDS)								
	16 & BELOW	17	19	20.9	23.5	26.9	29.4	30 TO 41	41 & ABOVE
	BRAKE TEMPERATURE MONITOR SYSTEM INDICATION ON CDS								
	UP TO 2.5	2.6	3	3.3	3.8	4.5	4.9	5.0 TO 7.1	7.1 & ABOVE
INFLIGHT GEAR DOWN	NO SPECIAL PROCEDURE REQUIRED	1	4	5	6	7	7.6	CAUTION	FUSE PLUG MELT ZONE
GROUND		6.7	16.0	24.1	34.2	45.9	53.3		

Observe maximum quick turnaround limit.
Table shows energy per brake added by a single stop with all brakes operating. Energy is assumed to be equally distributed among the operating brakes. Total energy is the sum of residual energy plus energy added.
Add 1.0 million foot pounds per brake for each taxi mile.

When in caution zone, wheel fuse plugs may melt. Delay takeoff and inspect after one hour. If overheat occurs after takeoff, extend gear soon for at least 7 minutes.

When in fuse plug melt zone, clear runway immediately. Unless required, do not set parking brake. Do not approach gear or attempt to taxi for one hour. Tire, wheel and brake replacement may be required. If overheat occurs after takeoff, extend gear soon for at least 12 minutes.

Brake temperature monitor system (BTMS) indication on CDS systems page may be used 10 to 15 minutes after airplane has come to a complete stop or inflight with gear retracted to determine recommended cooling schedule.

Performance Inflight — Chapter PI
Engine Inoperative — Section 53

ENGINE INOP

Initial Max Continuous %N1
Based on .79M, A/C high and anti-ice off

TAT (°C)	PRESSURE ALTITUDE (1000 FT)								
	25	27	29	31	33	35	37	39	41
20	96.8	96.6	96.3	96.1	95.9	95.4	95.0	94.7	93.9
15	97.4	97.2	96.9	96.8	96.6	96.2	95.7	95.5	94.8
10	98.0	97.8	97.5	97.4	97.4	96.9	96.5	96.3	95.7
5	98.3	98.6	98.3	98.1	98.1	97.7	97.3	97.1	96.6
0	97.5	98.7	99.2	99.0	98.9	98.5	98.2	98.0	97.5
-5	96.7	98.0	99.1	99.8	99.7	99.3	98.9	98.7	98.4
-10	96.0	97.2	98.4	99.6	100.5	100.2	99.8	99.6	99.4
-15	95.2	96.4	97.6	98.8	100.1	101.0	100.8	100.6	100.3
-20	94.4	95.6	96.8	98.0	99.3	100.5	101.1	100.8	100.6
-25	93.6	94.9	96.0	97.2	98.5	99.7	100.2	100.0	99.8
-30	92.8	94.1	95.2	96.4	97.7	98.8	99.4	99.2	99.0
-35	92.0	93.2	94.4	95.6	96.8	98.0	98.5	98.3	98.1
-40	91.2	92.4	93.5	94.7	96.0	97.1	97.6	97.4	97.2

%N1 Adjustments for Engine Bleeds

BLEED CONFIGURATION	PRESSURE ALTITUDE (1000 FT)								
	25	27	29	31	33	35	37	39	41
ENGINE ANTI-ICE	-1.2	-1.1	-1.0	-0.9	-0.8	-0.8	-0.8	-0.8	-0.8
ENGINE & WING ANTI-ICE	-4.2	-4.4	-4.5	-4.7	-5.0	-4.8	-4.8	-4.8	-4.8

ENGINE INOP

Max Continuous %N1

37000 FT to 29000 FT Pressure Altitudes

37000 FT PRESS ALT		TAT (°C)											
KIAS	M	-55	-50	-45	-40	-35	-30	-25	-20	-15	-10	-5	0
160	.51	96.6	97.6	98.5	99.4	100.2	99.6	98.8	97.6	96.3	94.7	93.2	91.8
200	.63	96.0	96.9	97.8	98.7	99.6	100.4	100.1	99.3	98.4	97.5	96.3	95.2
240	.74	95.1	96.0	96.8	97.7	98.6	99.4	100.3	100.7	100.0	99.2	98.4	97.5
280	.86	94.3	95.2	96.1	97.0	97.8	98.7	99.5	100.4	101.2	100.9	100.0	99.1
35000 FT PRESS ALT		TAT (°C)											
KIAS	M	-55	-50	-45	-40	-35	-30	-25	-20	-15	-10	-5	0
160	.49	96.5	97.4	98.3	99.2	100.1	99.8	99.0	98.0	96.8	95.4	94.0	92.7
200	.60	96.1	97.0	97.9	98.8	99.7	100.6	100.5	99.6	98.6	97.6	96.5	95.4
240	.71	95.0	95.9	96.8	97.7	98.6	99.4	100.3	100.8	100.2	99.5	98.6	97.7
280	.82	93.8	94.6	95.5	96.4	97.3	98.1	98.9	99.8	100.6	100.3	99.5	98.8
33000 FT PRESS ALT		TAT (°C)											
KIAS	M	-50	-45	-40	-35	-30	-25	-20	-15	-10	-5	0	5
160	.47	97.4	98.3	99.2	100.0	100.8	100.0	99.1	97.9	96.7	95.3	93.9	92.6
200	.58	97.0	97.9	98.8	99.7	100.6	101.4	100.6	99.6	98.6	97.5	96.3	95.1
240	.68	95.9	96.8	97.7	98.5	99.4	100.2	101.1	100.9	100.2	99.4	98.4	97.4
280	.79	94.3	95.1	96.0	96.8	97.7	98.5	99.3	100.2	100.5	99.7	98.9	98.1
320	.89	93.6	94.5	95.4	96.2	97.1	97.9	98.7	99.5	100.3	101.1	100.7	99.8
31000 FT PRESS ALT		TAT (°C)											
KIAS	M	-50	-45	-40	-35	-30	-25	-20	-15	-10	-5	0	5
160	.45	97.3	98.2	99.1	100.0	100.9	101.1	100.2	99.2	98.0	96.6	95.2	93.9
200	.55	97.1	98.0	98.9	99.7	100.6	101.5	101.6	100.7	99.7	98.6	97.4	96.2
240	.66	95.6	96.5	97.4	98.3	99.1	100.0	100.8	101.3	100.5	99.8	98.8	97.8
280	.76	93.8	94.7	95.5	96.4	97.2	98.0	98.8	99.7	100.5	99.8	98.9	98.0
320	.85	92.4	93.2	94.1	94.9	95.7	96.5	97.4	98.2	98.9	99.7	99.9	99.1
29000 FT PRESS ALT		TAT (°C)											
KIAS	M	-45	-40	-35	-30	-25	-20	-15	-10	-5	0	5	10
160	.43	98.1	99.0	99.9	100.8	101.6	101.2	100.2	99.1	97.9	96.4	95.1	93.8
200	.53	97.5	98.4	99.3	100.2	101.0	101.9	101.3	100.4	99.3	98.2	96.9	95.8
240	.63	96.3	97.1	98.0	98.9	99.7	100.5	101.4	101.1	100.2	99.2	98.3	97.2
280	.73	94.2	95.0	95.9	96.7	97.5	98.3	99.1	99.9	100.1	99.1	98.2	97.5
320	.82	92.1	92.9	93.7	94.5	95.3	96.1	96.9	97.7	98.5	99.2	98.5	97.6
360	.91	92.1	92.9	93.7	94.5	95.3	96.1	96.9	97.7	98.5	99.2	100.0	100.1

%N1 Adjustments for Engine Bleeds

BLEED CONFIGURATION	PRESSURE ALTITUDE (1000 FT)				
	29	31	33	35	37
ENGINE ANTI-ICE ON	-0.9	-0.9	-0.8	-0.8	-0.8
ENGINE & WING ANTI-ICE ON	-4.1	-4.3	-4.5	-4.7	-4.7

ENGINE INOP

Max Continuous %N1
27000 FT to 20000 FT Pressure Altitudes

27000 FT PRESS ALT		TAT (°C)											
KIAS	M	-45	-40	-35	-30	-25	-20	-15	-10	-5	0	5	10
160	.41	98.0	98.8	99.7	100.6	101.4	102.2	101.2	100.2	99.0	97.8	96.4	95.1
200	.51	96.9	97.8	98.7	99.6	100.4	101.2	101.8	100.8	99.9	98.8	97.6	96.4
240	.60	95.6	96.5	97.4	98.2	99.1	99.9	100.7	101.3	100.4	99.4	98.5	97.5
280	.70	93.6	94.4	95.3	96.1	96.9	97.7	98.5	99.3	100.1	99.4	98.4	97.6
320	.79	91.6	92.4	93.2	94.0	94.8	95.6	96.4	97.2	98.0	98.7	98.6	97.8
360	.88	91.0	91.8	92.6	93.4	94.2	95.0	95.8	96.6	97.3	98.1	98.8	99.4
25000 FT PRESS ALT		TAT (°C)											
KIAS	M	-40	-35	-30	-25	-20	-15	-10	-5	0	5	10	15
160	.39	98.8	99.7	100.5	101.4	102.2	102.4	101.4	100.3	99.1	97.7	96.5	95.2
200	.49	97.5	98.3	99.2	100.0	100.9	101.7	101.5	100.6	99.5	98.4	97.3	96.2
240	.58	95.7	96.5	97.4	98.2	99.0	99.9	100.7	100.5	99.5	98.6	97.6	96.7
280	.67	93.9	94.7	95.5	96.3	97.1	97.9	98.7	99.5	99.5	98.6	97.6	96.9
320	.76	91.7	92.6	93.4	94.2	95.0	95.8	96.5	97.3	98.0	98.6	97.8	97.2
360	.85	90.4	91.2	92.1	92.9	93.7	94.5	95.3	96.1	96.9	97.6	98.4	98.2
24000 FT PRESS ALT		TAT (°C)											
KIAS	M	-40	-35	-30	-25	-20	-15	-10	-5	0	5	10	15
160	.38	98.6	99.5	100.4	101.2	102.1	102.9	101.9	100.8	99.6	98.4	97.1	95.8
200	.48	97.5	98.4	99.2	100.1	100.9	101.8	102.2	101.1	100.1	99.0	97.8	96.7
240	.57	95.9	96.8	97.6	98.5	99.3	100.1	100.9	101.2	100.2	99.2	98.2	97.3
280	.66	94.2	95.1	95.9	96.7	97.5	98.3	99.1	99.9	100.4	99.4	98.3	97.5
320	.75	92.1	93.0	93.8	94.6	95.4	96.2	96.9	97.7	98.5	99.2	98.6	97.8
360	.83	90.6	91.4	92.2	93.1	93.9	94.7	95.5	96.2	97.0	97.8	98.5	98.6
22000 FT PRESS ALT		TAT (°C)											
KIAS	M	-35	-30	-25	-20	-15	-10	-5	0	5	10	15	20
160	.37	99.1	100.0	100.9	101.7	102.5	102.8	101.8	100.7	99.5	98.2	97.0	95.8
200	.46	98.4	99.3	100.1	101.0	101.8	102.6	102.3	101.2	100.0	98.9	97.8	96.8
240	.55	97.2	98.1	98.9	99.7	100.5	101.3	102.1	101.6	100.5	99.4	98.5	97.5
280	.63	95.7	96.5	97.4	98.2	99.0	99.8	100.6	101.3	101.0	99.8	98.9	98.1
320	.72	93.9	94.7	95.5	96.3	97.1	97.9	98.6	99.4	100.1	100.2	99.3	98.6
360	.80	92.2	93.0	93.8	94.6	95.4	96.1	96.9	97.7	98.4	99.2	99.7	99.1
20000 FT PRESS ALT		TAT (°C)											
KIAS	M	-35	-30	-25	-20	-15	-10	-5	0	5	10	15	20
160	.35	98.7	99.5	100.4	101.2	102.0	102.8	102.5	101.5	100.4	99.2	98.0	96.8
200	.44	98.3	99.2	100.0	100.9	101.7	102.5	103.3	102.3	101.1	100.0	98.9	97.8
240	.53	97.5	98.4	99.2	100.0	100.8	101.7	102.5	103.1	101.8	100.5	99.5	98.6
280	.61	96.2	97.0	97.8	98.7	99.5	100.3	101.1	101.8	102.5	101.3	100.1	99.3
320	.69	94.7	95.5	96.3	97.1	97.9	98.7	99.5	100.2	101.0	101.7	100.9	99.9
360	.77	93.0	93.8	94.6	95.4	96.2	97.0	97.7	98.5	99.2	100.0	100.7	100.4

%N1 Adjustments for Engine Bleeds

BLEED CONFIGURATION	PRESSURE ALTITUDE (1000 FT)				
	20	22	24	25	27
ENGINE ANTI-ICE ON	-0.9	-0.9	-1.0	-1.0	-1.0
ENGINE & WING ANTI-ICE ON	-3.6	-3.8	-3.8	-3.9	-4.0

ENGINE INOP

Max Continuous %N1
18000 FT to 12000 FT Pressure Altitudes

18000 FT PRESS ALT		TAT (°C)											
KIAS	M	-30	-25	-20	-15	-10	-5	0	5	10	15	20	25
160	.34	98.5	99.3	100.2	101.0	101.8	102.6	101.6	100.3	99.2	98.1	97.0	95.9
200	.42	98.7	99.6	100.4	101.2	102.0	102.8	103.1	101.7	100.4	99.3	98.3	97.3
240	.51	97.8	98.7	99.5	100.3	101.1	101.9	102.7	102.5	101.1	99.9	99.0	98.1
280	.59	96.3	97.1	97.9	98.7	99.5	100.3	101.0	101.8	101.6	100.5	99.6	98.8
320	.67	94.8	95.6	96.4	97.2	97.9	98.7	99.5	100.2	101.0	100.9	100.0	99.2
360	.75	93.0	93.8	94.6	95.3	96.1	96.9	97.6	98.4	99.1	99.9	100.2	99.6
16000 FT PRESS ALT		TAT (°C)											
KIAS	M	-30	-25	-20	-15	-10	-5	0	5	10	15	20	25
160	.33	97.1	98.0	98.8	99.6	100.4	101.2	101.6	100.3	99.1	98.1	97.1	96.1
200	.41	98.0	98.8	99.6	100.4	101.2	102.0	102.8	102.5	101.3	100.2	99.3	98.3
240	.49	97.1	97.9	98.7	99.5	100.3	101.1	101.9	102.7	101.8	100.5	99.6	98.7
280	.57	95.6	96.4	97.2	98.0	98.8	99.6	100.3	101.1	101.8	100.9	99.8	99.0
320	.64	94.0	94.8	95.6	96.4	97.2	97.9	98.7	99.4	100.2	100.9	100.2	99.4
360	.72	92.1	92.9	93.7	94.5	95.3	96.1	96.9	97.7	98.4	99.2	99.9	99.6
14000 FT PRESS ALT		TAT (°C)											
KIAS	M	-25	-20	-15	-10	-5	0	5	10	15	20	25	30
160	.31	96.6	97.4	98.2	99.0	99.8	100.6	100.4	99.1	98.0	97.1	96.2	95.3
200	.39	97.1	97.9	98.7	99.5	100.3	101.1	101.8	101.5	101.0	100.1	99.3	98.4
240	.47	96.6	97.4	98.2	99.0	99.8	100.6	101.3	101.8	101.1	100.3	99.5	98.7
280	.54	95.5	96.3	97.1	97.8	98.6	99.4	100.1	100.9	101.0	100.1	99.2	98.5
320	.62	94.1	94.9	95.7	96.5	97.2	98.0	98.7	99.5	100.2	100.3	99.5	98.8
360	.69	92.2	93.1	93.9	94.7	95.5	96.3	97.0	97.8	98.6	99.3	99.6	99.0
12000 FT PRESS ALT		TAT (°C)											
KIAS	M	-20	-15	-10	-5	0	5	10	15	20	25	30	35
160	.30	96.3	97.0	97.8	98.6	99.4	100.1	99.3	98.1	97.1	96.3	95.4	94.5
200	.38	97.1	97.9	98.7	99.5	100.3	101.0	101.5	100.8	99.8	99.0	98.2	97.3
240	.45	96.5	97.3	98.0	98.8	99.6	100.3	101.1	101.0	100.1	99.4	98.6	97.9
280	.52	95.5	96.3	97.0	97.8	98.6	99.3	100.0	100.8	100.3	99.4	98.6	98.0
320	.60	94.0	94.8	95.6	96.4	97.2	97.9	98.7	99.4	100.2	99.7	98.9	98.2
360	.67	92.3	93.2	94.0	94.8	95.6	96.4	97.1	97.9	98.7	99.4	99.1	98.5

%N1 Adjustments for Engine Bleeds

BLEED CONFIGURATION	PRESSURE ALTITUDE (1000 FT)			
	12	14	16	18
ENGINE ANTI-ICE ON	-0.9	-0.9	-0.9	-0.9
ENGINE & WING ANTI-ICE ON	-3.2	-3.4	-3.4	-3.5

ENGINE INOP

Max Continuous %N1
10000 FT to 1000 FT Pressure Altitudes

10000 FT PRESS ALT		TAT (°C)											
KIAS	M	-20	-15	-10	-5	0	5	10	15	20	25	30	35
160	.29	95.2	96.0	96.8	97.6	98.3	99.1	99.8	98.6	97.4	96.6	95.8	94.9
200	.36	96.0	96.7	97.5	98.3	99.0	99.8	100.5	100.5	99.4	98.5	97.8	97.0
240	.43	95.6	96.4	97.2	97.9	98.7	99.4	100.2	100.9	100.1	99.2	98.4	97.7
280	.51	94.5	95.3	96.1	96.9	97.6	98.4	99.1	99.9	100.4	99.5	98.7	98.0
320	.58	93.0	93.9	94.7	95.5	96.2	97.0	97.8	98.6	99.3	99.7	99.0	98.2
360	.65	91.6	92.4	93.2	94.0	94.8	95.6	96.4	97.2	98.0	98.7	99.1	98.5
5000 FT PRESS ALT		TAT (°C)											
KIAS	M	-10	-5	0	5	10	15	20	25	30	35	40	45
160	.26	94.9	95.7	96.4	97.2	98.0	98.8	99.2	98.3	97.4	96.6	95.9	95.1
200	.33	94.7	95.5	96.3	97.1	97.8	98.6	99.4	98.9	98.0	97.3	96.6	95.8
240	.40	94.0	94.8	95.6	96.4	97.2	97.9	98.7	99.5	98.7	97.9	97.2	96.5
280	.46	93.3	94.1	94.9	95.7	96.5	97.3	98.1	98.8	98.9	98.2	97.5	96.8
320	.53	92.5	93.3	94.1	94.9	95.7	96.5	97.2	98.0	98.7	98.4	97.7	97.1
360	.59	91.5	92.3	93.1	93.9	94.7	95.5	96.2	97.0	97.8	98.5	98.0	97.3
3000 FT PRESS ALT		TAT (°C)											
KIAS	M	-5	0	5	10	15	20	25	30	35	40	45	50
160	.26	94.8	95.6	96.4	97.2	98.0	98.7	98.8	97.9	97.1	96.4	95.6	94.8
200	.32	94.5	95.3	96.1	96.9	97.6	98.4	99.2	98.3	97.5	96.8	96.1	95.3
240	.38	94.1	94.9	95.6	96.4	97.2	98.0	98.7	98.8	98.0	97.2	96.6	95.9
280	.45	93.2	94.0	94.8	95.6	96.4	97.2	97.9	98.7	98.3	97.5	96.9	96.2
320	.51	92.5	93.3	94.1	94.9	95.7	96.4	97.2	98.0	98.5	97.8	97.1	96.5
360	.57	91.6	92.4	93.2	94.0	94.7	95.5	96.3	97.1	97.8	98.1	97.4	96.8
1000 FT PRESS ALT		TAT (°C)											
KIAS	M	-5	0	5	10	15	20	25	30	35	40	45	50
160	.25	93.9	94.7	95.4	96.2	97.0	97.8	98.5	98.2	97.4	96.7	96.0	95.2
200	.31	93.5	94.3	95.1	95.9	96.7	97.4	98.2	98.5	97.8	97.0	96.3	95.6
240	.37	93.0	93.8	94.6	95.4	96.1	96.9	97.7	98.4	98.1	97.3	96.6	95.9
280	.43	92.3	93.2	93.9	94.7	95.5	96.3	97.1	97.8	98.3	97.6	96.9	96.2
320	.49	91.6	92.4	93.2	94.0	94.8	95.6	96.3	97.1	97.9	97.9	97.2	96.5
360	.55	90.7	91.5	92.3	93.1	93.9	94.7	95.4	96.2	96.9	97.7	97.3	96.6

%N1 Adjustments for Engine Bleeds

BLEED CONFIGURATION	PRESSURE ALTITUDE (1000 FT)			
	1	3	5	10
ENGINE ANTI-ICE ON	-0.6	-0.8	-0.8	-0.8
ENGINE & WING ANTI-ICE ON	-2.9	-3.0	-2.7	-3.2

ENGINE INOP

MAX CONTINUOUS THRUST

Driftdown Speed/Level Off Altitude

100 ft/min residual rate of climb

WEIGHT (1000 KG)		OPTIMUM DRIFTDOWN SPEED (KIAS)	LEVEL OFF ALTITUDE (FT)		
START DRIFTDOWN	LEVEL OFF		ISA + 10°C & BELOW	ISA + 15°C	ISA + 20°C
85	82	271	18500	17300	15900
80	77	263	20200	19000	17700
75	72	255	21600	20600	19400
70	67	247	23100	22200	21100
65	62	238	24700	23800	22800
60	57	229	26800	25800	24700
55	53	219	29100	28100	27000
50	48	209	31200	30400	29400
45	43	199	33300	32600	31700
40	38	187	35600	34900	34000

Includes APU fuel burn.

ENGINE INOP

MAX CONTINUOUS THRUST

Driftdown/LRC Cruise Range Capability

Ground to Air Miles Conversion

AIR DISTANCE (NM)					GROUND DISTANCE (NM)	AIR DISTANCE (NM)				
HEADWIND COMPONENT (KTS)						TAILWIND COMPONENT (KTS)				
100	80	60	40	20		20	40	60	80	100
138	128	120	112	106	100	95	90	86	82	78
275	256	239	225	212	200	190	180	172	164	157
413	384	359	337	317	300	284	270	258	246	235
551	512	479	449	423	400	379	360	344	328	314
689	640	598	562	529	500	474	451	429	410	392
826	768	718	674	635	600	569	541	515	492	471
964	896	838	786	741	700	664	631	601	574	549
1102	1025	957	898	846	800	758	721	687	656	628
1240	1153	1077	1011	952	900	853	811	773	738	706
1377	1281	1197	1123	1058	1000	948	901	859	820	785
1515	1409	1317	1235	1164	1100	1043	991	945	902	863
1653	1537	1436	1348	1270	1200	1138	1081	1030	984	942
1792	1666	1556	1460	1375	1300	1232	1171	1116	1066	1020
1930	1794	1676	1573	1481	1400	1327	1261	1202	1148	1098
2068	1922	1796	1685	1587	1500	1422	1351	1288	1230	1177
2207	2051	1916	1798	1693	1600	1517	1441	1373	1312	1255
2345	2180	2036	1910	1799	1700	1611	1531	1459	1393	1333
2484	2309	2156	2023	1905	1800	1706	1621	1545	1475	1411

Driftdown/Cruise Fuel and Time

AIR DIST (NM)	FUEL REQUIRED (1000 KG)										TIME (HR:MIN)
	WEIGHT AT START OF DRIFTDOWN (1000 KG)										
	40	45	50	55	60	65	70	75	80	85	
100	0.4	0.4	0.4	0.4	0.4	0.5	0.5	0.5	0.5	0.5	0:16
200	0.8	0.8	0.9	0.9	1.0	1.0	1.1	1.1	1.2	1.3	0:33
300	1.2	1.3	1.4	1.5	1.6	1.7	1.8	1.9	2.0	2.1	0:49
400	1.6	1.8	1.9	2.0	2.2	2.3	2.5	2.6	2.8	2.9	1:06
500	2.0	2.2	2.4	2.6	2.8	3.0	3.2	3.3	3.5	3.7	1:22
600	2.4	2.7	2.9	3.1	3.3	3.6	3.8	4.0	4.3	4.5	1:39
700	2.8	3.1	3.4	3.6	3.9	4.2	4.5	4.7	5.0	5.3	1:55
800	3.2	3.6	3.9	4.2	4.5	4.8	5.1	5.4	5.7	6.1	2:11
900	3.6	4.0	4.3	4.7	5.0	5.4	5.7	6.1	6.4	6.8	2:28
1000	4.0	4.4	4.8	5.2	5.6	6.0	6.4	6.7	7.1	7.6	2:44
1100	4.4	4.8	5.3	5.7	6.1	6.6	7.0	7.4	7.9	8.3	3:01
1200	4.8	5.3	5.7	6.2	6.7	7.1	7.6	8.1	8.6	9.0	3:17
1300	5.2	5.7	6.2	6.7	7.2	7.7	8.2	8.7	9.2	9.8	3:34
1400	5.5	6.1	6.6	7.2	7.7	8.3	8.8	9.4	9.9	10.5	3:51
1500	5.9	6.5	7.1	7.7	8.3	8.9	9.4	10.0	10.6	11.2	4:07
1600	6.3	6.9	7.5	8.2	8.8	9.4	10.0	10.7	11.3	12.0	4:24
1700	6.6	7.3	8.0	8.6	9.3	10.0	10.6	11.3	12.0	12.7	4:41
1800	7.0	7.7	8.4	9.1	9.8	10.5	11.2	11.9	12.6	13.4	4:57

Includes APU fuel burn.
Driftdown at optimum driftdown speed and cruise at long range cruise speed.

ENGINE INOP

MAX CONTINUOUS THRUST

Long Range Cruise Altitude Capability

100 ft/min residual rate of climb

WEIGHT (1000 KG)	PRESSURE ALTITUDE (FT)		
	ISA + 10°C & BELOW	ISA + 15°C	ISA + 20°C
85	15200	12600	9900
80	17200	15300	12500
75	19200	17400	15000
70	20900	19700	17300
65	22500	21300	19800
60	24100	23000	21600
55	26300	24800	23500
50	29000	27700	25800
45	31400	30500	29200
40	33800	33000	31800

With engine anti-ice on, decrease altitude capability by 1200 ft.
With engine and wing anti-ice on, decrease altitude capability by 5500 ft.

ENGINE INOP

Long Range Cruise Control

WEIGHT (1000 KG)		PRESSURE ALTITUDE (1000 FT)									
		10	15	17	19	21	23	25	27	29	31
85	%N1	91.8	95.5	97.9							
	MACH	.561	.600	.616							
	KIAS	311	303	300							
	FF/ENG	3067	3033	3052							
80	%N1	90.1	94.0	95.9	98.5						
	MACH	.545	.590	.603	.621						
	KIAS	302	299	294	291						
	FF/ENG	2875	2870	2846	2886						
75	%N1	88.4	92.5	94.0	96.1						
	MACH	.528	.579	.593	.607						
	KIAS	293	293	288	284						
	FF/ENG	2684	2709	2674	2662						
70	%N1	86.5	90.7	92.3	94.0	96.2					
	MACH	.510	.562	.582	.595	.610					
	KIAS	282	284	283	278	274					
	FF/ENG	2494	2518	2520	2481	2487					
65	%N1	84.5	88.7	90.4	92.2	93.9	96.4				
	MACH	.491	.542	.563	.584	.596	.612				
	KIAS	271	274	274	273	268	265				
	FF/ENG	2306	2327	2330	2330	2295	2317				
60	%N1	82.3	86.5	88.3	90.0	91.9	93.7	96.4			
	MACH	.471	.521	.543	.564	.585	.597	.614			
	KIAS	261	263	263	263	263	258	254			
	FF/ENG	2124	2137	2139	2140	2143	2114	2146			
55	%N1	80.2	84.2	85.9	87.7	89.5	91.4	93.3	96.2		
	MACH	.453	.498	.520	.541	.563	.585	.597	.614		
	KIAS	250	251	252	252	253	252	247	244		
	FF/ENG	1954	1948	1950	1950	1953	1958	1938	1971		
50	%N1	77.8	81.6	83.4	85.2	87.0	88.7	90.7	92.7	95.7	
	MACH	.434	.475	.495	.516	.538	.561	.583	.596	.613	
	KIAS	240	239	239	240	241	241	241	236	233	
	FF/ENG	1791	1764	1762	1762	1764	1767	1777	1765	1793	
45	%N1	75.5	79.1	80.6	82.3	84.1	85.9	87.7	89.7	91.8	94.8
	MACH	.415	.452	.469	.489	.511	.533	.556	.578	.593	.610
	KIAS	229	227	227	227	228	229	229	229	225	222
	FF/ENG	1636	1594	1582	1575	1577	1580	1586	1600	1593	1613
40	%N1	73.0	76.2	77.8	79.4	81.0	82.8	84.6	86.4	88.3	90.7
	MACH	.395	.429	.445	.462	.480	.502	.525	.548	.571	.589
	KIAS	218	215	215	214	214	215	216	216	216	214
	FF/ENG	1485	1434	1416	1402	1392	1394	1400	1410	1421	1424

ENGINE INOP

MAX CONTINUOUS THRUST

Long Range Cruise Diversion Fuel and Time

Ground to Air Miles Conversion

AIR DISTANCE (NM)					GROUND DISTANCE (NM)	AIR DISTANCE (NM)				
HEADWIND COMPONENT (KTS)						TAILWIND COMPONENT (KTS)				
100	80	60	40	20		20	40	60	80	100
298	272	249	230	214	200	190	180	172	164	158
600	547	501	462	429	400	379	361	344	328	315
903	823	753	694	644	600	570	542	517	494	473
1209	1100	1005	926	859	800	759	721	687	657	630
1516	1379	1259	1159	1075	1000	949	902	859	820	786
1825	1659	1513	1393	1290	1200	1139	1082	1031	984	943
2137	1940	1768	1626	1506	1400	1328	1262	1202	1147	1099
2450	2222	2024	1860	1722	1600	1518	1442	1373	1311	1256
2766	2507	2281	2095	1938	1800	1707	1622	1544	1474	1412
3083	2792	2539	2331	2155	2000	1896	1801	1715	1637	1568

Reference Fuel and Time Required at Check Point

AIR DIST (NM)	PRESSURE ALTITUDE (1000 FT)									
	10		14		18		22		26	
	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)
200	1.4	0:43	1.2	0:41	1.1	0:39	1.0	0:38	0.9	0:37
400	2.8	1:23	2.6	1:19	2.4	1:14	2.2	1:11	2.1	1:09
600	4.3	2:04	3.9	1:57	3.6	1:50	3.4	1:45	3.2	1:42
800	5.7	2:46	5.2	2:36	4.9	2:26	4.5	2:19	4.4	2:14
1000	7.1	3:28	6.6	3:15	6.1	3:03	5.7	2:53	5.5	2:47
1200	8.5	4:10	7.9	3:55	7.3	3:40	6.8	3:28	6.6	3:21
1400	9.8	4:53	9.1	4:36	8.5	4:18	8.0	4:02	7.7	3:54
1600	11.2	5:36	10.4	5:16	9.7	4:55	9.1	4:38	8.7	4:28
1800	12.5	6:20	11.7	5:58	10.9	5:34	10.2	5:13	9.8	5:02
2000	13.9	7:05	12.9	6:39	12.0	6:13	11.3	5:49	10.8	5:36

Fuel Required Adjustments (1000 KG)

REFERENCE FUEL REQUIRED (1000 KG)	WEIGHT AT CHECK POINT (1000 KG)								
	40	45	50	55	60	65	70	75	80
1	-0.1	-0.1	-0.1	0.0	0.0	0.1	0.1	0.2	0.3
2	-0.3	-0.2	-0.1	-0.1	0.0	0.2	0.3	0.6	0.8
3	-0.4	-0.3	-0.2	-0.1	0.0	0.3	0.5	0.9	1.2
4	-0.6	-0.4	-0.3	-0.1	0.0	0.3	0.7	1.2	1.6
5	-0.7	-0.5	-0.4	-0.2	0.0	0.4	0.9	1.4	2.0
6	-0.8	-0.6	-0.4	-0.2	0.0	0.5	1.1	1.7	2.4
7	-1.0	-0.8	-0.5	-0.3	0.0	0.6	1.2	2.0	2.8
8	-1.1	-0.9	-0.6	-0.3	0.0	0.6	1.4	2.2	3.2
9	-1.3	-1.0	-0.7	-0.3	0.0	0.7	1.5	2.4	3.5
10	-1.4	-1.1	-0.7	-0.4	0.0	0.7	1.6	2.6	3.8
11	-1.6	-1.2	-0.8	-0.4	0.0	0.8	1.7	2.8	4.1
12	-1.7	-1.3	-0.9	-0.4	0.0	0.8	1.9	3.0	4.4
13	-1.9	-1.4	-0.9	-0.5	0.0	0.9	2.0	3.2	4.7
14	-2.0	-1.5	-1.0	-0.5	0.0	0.9	2.0	3.4	4.9

Includes APU fuel burn.

ENGINE INOP

MAX CONTINUOUS THRUST

Holding

Flaps Up

WEIGHT (1000 KG)		PRESSURE ALTITUDE (FT)							
		1500	5000	10000	15000	20000	25000	30000	35000
85	%N1	81.1	84.1	88.3	92.8				
	KIAS	250	251	252	253				
	FF/ENG	2740	2730	2750	2800				
80	%N1	79.5	82.4	86.5	91.0	98.3			
	KIAS	242	243	244	245	247			
	FF/ENG	2580	2570	2570	2610	2740			
75	%N1	77.8	80.5	84.7	89.1	95.0			
	KIAS	235	236	236	238	239			
	FF/ENG	2420	2400	2400	2420	2490			
70	%N1	76.0	78.6	82.8	87.1	92.1			
	KIAS	227	227	228	229	231			
	FF/ENG	2260	2240	2230	2250	2270			
65	%N1	74.0	76.7	80.8	85.0	89.7	97.7		
	KIAS	219	219	220	221	222	224		
	FF/ENG	2100	2090	2070	2070	2080	2230		
60	%N1	71.7	74.6	78.5	82.8	87.4	93.7		
	KIAS	210	210	211	212	213	214		
	FF/ENG	1950	1930	1910	1910	1910	1970		
55	%N1	69.4	72.3	76.3	80.5	84.9	90.0		
	KIAS	200	201	202	203	204	205		
	FF/ENG	1800	1770	1750	1740	1730	1760		
50	%N1	66.9	69.7	73.8	77.8	82.3	87.0	94.9	
	KIAS	192	192	192	193	194	195	196	
	FF/ENG	1650	1620	1600	1580	1570	1570	1680	
45	%N1	64.2	66.9	70.9	75.0	79.4	84.0	89.6	
	KIAS	185	185	185	185	185	185	186	
	FF/ENG	1500	1470	1440	1420	1400	1400	1450	
40	%N1	61.1	64.0	67.8	72.0	76.2	80.7	85.4	94.0
	KIAS	178	178	178	178	178	178	178	178
	FF/ENG	1350	1330	1300	1270	1250	1240	1260	1360

This table includes 5% additional fuel for holding in a racetrack pattern.

ENGINE INOP

ADVISORY INFORMATION

Gear Down Landing Rate of Climb Available

Flaps 15

TAT (°C)	RATE OF CLIMB (FT/MIN)					
	PRESSURE ALTITUDE (FT)					
	-2000	0	2000	4000	6000	8000
52	-80	-140				
50	-50	-110	-220			
48	-20	-90	-190			
46	10	-60	-160	-270		
44	40	-30	-140	-250		
42	70	0	-110	-220	-340	
40	100	30	-80	-190	-310	
38	120	60	-50	-160	-290	-430
36	140	90	-20	-140	-260	-400
34	140	120	0	-120	-240	-380
32	140	130	20	-100	-220	-360
30	140	130	40	-80	-210	-340
20	160	140	60	-50	-160	-280
10	170	150	60	-50	-160	-280
0	170	160	70	-50	-160	-280
-20	190	170	80	-40	-160	-280
-40	200	180	80	-40	-170	-290

Rate of climb capability shown is valid for 60000 kg, gear down at VREF15+5.
Decrease rate of climb 130 ft/min per 5000 kg greater than 60000 kg.
Increase rate of climb 160 ft/min per 5000 kg less than 60000 kg.

Flaps 30

TAT (°C)	RATE OF CLIMB (FT/MIN)					
	PRESSURE ALTITUDE (FT)					
	-2000	0	2000	4000	6000	8000
52	-260	-320				
50	-230	-300	-400			
48	-200	-270	-380			
46	-180	-250	-350	-460		
44	-150	-220	-330	-430		
42	-120	-190	-300	-410	-530	
40	-100	-170	-280	-390	-500	
38	-70	-140	-250	-360	-480	-620
36	-60	-110	-220	-340	-460	-600
34	-50	-80	-200	-320	-440	-580
32	-50	-70	-180	-300	-420	-560
30	-50	-60	-160	-280	-410	-540
20	-40	-60	-150	-260	-370	-490
10	-40	-50	-140	-260	-370	-480
0	-30	-50	-140	-260	-370	-490
-20	-30	-40	-140	-260	-380	-500
-40	-20	-40	-140	-270	-390	-520

Rate of climb capability shown is valid for 60000 kg, gear down at VREF30+5.
Decrease rate of climb 130 ft/min per 5000 kg greater than 60000 kg.
Increase rate of climb 170 ft/min per 5000 kg less than 60000 kg.

Performance Inflight — Chapter PI
Alternate Mode EEC — Section 54

ALTERNATE MODE EEC

Alternate Mode EEC Limit Weight

PERFORMANCE LIMIT	NORMAL MODE PERFORMANCE LIMIT WEIGHT (1000 KG)										
	44	48	52	56	60	64	68	72	76	80	84
FIELD	41.8	45.6	49.5	53.3	57.0	60.8	64.2	68.4	72.2	75.9	79.8
CLIMB	41.1	44.9	48.6	52.4	56.1	60.0	63.6	67.3	71.1	74.3	78.6
OBSTACLE	41.3	45.1	48.8	52.6	56.3	60.1	63.7	67.4	71.1	74.7	78.6

Alternate Mode EEC Takeoff Speed Adjustment

TAKEOFF SPEEDS	TAKEOFF SPEED ADJUSTMENT (KTS)
DRY V1	+1
WET V1	+2
VR	+1
V2	0

Alternate Mode EEC Max Takeoff %N1

Based on engine bleeds for packs on, engine and wing anti-ice on or off

AIRPORT OAT (°C)	AIRPORT PRESSURE ALTITUDE (FT)												
	-2000	-1000	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
60	92.6	93.2	93.6	93.7	93.8	93.9	94.0	94.1	94.0	93.7	93.6	93.5	93.5
55	93.2	93.8	94.3	94.4	94.5	94.6	94.7	94.9	94.7	94.4	94.1	93.5	92.8
50	93.8	94.4	94.9	95.1	95.2	95.4	95.5	95.6	95.5	95.2	94.9	94.4	93.9
45	94.6	95.2	95.6	95.8	95.9	96.1	96.2	96.3	96.2	95.9	95.6	95.3	94.9
40	95.2	95.9	96.4	96.5	96.6	96.7	96.8	97.0	96.9	96.6	96.3	96.2	95.9
35	95.8	96.5	97.2	97.3	97.4	97.5	97.6	97.7	97.6	97.3	97.0	96.9	96.8
30	95.4	96.6	98.1	98.1	98.2	98.2	98.3	98.3	98.2	98.1	97.8	97.7	97.7
25	94.6	95.9	97.3	97.9	98.5	98.6	98.5	98.5	98.5	98.5	98.4	98.4	98.5
20	93.8	95.1	96.6	97.1	97.7	98.0	98.3	98.6	98.6	98.7	98.6	98.6	98.6
15	93.0	94.3	95.8	96.4	97.0	97.3	97.6	97.9	98.3	98.7	98.9	98.9	98.9
10	92.3	93.6	95.0	95.6	96.2	96.5	96.8	97.2	97.5	97.9	98.3	98.8	99.3
5	91.5	92.8	94.2	94.8	95.4	95.8	96.1	96.4	96.8	97.2	97.6	98.1	98.5
0	90.7	92.0	93.4	94.1	94.7	95.0	95.3	95.7	96.0	96.4	96.8	97.3	97.8
-5	89.8	91.2	92.6	93.3	93.9	94.2	94.5	94.9	95.3	95.7	96.1	96.5	97.0
-10	89.0	90.4	91.8	92.5	93.1	93.4	93.8	94.1	94.5	94.9	95.3	95.8	96.2
-15	88.2	89.5	91.0	91.7	92.3	92.6	93.0	93.4	93.7	94.1	94.5	95.0	95.4
-20	87.4	88.7	90.2	90.8	91.5	91.8	92.2	92.6	93.0	93.4	93.7	94.2	94.6
-25	86.5	87.9	89.4	90.0	90.7	91.0	91.4	91.8	92.2	92.6	93.0	93.4	93.8
-30	85.7	87.0	88.5	89.2	89.8	90.2	90.6	91.0	91.4	91.8	92.1	92.6	93.0
-35	84.8	86.2	87.7	88.3	89.0	89.4	89.7	90.2	90.6	90.9	91.3	91.8	92.2
-40	83.9	85.3	86.8	87.5	88.1	88.5	88.9	89.3	89.7	90.1	90.5	90.9	91.4
-45	83.1	84.4	86.0	86.6	87.3	87.7	88.1	88.5	88.9	89.3	89.7	90.1	90.5
-50	82.2	83.5	85.1	85.7	86.4	86.8	87.2	87.7	88.1	88.4	88.8	89.3	89.7

%N1 Adjustments for Engine Bleed

BLEED CONFIGURATION	AIRPORT PRESSURE ALTITUDE (FT)												
	-2000	-1000	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
PACKS OFF	0.7	0.8	0.8	0.9	0.9	0.9	1.0	1.0	1.0	1.0	1.0	1.0	1.0

Intentionally
Blank

Performance Inflight — Chapter PI

Gear Down — Section 55

GEAR DOWN

Long Range Cruise Altitude Capability

Max Cruise Thrust, 100 ft/min residual rate of climb

WEIGHT (1000 KG)	PRESSURE ALTITUDE (FT)		
	ISA + 10°C & BELOW	ISA + 15°C	ISA + 20°C
85	15600	12500	9400
80	18400	15500	12600
75	21100	18500	15700
70	23600	21400	18600
65	26100	24400	21800
60	28600	27100	25300
55	30800	29600	28100
50	32900	31900	30700
45	35100	34100	33000
40	37500	36500	35400

GEAR DOWN

Long Range Cruise Control

WEIGHT (1000 KG)		PRESSURE ALTITUDE (1000 FT)								
		10	21	23	25	27	29	31	33	35
85	%N1	85.9								
	MACH	.482								
	KIAS	267								
	FF/ENG	2421								
80	%N1	84.2								
	MACH	.468								
	KIAS	259								
	FF/ENG	2271								
75	%N1	82.5	91.7							
	MACH	.454	.554							
	KIAS	251	248							
	FF/ENG	2123	2101							
70	%N1	80.6	89.8	91.7						
	MACH	.440	.541	.557						
	KIAS	243	242	240						
	FF/ENG	1977	1960	1950						
65	%N1	78.6	87.9	89.5	91.6	94.5				
	MACH	.425	.524	.543	.560	.578				
	KIAS	235	234	233	231	229				
	FF/ENG	1835	1812	1806	1805	1836				
60	%N1	76.5	85.6	87.4	89.1	91.3	94.5			
	MACH	.409	.504	.525	.544	.562	.580			
	KIAS	226	225	225	224	222	220			
	FF/ENG	1696	1661	1661	1658	1664	1696			
55	%N1	74.4	83.3	85.0	86.8	88.5	90.9	94.1		
	MACH	.393	.484	.504	.525	.545	.562	.581		
	KIAS	217	216	216	216	215	213	211		
	FF/ENG	1559	1515	1512	1515	1517	1523	1555		
50	%N1	71.9	80.7	82.5	84.2	86.0	87.8	90.2	93.5	
	MACH	.376	.463	.482	.502	.523	.544	.561	.580	
	KIAS	207	206	206	206	206	205	203	201	
	FF/ENG	1424	1371	1367	1368	1374	1377	1381	1411	
45	%N1	69.1	78.0	79.7	81.4	83.1	85.0	86.8	89.1	92.5
	MACH	.358	.441	.458	.477	.498	.520	.541	.559	.578
	KIAS	197	196	196	196	196	196	195	193	191
	FF/ENG	1294	1231	1224	1224	1230	1235	1237	1239	1265
40	%N1	66.2	74.9	76.6	78.3	80.0	81.8	83.6	85.5	87.7
	MACH	.340	.417	.434	.452	.471	.491	.513	.535	.554
	KIAS	187	185	185	185	185	185	185	185	183
	FF/ENG	1170	1098	1085	1083	1089	1092	1094	1096	1097

GEAR DOWN

Long Range Cruise Enroute Fuel and Time

Ground to Air Miles Conversion

AIR DISTANCE (NM)					GROUND DISTANCE (NM)	AIR DISTANCE (NM)				
HEADWIND COMPONENT (KTS)						TAILWIND COMPONENT (KTS)				
100	80	60	40	20		20	40	60	80	100
324	290	260	236	217	200	188	178	168	160	153
654	583	523	474	435	400	377	357	338	321	307
989	880	787	713	653	600	566	535	507	483	461
1329	1181	1054	953	871	800	754	713	676	643	614
1674	1484	1322	1194	1090	1000	943	891	844	803	766
2024	1791	1593	1436	1310	1200	1131	1069	1013	962	918
2381	2103	1865	1680	1530	1400	1320	1247	1181	1122	1070
2743	2417	2140	1924	1751	1600	1508	1424	1348	1280	1221
3113	2737	2418	2171	1972	1800	1695	1600	1514	1438	1371

Reference Fuel and Time Required at Check Point

AIR DIST (NM)	PRESSURE ALTITUDE (1000 FT)									
	10		14		20		24		28	
	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)
200	2.4	0:49	2.2	0:47	1.9	0:44	1.7	0:42	1.6	0:41
400	4.9	1:36	4.5	1:31	4.0	1:25	3.7	1:20	3.5	1:17
600	7.4	2:25	6.8	2:17	6.1	2:06	5.7	1:59	5.4	1:54
800	9.8	3:14	9.1	3:03	8.1	2:48	7.6	2:38	7.2	2:31
1000	12.1	4:04	11.3	3:50	10.1	3:30	9.5	3:18	9.0	3:08
1200	14.4	4:56	13.5	4:39	12.1	4:14	11.3	3:58	10.7	3:46
1400	16.7	5:49	15.6	5:28	14.0	4:58	13.1	4:40	12.4	4:24
1600	18.9	6:43	17.7	6:18	15.9	5:44	14.9	5:22	14.1	5:03
1800	21.1	7:38	19.7	7:10	17.7	6:30	16.6	6:05	15.7	5:43

Fuel Required Adjustments (1000 KG)

REFERENCE FUEL REQUIRED (1000 KG)	WEIGHT AT CHECK POINT (1000 KG)				
	40	50	60	70	80
2	-0.3	-0.2	0.0	0.3	0.7
4	-0.7	-0.3	0.0	0.6	1.3
6	-1.0	-0.5	0.0	0.9	2.0
8	-1.3	-0.7	0.0	1.2	2.6
10	-1.7	-0.8	0.0	1.4	3.2
12	-2.0	-1.0	0.0	1.6	3.7
14	-2.4	-1.2	0.0	1.8	4.2
16	-2.7	-1.3	0.0	2.0	4.6
18	-3.0	-1.5	0.0	2.2	5.0
20	-3.4	-1.7	0.0	2.4	5.3
22	-3.7	-1.8	0.0	2.5	5.6

GEAR DOWN

Descent
VREF40 + 70 KIAS

PRESSURE ALTITUDE (FT)	TIME (MIN)	FUEL (KG)	DISTANCE (NM)
41000	21	280	91
39000	20	270	86
37000	19	270	81
35000	19	260	77
33000	18	260	72
31000	17	250	68
29000	17	250	64
27000	16	240	60
25000	15	230	56
23000	14	230	52
21000	13	220	48
19000	13	210	44
17000	12	200	40
15000	11	190	36
10000	8	170	26
5000	6	140	16
1500	4	110	9

Allowances for a straight-in approach are included.

GEAR DOWN

Holding

Flaps Up

WEIGHT (1000 KG)		PRESSURE ALTITUDE (FT)							
		1500	5000	10000	15000	20000	25000	30000	35000
85	%N1	75.8	78.5	82.7	87.0	92.0			
	KIAS	230	230	230	230	230			
	FF/ENG	2240	2230	2220	2240	2260			
80	%N1	74.2	77.0	81.1	85.4	90.0			
	KIAS	225	225	225	225	225			
	FF/ENG	2120	2110	2100	2100	2110			
75	%N1	72.5	75.4	79.4	83.7	88.3	94.8		
	KIAS	220	220	220	220	220	220		
	FF/ENG	2000	1990	1970	1970	1970	2050		
70	%N1	70.8	73.7	77.6	81.9	86.4	91.8		
	KIAS	216	216	216	216	216	216		
	FF/ENG	1890	1870	1850	1840	1840	1870		
65	%N1	69.0	71.9	75.9	80.1	84.5	89.3		
	KIAS	211	211	211	211	211	211		
	FF/ENG	1770	1750	1730	1720	1710	1730		
60	%N1	67.1	69.8	74.0	78.0	82.5	87.1	94.3	
	KIAS	204	204	204	204	204	204	204	
	FF/ENG	1660	1630	1610	1600	1580	1590	1670	
55	%N1	65.1	67.8	71.9	75.9	80.3	84.8	90.4	
	KIAS	198	198	198	198	198	198	198	
	FF/ENG	1540	1520	1490	1480	1460	1460	1500	
50	%N1	62.8	65.6	69.6	73.7	78.0	82.4	87.1	
	KIAS	192	192	192	192	192	192	192	
	FF/ENG	1430	1400	1380	1360	1330	1330	1350	
45	%N1	60.3	63.3	67.1	71.4	75.5	79.9	84.5	91.5
	KIAS	185	185	185	185	185	185	185	185
	FF/ENG	1310	1290	1270	1250	1220	1210	1220	1270
40	%N1	57.9	60.6	64.6	68.7	72.9	77.3	81.7	86.8
	KIAS	178	178	178	178	178	178	178	178
	FF/ENG	1200	1180	1160	1130	1110	1090	1100	1110

This table includes 5% additional fuel for holding in a racetrack pattern.

Intentionally
Blank

Performance Inflight — Chapter PI
Gear Down, Engine Inop — Section 56

GEAR DOWN
ENGINE INOP
MAX CONTINUOUS THRUST

Driftdown Speed/Level Off Altitude

100 ft/min residual rate of climb

WEIGHT (1000 KG)		OPTIMUM DRIFTDOWN SPEED (KIAS)	LEVEL OFF ALTITUDE (FT)		
START DRIFTDOWN	LEVEL OFF		ISA + 10°C & BELOW	ISA + 15°C	ISA + 20°C
85	80	227	1700		
80	76	223	4000	2300	200
75	71	218	6300	4900	2800
70	66	213	8600	7300	5300
65	62	208	10900	9800	8000
60	57	202	13200	12300	10900
55	52	196	15600	14800	13900
50	47	190	18100	17300	16500
45	43	183	20600	19800	18900
40	38	176	23100	22300	21400

Includes APU fuel burn.

Long Range Cruise Altitude Capability

100 ft/min residual rate of climb

WEIGHT (1000 KG)	PRESSURE ALTITUDE (FT)		
	ISA + 10°C & BELOW	ISA + 15°C	ISA + 20°C
75	1500		
70	4500	2500	
65	7500	5900	3400
60	10600	9200	6900
55	13300	12300	10600
50	16200	15400	14500
45	19300	18300	17500
40	22200	21400	20500

GEAR DOWN

ENGINE INOP

MAX CONTINUOUS THRUST

Long Range Cruise Control

WEIGHT (1000 KG)		PRESSURE ALTITUDE (1000 FT)									
		5	7	9	11	13	15	17	19	21	23
70	%N1	94.8									
	MACH	.389									
	KIAS	235									
	FF/ENG	3774									
65	%N1	92.6	94.3	96.9							
	MACH	.376	.389	.402							
	KIAS	228	227	226							
	FF/ENG	3477	3485	3527							
60	%N1	90.2	91.9	93.7	96.3						
	MACH	.364	.375	.388	.402						
	KIAS	220	219	218	218						
	FF/ENG	3192	3191	3198	3240						
55	%N1	87.8	89.3	91.0	92.8	95.4					
	MACH	.351	.362	.374	.387	.400					
	KIAS	212	211	210	209	209					
	FF/ENG	2924	2909	2906	2913	2951					
50	%N1	85.3	86.7	88.2	89.9	91.7	94.2	98.2			
	MACH	.338	.348	.359	.371	.384	.398	.412			
	KIAS	204	203	202	201	200	199	198			
	FF/ENG	2672	2647	2630	2626	2633	2657	2737			
45	%N1	82.7	84.0	85.4	86.9	88.6	90.4	92.7	96.6		
	MACH	.325	.334	.344	.355	.367	.380	.393	.408		
	KIAS	196	195	193	192	191	190	189	189		
	FF/ENG	2432	2400	2374	2356	2351	2352	2359	2417		
40	%N1	79.8	81.1	82.5	83.9	85.4	87.0	88.8	90.8	94.1	98.4
	MACH	.311	.320	.329	.339	.349	.361	.374	.387	.402	.418
	KIAS	188	186	184	183	182	181	180	179	179	178
	FF/ENG	2206	2166	2133	2107	2088	2076	2069	2065	2101	2201

GEAR DOWN
ENGINE INOP
MAX CONTINUOUS THRUST

Long Range Cruise Diversion Fuel and Time
Ground to Air Miles Conversion

AIR DISTANCE (NM)					GROUND DISTANCE (NM)	AIR DISTANCE (NM)				
HEADWIND COMPONENT (KTS)						TAILWIND COMPONENT (KTS)				
100	80	60	40	20		20	40	60	80	100
172	151	134	120	109	100	93	88	83	78	75
352	308	270	242	219	200	187	175	165	156	148
533	465	408	364	330	300	280	262	246	232	220
716	623	545	486	440	400	373	349	328	309	293
900	783	684	609	551	500	466	436	409	385	365
1086	943	823	733	661	600	559	523	490	462	438
1273	1105	964	856	772	700	652	610	572	538	510
1462	1267	1103	980	883	800	745	696	652	614	581
1653	1431	1245	1104	994	900	838	782	733	690	653
1845	1595	1386	1228	1105	1000	931	868	813	765	724

Reference Fuel and Time Required at Check Point

AIR DIST (NM)	PRESSURE ALTITUDE (1000 FT)					
	6		10		14	
	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)
100	1.3	0:27	1.1	0:26	1.0	0:26
200	2.6	0:53	2.4	0:50	2.3	0:48
300	3.9	1:18	3.7	1:15	3.6	1:11
400	5.2	1:44	4.9	1:39	4.8	1:35
500	6.5	2:10	6.1	2:04	6.0	1:58
600	7.8	2:37	7.3	2:29	7.1	2:22
700	9.1	3:03	8.5	2:55	8.3	2:46
800	10.3	3:30	9.7	3:20	9.4	3:10
900	11.6	3:58	10.9	3:46	10.5	3:35
1000	12.8	4:25	12.0	4:12	11.6	3:59

Fuel Required Adjustments (1000 KG)

REFERENCE FUEL REQUIRED (1000 KG)	WEIGHT AT CHECK POINT (1000 KG)				
	40	50	60	70	80
1	-0.2	-0.1	0.0	0.1	0.3
2	-0.3	-0.2	0.0	0.3	0.6
3	-0.5	-0.3	0.0	0.5	1.0
4	-0.6	-0.3	0.0	0.7	1.3
5	-0.8	-0.4	0.0	0.9	1.7
6	-1.0	-0.5	0.0	1.0	2.0
7	-1.1	-0.6	0.0	1.2	2.4
8	-1.3	-0.7	0.0	1.4	2.7
9	-1.5	-0.7	0.0	1.6	3.1
10	-1.6	-0.8	0.0	1.8	3.5
11	-1.8	-0.9	0.0	1.9	3.8
12	-1.9	-1.0	0.0	2.1	4.2
13	-2.1	-1.1	0.0	2.3	4.5
14	-2.3	-1.1	0.0	2.5	4.9

Includes APU fuel burn.

GEAR DOWN
ENGINE INOP
MAX CONTINUOUS THRUST

Holding
Flaps Up

WEIGHT (1000 KG)		PRESSURE ALTITUDE (FT)			
		1500	5000	10000	15000
80	%N1	93.4			
	KIAS	225			
	FF/ENG	4140			
75	%N1	91.4	94.7		
	KIAS	220	220		
	FF/ENG	3870	3910		
70	%N1	89.4	92.6		
	KIAS	216	216		
	FF/ENG	3610	3640		
65	%N1	87.4	90.5	95.9	
	KIAS	211	211	211	
	FF/ENG	3360	3380	3460	
60	%N1	85.2	88.2	92.9	
	KIAS	204	204	204	
	FF/ENG	3110	3110	3150	
55	%N1	82.9	85.9	90.4	97.2
	KIAS	198	198	198	198
	FF/ENG	2860	2860	2880	3010
50	%N1	80.4	83.4	87.7	92.8
	KIAS	192	192	192	192
	FF/ENG	2630	2620	2620	2670
45	%N1	77.8	80.7	85.0	89.6
	KIAS	185	185	185	185
	FF/ENG	2400	2380	2380	2400
40	%N1	75.1	77.8	82.1	86.5
	KIAS	178	178	178	178
	FF/ENG	2180	2160	2140	2140

This table includes 5% additional fuel for holding in a racetrack pattern.

Performance Inflight — Chapter PI
Text — Section 57

Introduction

This chapter contains information to supplement performance data from the Flight Management Computer (FMC). In addition, sufficient inflight data is provided to complete a flight with the FMC inoperative. In the event of conflict between data presented in this chapter and that contained in the approved Airplane Flight Manual, the Flight Manual shall always take precedence.

General

Takeoff Speeds

The speeds presented in the Takeoff Speeds table as well as FMC computed takeoff speeds can be used for all performance conditions except where adjustments must be made for anti-skid inoperative, thrust reversers inoperative, improved climb, contaminated runway situations, or brake energy limits.

V1 adjustments are not necessary for equal amounts of clearway and stopway. V1 for takeoff limit weights based on unequal clearway and stopway should be obtained from computerized takeoff speeds calculations for the specific takeoff conditions.

These speeds may be used for weights less than or equal to the performance limited weight subject to the restrictions noted above.

The FMC will protect for minimum control speeds by increasing V1, VR and V2 as required. However, the FMC will not compute takeoff speeds for weights where the required speed increase exceeds the maximum certified speed increase. This typically occurs at full rated thrust and light weights. In this case, the message "V SPEEDS UNAVAILABLE" will appear on the FMC scratchpad and the takeoff speed entries will be blank. In this situation, manually verify takeoff speeds using an approved source of takeoff performance information. Upon verifying the takeoff speeds, takeoff is permitted. When selected takeoff speeds cannot be verified, the options are to select a lower number flap setting, select derate thrust and/or increase airplane gross weight (e.g. add fuel). Selecting derate thrust is the preferred method as this will reduce the minimum control speeds. Note that the assumed temperature method will not help this condition as the minimum control speeds are determined at the actual temperature and therefore are not reduced by an assumed temperature selection.

Normal takeoff speeds, V1, VR, and V2 are read from either the dry or wet table by entering with takeoff flap setting and brake release weight. Use the tables provided to adjust takeoff speeds for altitude and actual temperature or assumed temperature for reduced thrust takeoffs. Slope and wind adjustments to V1 are obtained by entering the Slope and Wind V1 Adjustment table.

V1(MCG)

Regulations prohibit scheduling takeoff with a V1 less than minimum V1 for control on the ground, V1(MCG). It is therefore necessary to compare the adjusted V1 to V1(MCG). The V1(MCG) presented in this manual is conservative for all weight and bleed configurations.

To find V1(MCG) enter the V1(MCG) table with the airport pressure altitude and actual OAT. If the adjusted V1 is less than V1(MCG), set V1 equal to V1(MCG). If the adjusted VR is less than V1(MCG), set VR equal to V1(MCG), and determine a new V2 by adding the difference between the normal VR and V1(MCG) to the normal V2. No takeoff weight adjustment is necessary provided that the actual field length exceeds the minimum field length shown in the Field and Climb Limit Weight table in chapter Performance Dispatch.

Stab Trim

To find takeoff stabilizer trim setting, enter Stab Trim Setting table with anticipated brake release weight and center of gravity (C.G. % MAC) and read required stabilizer trim units.

VREF

This table contains flaps 40, 30 and 15 reference speeds for a given weight.

Flap Maneuver Speeds

This table provides flap maneuver speeds for various flap settings. During flap retraction, selection of the next flap position is initiated when reaching the maneuver speed for the existing flap position. During flap retraction, at least adequate maneuver capability or 30° of bank (15° of bank and 15° overshoot) to stick shaker is provided at the flap retraction speed. Full maneuver capability or at least 40° of bank (25° of bank and 15° overshoot) is provided when the airplane has accelerated to the recommended maneuver speed for the selected flap position.

During flap extension, selection of the flaps to the next flap position should be made when approaching, and before decelerating below, the maneuver speed for the existing flap position. The flap extension speed schedule varies with airplane weight and provides full maneuver capability or at least 40° of bank (25° of bank and 15° overshoot) to stick shaker at all weights.

Slush/Standing Water Takeoff

Experience has shown that aircraft performance may deteriorate significantly on runways covered with snow, slush, standing water or ice. Therefore, reductions in field/obstacle limited takeoff weight and revised takeoff speeds are necessary. The tables are intended for guidance in accordance with advisory material and assume an engine failure at the critical point during the takeoff.

The entire runway is assumed to be completely covered by a contaminant of uniform thickness and density. Therefore this information is conservative when operating under typical cold weather conditions where patches of slush exist and some degree of sanding is common. Takeoffs in slush or standing water depths greater than 13 mm (0.5 inches) are not recommended because of possible airplane damage as a result of spray impingement on the airplane structure. The use of assumed temperature for reduced thrust is not allowed on contaminated runways. Interpolation for slush/standing water depths between the values shown is permitted.

Takeoff weight determination:

1. Enter the Weight Adjustment table with the dry field/obstacle limit weight to obtain the weight reduction for the slush/standing water depth and airport pressure altitude.
2. Adjust field length available for temperature by amount shown beneath V1(MCG) limit weight table.
3. Enter the V1(MCG) Limit Weight table with the adjusted field length and pressure altitude to obtain the slush/standing water limit weight with respect to minimum field length required for V1(MCG) speed.
4. The maximum allowable takeoff weight in slush/standing water is the lesser of the limit weights found in steps 1 and 3.

Takeoff speed determination:

1. Determine takeoff speeds V1, VR and V2 for actual brake release weight using the Dry Runway Takeoff Speeds table for the appropriate flap setting and thrust rating.
2. If V1(MCG) limited, set V1=V1(MCG). If not limited by V1(MCG) considerations, enter the V1 Adjustment table with actual brake release weight to determine the V1 reduction to apply to V1 speed. If the adjusted V1 is less than V1(MCG), set V1=V1(MCG).

Slippery Runway Takeoff

Airplane braking action is reported as good, medium or poor, depending on existing runway conditions. If braking action is reported as good, conditions should not be expected to be as good as on clean, dry runways. The value “good” is comparative and is intended to mean that airplanes should not experience braking or directional control difficulties when stopping. The performance level used to calculate the “good” data is consistent with wet runway testing done on early Boeing jets. The performance level used to calculate the “poor” data reflects a runway covered with wet ice. Performance is based on a 15 ft screen height at the end of the runway. The tables provided are used in the same manner as the Slush/Standing Water tables.

Anti-Skid Inoperative

When operating with anti-skid inoperative, the field limit weight and V1 must be reduced to account for the effect on accelerate-stop performance. Anti-skid inoperative is only allowed on a dry runway. A simplified method which conservatively accounts for the effects of anti-skid inoperative is to reduce the normal dry field/obstacle limited weight by 8500 kg and the V1 associated with the reduced weight by the amount shown in the table below.

ANTI-SKID INOPERATIVE V1 ADJUSTMENTS	
FIELD LENGTH (M)	V1 ADJUSTMENT (KIAS)
2000	-19
2500	-16
3000	-14
3500	-12
4000	-11

If the resulting V1 is less than V1(MCG), takeoff is permitted with V1 set equal to V1(MCG) provided the dry accelerate-stop distance adjusted for wind and slope exceeds approximately 1800 m.

Detailed analysis for the specific case from the Airplane Flight Manual may yield a less restrictive penalty.

Thrust Reverser Inoperative

When dispatching on a wet runway with both thrust reversers operative, an operative anti-skid system, and all brakes operating, regulations allow deceleration credit for one thrust reverser in the engine failure case and two thrust reversers in the all engine stop case.

When dispatching on a wet runway with one thrust reverser inoperative, the field/obstacle limited weight and V1 must be reduced to account for the effect on accelerate-stop performance. A simplified method, which conservatively accounts for this, is to reduce the normal wet runway/field/obstacle limited weight by 1050 kg and the V1 associated with the reduced weight by 2 knots.

If the resulting V1 is less than minimum V1, takeoff is permitted with V1 set equal to V1(MCG) provided the accelerate-stop distance available adjusted for wind and slope exceeds approximately 1200 m.

Detailed analysis for the specific case from the Airplane Flight Manual may yield a less restrictive penalty.

Takeoff %N1

To find Max Takeoff %N1 based on normal engine bleed for air conditioning packs on, enter Takeoff %N1 Table with airport pressure altitude and airport OAT and read %N1. Apply %N1 adjustments as provided when applicable.

Assumed Temperature Reduced Thrust

Regulations permit the use of up to 25% takeoff thrust reduction for operation with assumed temperature reduced thrust. Use of assumed temperature reduced thrust is not allowed with anti-skid inoperative or on runways contaminated with standing water, ice, slush, or snow. Use of assumed temperature reduced thrust is not recommended if potential windshear conditions exist.

To find the maximum allowable assumed temperature enter the Maximum Assumed Temperature table with airport pressure altitude and OAT. Compare this temperature to that at which the airplane is performance limited as determined from available takeoff performance data. Next, enter the Maximum Takeoff %N1 table with airport pressure altitude and the lower of the two temperatures previously determined, to obtain a maximum takeoff %N1. Do not use an assumed temperature less than the minimum assumed temperature shown. Enter the %N1 Adjustment table with OAT and the difference between the assumed and actual OAT to obtain a %N1 adjustment. Subtract the %N1 adjustment from the maximum takeoff %N1 found previously to determine the assumed temperature reduced thrust %N1.

Apply %N1 adjustments as provided when applicable.

Max Climb %N1

This table shows Max Climb %N1 for a 280/.78 climb speed schedule, normal engine bleed for packs on or off and anti-ice off. Enter the table with airport pressure altitude and TAT and read %N1. %N1 adjustments are shown for anti-ice operation.

Go-around %N1

To find Max Go-around %N1 based on normal engine bleed for packs on (AUTO) and anti-ice on or off, enter the Go-around %N1 table with airport pressure altitude and reported OAT or TAT and read %N1. For packs OFF or HIGH operation, apply the %N1 adjustment shown below the table.

Flight with Unreliable Airspeed / Turbulent Air Penetration

Pitch attitude and average %N1 information is provided for use in all phases of flight in the event of unreliable airspeed/Mach indications resulting from blocking or freezing of the pitot system. Loss of radome or turbulent air may also cause unreliable airspeed/Mach indications. The cruise table in this section may also be used for turbulent air penetration. The Flight with Unreliable Airspeed - FINAL APPROACH table includes a 10 knot margin for landing.

Pitch attitude is shown in bold type for emphasis since altitude and/or vertical speed indications may also be unreliable.

All Engines

Long Range Cruise Maximum Operating Altitude

These tables provide the maximum operating altitude in the same manner as the FMC. Maximum altitudes are shown for a given cruise weight and maneuver capability. This table considers both thrust and buffet limits, providing the more limiting of the two. Any data that is thrust limited is denoted by an asterisk and represents only a thrust limited condition in level flight with 100 ft/min residual rate of climb. Flying above these altitudes with sustained banks in excess of approximately 15° may cause the airplane to lose speed and/or altitude. The altitudes shown in the table are limited to the maximum certified altitude of 41000 ft.

Long Range Cruise Control

These tables provide target %N1, Long Range Cruise Mach number, IAS and standard day fuel flow per engine for the airplane weight and pressure altitude. As indicated by the shaded area, at optimum altitude .79M approximates the Long Range Cruise Mach schedule.

Long Range Cruise Enroute Fuel and Time

Long Range Cruise Enroute Fuel and Time tables are provided to determine remaining time and fuel required to destination. The data is based on Long Range Cruise and .78/280/250 descent. Tables are presented for low altitudes and high altitudes.

To determine remaining fuel and time required, first enter the Ground to Air Miles Conversion table to convert ground distance and enroute wind to an equivalent still air distance for use with the Reference Fuel and Time tables. Next, enter the Reference Fuel and Time table with air distance from the Ground to Air Miles Conversion table and the desired altitude and read Reference Fuel and Time Required. Lastly, enter the Fuel Required Adjustment table with the Reference Fuel and the actual weight at checkpoint to obtain fuel required to destination.

APU Operation During Flight

For APU operation during flight, increase fuel flow according to the table in the Engine Inoperative text section.

Long Range Cruise Wind-Altitude Trade

Wind is a factor which may justify operations considerably below optimum altitude. For example, a favorable wind component may have an effect on ground speed which more than compensates for the loss in air range.

Using this table, it is possible to determine the break-even wind (advantage necessary or disadvantage that can be tolerated) to maintain the same range at another altitude and long range cruise speed. The tables make no allowance for climb or descent time, fuel or distance, and are based on comparing ground fuel mileage.

Descent

Time, fuel, and distance for descent are shown for a .78/280/250 descent speed schedule. Enter the table with top of descent pressure altitude and read distance, time and fuel. Data is based on flight idle thrust descent in zero wind. Allowances are included for a straight-in approach with gear down and landing flaps at the outer marker.

Holding

Target %N1, indicated airspeed and fuel flow per engine information is tabulated for holding with flaps up based on the FMC optimum holding speed schedule. This is the higher of the maximum endurance speed and the maneuvering speed. Small variations in airspeed will not appreciably affect the overall endurance time. Enter the table with weight and pressure altitude to read %N1, IAS and fuel flow per engine.

Advisory Information

Normal Configuration Landing Distance

The normal configuration distance tables are provided as advisory information to help determine the actual landing distance performance of the airplane for different runway surface conditions and brake configurations.

Flaps 15, 30, and 40 landing distances and adjustments are provided for dry runways as well as runways with good, medium, and poor reported braking action, which are commonly referred to as slippery runway conditions.

If the surface is affected by water, snow or ice, and the braking action is reported as "good", conditions should not be expected to be as good as on clean, dry runways. The value "good" is comparative and is intended to mean that airplanes should not experience braking or directional control difficulties when landing. The performance level used to calculate the "good" data is consistent with wet runway testing done on early Boeing jets. The performance level used to calculate "poor" data reflects runways covered with wet ice.

Dry runway landing performance is shown for max manual braking configuration and autobrake settings max, 3, 2, and 1. The autobrake performance may be used to assist in the selection of the most desirable autobrake setting for a given field length. Selection of an autobrake setting results in a constant rate of deceleration. Maximum effort manual braking should achieve shorter landing distance than the max autobrake setting. The reference landing distance is a reference distance from 50 ft above the threshold to stop based on a reference landing weight and normal approach speed for the selected landing flap at sea level, zero wind, zero slope, and two engine detent reverse thrust. Subsequent columns provide adjustments for off-reference landing weight, altitude, wind, slope, temperature, speed, and reverse thrust. Each adjustment is independently added to the reference landing distance.

Non-normal Configuration Landing Distance

Advisory information is provided to support non-normal configurations that affect the landing performance of the airplane. Landing distances and adjustments are provided for dry runways and runways with good, medium, and poor reported braking action.

Enter the table with the applicable non-normal configuration and read the normal approach speed. The reference landing distance is a reference distance from 50 ft above the threshold to stop based on a reference landing weight and speed at sea level, zero wind, and zero slope. Subsequent columns provide adjustments for off-reference landing weight, altitude, wind, slope, and speed conditions. Each adjustment is independently added to the reference landing distance. Landing distance includes the effect of reverse thrust.

Recommended Brake Cooling Schedule

Advisory information is provided to assist in avoiding the problems associated with hot brakes. For normal operation, most landings are at weights below the AFM quick turnaround limit weight.

Use of the recommended cooling schedule will help avoid brake overheat and fuse plug problems that could result from repeated landings at short time intervals or a rejected takeoff.

Enter the Recommended Brake Cooling Schedule table with the airplane weight and brakes on speed, adjusted for wind at the appropriate temperature and altitude condition. Instructions for applying wind adjustments are included below the table. Linear interpolation may be used to obtain intermediate values. The resulting number is the reference brake energy per brake in millions of foot-pounds, and represents the amount of energy absorbed by each brake during a rejected takeoff. Notes providing adjustments for wind are included below the table.

To determine the energy per brake absorbed during landing, enter the appropriate Adjusted Brake Energy Per Brake table (No Reverse Thrust or 2 Engine Reverse) with the reference brake energy per brake and the type of braking used during landing (Max Manual, Max Auto, or Autobrake). The resulting number is the adjusted brake energy per brake and represents the energy absorbed in each brake during the landing.

The recommended cooling time is found in the appropriate (steel or carbon brakes) final table by entering with the adjusted brake energy per brake. Times are provided for ground cooling and inflight gear down cooling.

Brake Temperature Monitor System (BTMS) indications are also shown. If brake cooling is determined from the BTMS, use the hottest brake indication 10 to 15 minutes after the airplane has come to a complete stop, or inflight with gear retracted to determine recommended cooling schedule.

Engine Inoperative

Initial Max Continuous %N1

The Initial Max Continuous %N1 setting for use following an engine failure is shown. The table is based on the typical all engine cruise speed of .79M to provide a target %N1 setting at the start of driftdown. Once driftdown is established, the Max Continuous %N1 table should be used to determine %N1 for the given conditions.

Max Continuous %N1

Power setting is based on one engine operating with one A/C pack operating and all anti-ice bleeds off. Enter the table with pressure altitude, TAT, and IAS or Mach to read %N1.

It is desirable to maintain engine thrust level within the limits of the Max Cruise thrust rating. However, where thrust level in excess of Max Cruise rating is required, such as for meeting terrain clearance, ATC altitude assignments, or to attain maximum range capability, it is permissible to use the thrust needed up to the Max Continuous thrust rating. The Max Continuous thrust rating is intended primarily for emergency use at the discretion of the pilot and is the maximum thrust that may be used continuously.

Driftdown Speed/Level Off Altitude

The table shows optimum driftdown speed as a function of cruise weight at start of driftdown. Also shown are the approximate weight and pressure altitude at which the airplane will level off considering 100 ft/min residual rate of climb.

The level off altitude is dependent on air temperature (ISA deviation).

Driftdown/LRC Range Capability

This table shows the range capability from the start of driftdown. Driftdown is continued to level off altitude. As weight decreases due to fuel burn, the airplane is accelerated to Long Range Cruise speed. Cruise is continued at level off altitude and Long Range Cruise speed.

To determine fuel required, enter the Ground to Air Miles Conversion table with the desired ground distance and adjust for anticipated winds to obtain air distance to destination. Then enter the Driftdown/Cruise Fuel and Time table with air distance and weight at start of driftdown to determine fuel and time required. If altitudes other than the level off altitude is used, fuel and time required may be obtained by using the Engine Inoperative Long Range Cruise Enroute Fuel and Time table.

Long Range Cruise Altitude Capability

The table shows the maximum altitude that can be maintained at a given weight and air temperature (ISA deviation), based on Long Range Cruise speed, Max Continuous thrust, and 100 ft/min residual rate of climb.

Long Range Cruise Control

The table provides target %N1, engine inoperative Long Range Cruise Mach number, IAS and fuel flow for the airplane weight and pressure altitude. The fuel flow values in this table reflect single engine fuel burn.

APU Operation During Flight

For APU operation during flight, increase fuel flow according to the following table. These increments include the APU fuel flow and the effect of increased drag from the APU door.

PRESSURE ALTITUDE (1000 FT)	APU FUEL FLOW (KG/HR)
39	45
35	45
31	50
25	60
20	65
15	75
10	85
5	95

Long Range Cruise Diversion Fuel and Time

Tables are provided for crews to determine the fuel and time required to proceed to an alternate airfield with one engine inoperative. The data is based on single engine Long Range Cruise speed and .78/280/250 descent. Enter with Air Distance as determined from the Ground to Air Miles Conversion table and read Fuel and Time required at the cruise pressure altitude. Adjust the fuel obtained for deviation from the reference weight at checkpoint as required by entering the off reference fuel adjustments table with the fuel required for the reference weight and the actual weight at checkpoint. Read fuel required and time for the actual weight.

Holding

Single engine holding data is provided in the same format as the all engine holding data and is based on the same assumptions.

Gear Down Landing Rate of Climb Available

Rate of climb data is provided as guidance information in the event an engine inoperative landing (manual or autoland) is planned. The tables show gear down rate of climb available for Flaps 15 and Flaps 30. Enter the table with TAT and pressure altitude to read rate of climb available. Apply adjustments shown to correct for weight.

Alternate Mode EEC

Introduction

This section contains performance data for airplane operation with the Electronic Engine Control (EEC) in the alternate mode (ALTN EEC switch illuminated) for applicable thrust ratings. The data includes engine bleed effects for normal air conditioning operation i.e., two packs on at normal flow all engines operating.

Operation with derate and/or assumed temperature reduced thrust is not permitted with the EEC in alternate mode.

Limit Weight

A simplified method which conservatively accounts for the effects of EEC in alternate mode is to reduce the normal mode (ON EEC switch illuminated) performance limited weights. The Limit Weight table provides takeoff field, climb, and obstacle limit weights. To determine limit weights for operations with the EEC in alternate mode, enter the table with the limit weights for normal mode EEC operation and read the associated limit weight for each performance condition. The most limiting of the takeoff weights must be used. Analysis from the Airplane Flight Manual - Digital Performance Information may yield less restrictive limit weights.

Takeoff Speed Adjustment

Takeoff speeds for the reduced weight should be increased by the amount shown in the Takeoff Speeds Adjustment table. The adjusted V1 should not exceed the adjusted VR.

Note: The FMC does not incorporate alternate mode EEC performance in its takeoff speeds calculations.

Max Takeoff %N1

The alternate mode EEC thrust schedule provides equal or greater thrust than the normal mode thrust for the same thrust lever position. Thrust limit protection is not provided in alternate mode EEC and maximum rated thrust may be reached at thrust lever position less than full forward. As a result, thrust overboost may occur if the target alternate mode EEC Max Takeoff %N1 settings are not observed.

To find alternate mode EEC Max Takeoff %N1 based on normal engine bleed for air conditioning packs on, enter the Alternate Mode EEC Max Takeoff %N1 table with airport pressure altitude and airport OAT and read %N1. For packs off apply the %N1 adjustment provided below the table. No %N1 adjustment is required for engine or wing anti-ice.

Gear Down

This section contains performance for airplane operation with the landing gear extended. The data is based on engine bleeds for normal air conditioning.

Note: The Flight Management Computer System (FMCS) does not contain special provisions for operation with landing gear extended. As a result, the FMCS may generate inappropriate enroute speed schedules, display non-conservative predictions of fuel burn, estimated time of arrival (ETA), maximum altitude, and compute overly shallow descent path. An accurate estimated time of arrival (ETA) is available if current speed or Mach is entered into the VNAV cruise page.

Tables for gear down performance in this section are identical in format and used in the same manner as tables for the gear up configuration previously described.

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Performance Inflight — Chapter PI
Table of Contents — Section 60

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Performance Inflight — Chapter PI

Pkg Model Identification — Section 60

General

The table below shows the airplanes that have been identified with the following performance package. Note, some airplanes may be identified with more than one performance package. This configuration table information reflects the Boeing delivered configuration updated for service bulletin incorporations in conformance with the policy stated in the introduction section of the FCOM. The performance data is prepared for the owner/operator named on the title page. The intent of this information is to assist flight crews and airlines in knowing which performance package is applicable to a given airplane. The performance package model identification information is based on Boeing's knowledge of the airline's fleet at a point in time approximately three months prior to the page date. Notice of Errata (NOE) will not be provided to airlines to identify airplanes that are moved between performance packages within this manual or airplanes added to the airline's fleet whose performance packages are already represented in this manual. These types of changes will be updated in the next block revision. Owners/operators are responsible for ensuring the operational documentation they are using is complete and matches the current configuration of their airplanes, and the accuracy and validity of all information furnished by the owner/operator or any other party. Owners/operators receiving active revision service are responsible to ensure that any modifications to the listed airplanes are properly reflected in this manual.

Serial and tabulation number are supplied by Boeing.

Registry Number	Serial Number	Tabulation Number
YX900	YX900	YX900

Intentionally
Blank

Performance Inflight — Chapter PI
General — Section 60

Takeoff Speeds - Dry Runway
V1, VR, V2 for Max Takeoff Thrust

WEIGHT (1000 LB)	FLAPS 1			FLAPS 5			FLAPS 10			FLAPS 15			FLAPS 25		
	V1	VR	V2	V1	VR	V2	V1	VR	V2	V1	VR	V2	V1	VR	V2
190	171	173	179	163	166	172	163	164	168						
180	166	168	175	158	161	168	158	159	164	154	156	161	152	152	158
170	161	163	171	153	156	164	153	154	161	149	151	157	147	148	154
160	155	158	166	148	150	160	148	149	157	144	146	153	142	143	150
150	150	152	162	143	145	155	142	144	152	139	140	149	136	137	146
140	144	146	157	137	139	151	136	138	148	133	135	145	131	132	142
130	138	139	152	131	133	146	130	131	143	127	128	140	125	126	138
120	131	132	146	125	126	141	124	125	138	121	122	135	119	120	133
110	124	125	141	118	119	135	117	118	133	114	116	130	112	113	128
100	117	118	135	112	112	129	111	111	128	108	109	125	106	106	122

Check V1(MCG).

V1, VR, V2 Adjustments*

TEMP		V1							VR							V2						
		PRESS ALT (1000 FT)							PRESS ALT (1000 FT)							PRESS ALT (1000 FT)						
°C	°F	-2	0	2	4	6	8	10	-2	0	2	4	6	8	10	-2	0	2	4	6	8	10
70	158	5	6						5	6						-2	-3					
60	140	4	5	6	7				3	4	5	6				-2	-2	-2	-3			
50	122	2	3	4	5	6	8	9	2	3	4	5	6	8	9	-1	-1	-2	-2	-3	-3	-4
40	104	1	2	3	4	5	6	7	1	2	3	4	5	6	8	-1	-1	-1	-2	-2	-3	-3
30	86	0	0	1	3	4	5	6	0	0	1	3	4	5	7	0	0	-1	-1	-2	-2	-3
20	68	0	0	1	2	3	4	5	0	0	1	2	3	4	6	0	0	0	-1	-1	-2	-2
-60	-76	0	0	1	2	3	4	5	0	0	1	2	3	4	5	0	0	0	-1	-1	-2	-2

Slope and Wind V1 Adjustments*

WEIGHT (1000 LB)	SLOPE (%)					WIND (KTS)							
	-2	-1	0	1	2	-15	-10	-5	0	10	20	30	40
190	-4	-2	0	1	0	-2	-1	-1	0	0	0	1	1
170	-3	-2	0	1	1	-2	-1	-1	0	0	1	1	1
150	-2	-1	0	1	1	-2	-1	-1	0	0	1	1	1
130	-1	-1	0	1	1	-2	-1	-1	0	0	1	1	1
110	-1	0	0	0	1	-2	-1	0	0	0	0	1	1
100	0	0	0	0	0	-2	-1	0	0	0	0	0	0

***V1 not to exceed VR.**

V1(MCG)
Max Takeoff Thrust

TEMP		PRESSURE ALTITUDE (FT)						
°C	°F	-2000	0	2000	4000	6000	8000	10000
70	158	93	91					
60	140	93	91	89	88			
50	122	95	93	90	88	86	83	81
40	104	99	97	94	90	87	83	81
30	86	102	101	98	94	90	86	83
20	68	102	102	99	95	92	88	84
-60	-76	104	103	100	96	93	90	87

Takeoff Speeds - Wet Runway

V1, VR, V2 for Max Takeoff Thrust

WEIGHT (1000 LB)	FLAPS 1			FLAPS 5			FLAPS 10			FLAPS 15			FLAPS 25		
	V1	VR	V2	V1	VR	V2	V1	VR	V2	V1	VR	V2	V1	VR	V2
190	165	173	179	157	166	172	158	164	168						
180	159	168	175	151	161	168	152	159	164	148	156	161	145	152	158
170	154	163	171	146	156	164	146	154	161	142	151	157	140	148	154
160	148	158	166	140	150	160	140	149	157	136	146	153	134	143	150
150	141	152	162	134	145	155	134	144	152	131	140	149	128	137	146
140	135	146	157	128	139	151	128	138	148	125	135	145	123	132	142
130	128	139	152	122	133	146	121	131	143	119	128	140	116	126	138
120	121	132	146	115	126	141	115	125	138	112	122	135	110	120	133
110	114	125	141	108	119	135	108	118	133	105	116	130	103	113	128
100	107	118	135	101	112	129	101	111	128	98	109	125	96	106	122

Check V1(MCG).

V1, VR, V2 Adjustment*

TEMP		V1							VR							V2						
		PRESS ALT (1000 FT)							PRESS ALT (1000 FT)							PRESS ALT (1000 FT)						
°C	°F	-2	0	2	4	6	8	10	-2	0	2	4	6	8	10	-2	0	2	4	6	8	10
70	158	8	9						5	6						-2	-3					
60	140	6	7	8	10				3	4	5	6				-2	-2	-2	-3			
50	122	4	4	6	7	9	11	13	2	3	4	5	6	8	9	-1	-1	-2	-2	-3	-3	-4
40	104	1	2	3	5	6	8	10	1	2	3	4	5	6	8	-1	-1	-1	-2	-2	-3	-3
30	86	0	0	2	3	5	6	8	0	0	1	3	4	5	7	0	0	-1	-1	-2	-2	-3
20	68	0	0	1	2	4	6	7	0	0	1	2	3	4	6	0	0	0	-1	-1	-2	-2
-60	-76	0	0	1	2	4	6	7	0	0	1	2	3	4	5	0	0	0	-1	-1	-2	-2

Slope and Wind V1 Adjustment*

WEIGHT (1000 LB)	SLOPE (%)					WIND (KTS)							
	-2	-1	0	1	2	-15	-10	-5	0	10	20	30	40
190	-5	-3	0	3	6	-4	-2	-1	0	1	2	2	3
180	-5	-2	0	3	6	-4	-2	-1	0	1	1	2	3
170	-5	-2	0	3	5	-4	-2	-1	0	1	1	2	3
160	-4	-2	0	2	5	-4	-2	-1	0	1	1	2	3
150	-4	-2	0	2	4	-4	-2	-1	0	1	2	2	3
140	-4	-2	0	2	4	-4	-3	-1	0	1	2	2	3
130	-3	-2	0	2	3	-4	-3	-1	0	1	2	2	3
120	-3	-1	0	2	3	-4	-3	-1	0	1	2	3	3
110	-2	-1	0	1	3	-5	-3	-1	0	1	2	3	4
100	-2	-1	0	1	2	-5	-3	-1	0	1	2	3	4

***V1 not to exceed VR.**

V1(MCG)

Max Takeoff Thrust

TEMP		PRESSURE ALTITUDE (FT)						
°C	°F	-2000	0	2000	4000	6000	8000	10000
70	158	93	91					
60	140	93	91	89	88			
50	122	95	93	90	88	86	83	81
40	104	99	97	94	90	87	83	81
30	86	102	101	98	94	90	86	83
20	68	102	102	99	95	92	88	84
-60	-76	104	103	100	96	93	90	87

Stab Trim Setting
Max Takeoff Thrust
Flaps 1 and 5

WEIGHT (1000 LB)	C.G. (%MAC)										
	6	8	12	16	20	24	28	31	33	35	36
180	8 1/4	8	7 1/2	6 3/4	6 1/4	5 1/2	5	4 1/2	4 1/4	4	3 3/4
160	7 3/4	7 1/2	7	6 1/4	5 3/4	5 1/4	4 1/2	4 1/4	3 3/4	3 1/2	3 1/2
140	7 1/4	7	6 1/4	5 3/4	5 1/4	4 3/4	4	3 3/4	3 1/2	3 1/4	3
120	6 1/2	6 1/4	5 3/4	5 1/4	4 3/4	4 1/4	3 3/4	3 1/4	3	2 3/4	2 3/4
100	5 3/4	5 1/2	5	4 1/2	4	3 1/2	3 1/4	2 3/4	2 3/4	2 3/4	2 3/4
70	5 3/4	5 1/2	5	4 1/2	4	3 1/2	3 1/4	2 3/4	2 3/4	2 3/4	2 3/4

Flaps 10, 15 and 25

WEIGHT (1000 LB)	C.G. (%MAC)											
	6	8	12	16	20	24	25	28	31	33	35	36
180	8	7 1/2	6 3/4	6 1/4	5 1/2	4 3/4	4 1/2	4	3 1/2	3 1/4	2 3/4	2 3/4
160	7 1/4	7	6 1/4	5 3/4	5	4 1/4	4 1/4	3 3/4	3 1/4	2 3/4	2 3/4	2 3/4
140	6 3/4	6 1/2	5 3/4	5 1/4	4 1/2	4	3 3/4	3 1/4	2 3/4	2 3/4	2 3/4	2 3/4
120	6	5 3/4	5 1/4	4 1/2	4	3 1/2	3 1/4	2 3/4	2 3/4	2 3/4	2 3/4	2 3/4
100	5 1/2	5 1/4	4 1/2	4	3 1/2	3	2 3/4	2 3/4	2 3/4	2 3/4	2 3/4	2 3/4
70	5 1/2	5 1/4	4 1/2	4	3 1/2	3	2 3/4	2 3/4	2 3/4	2 3/4	2 3/4	2 3/4

VREF

Based on 10000 ft reference pressure altitude

WEIGHT (1000 LB)	FLAPS		
	40	30	15
180	155	166	177
170	151	161	171
160	146	156	166
150	141	151	161
140	139	149	159
130	134	144	153
120	129	138	147
110	123	132	140
100	117	126	134
90	111	119	127

Flap Maneuver Speeds

FLAP POSITION	MANEUVER SPEED
UP	VREF40 + 70
1	VREF40 + 50
5	VREF40 + 30
10	VREF40 + 30
15	VREF40 + 20
25	VREF40 + 10
30	VREF30
40	VREF40

ADVISORY INFORMATION

Slush/Standing Water Takeoff

Maximum Reverse Thrust

Weight Adjustments (1000 LB)

DRY FIELD/OBSTACLE LIMIT WEIGHT (1000 LB)	SLUSH/STANDING WATER DEPTH								
	0.12 INCHES (3 mm)			0.25 INCHES (6 mm)			0.50 INCHES (13 mm)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
190	-23.8	-28.8	-33.8	-29.3	-34.3	-39.3	-40.3	-45.3	-50.3
180	-22.1	-27.1	-32.1	-26.7	-31.7	-36.7	-36.0	-41.0	-46.0
170	-20.4	-25.4	-30.4	-24.0	-29.0	-34.0	-31.9	-36.9	-41.9
160	-18.5	-23.5	-28.5	-21.5	-26.5	-31.5	-28.0	-33.0	-38.0
150	-16.5	-21.5	-26.5	-18.9	-23.9	-28.9	-24.3	-29.3	-34.3
140	-14.5	-19.5	-24.5	-16.5	-21.5	-26.5	-20.8	-25.8	-30.8
130	-12.3	-17.3	-22.3	-14.0	-19.0	-24.0	-17.5	-22.5	-27.5
120	-10.0	-15.0	-20.0	-11.7	-16.7	-21.7	-14.4	-19.4	-24.4
110	-7.7	-12.7	-17.7	-9.3	-14.3	-19.3	-11.4	-16.4	-21.4
100	-5.3	-10.3	-15.3	-7.0	-12.0	-17.0	-8.5	-13.5	-18.5
90	-3.0	-8.0	-13.0	-4.7	-9.7	-14.7	-5.5	-10.5	-15.5

V1(MCG) Limit Weight (1000 LB)

ADJUSTED FIELD LENGTH (FT)	SLUSH/STANDING WATER DEPTH								
	0.12 INCHES (3 mm)			0.25 INCHES (6 mm)			0.50 INCHES (13 mm)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
4200				76.3			90.1		
4600	93.6			101.7	70.0		115.2	84.0	
5000	120.2	87.2		128.2	95.2		141.3	108.9	77.9
5400	148.3	113.5	80.8	156.1	121.4	88.8	168.3	134.7	102.6
5800	177.9	141.1	106.8	185.6	149.0	114.8	196.4	161.4	128.1
6200	209.1	170.3	134.1		178.0	142.0		189.3	154.6
6600		201.3	162.9		208.5	170.6			182.2
7000			193.4			200.8			

1. **Enter Weight Adjustment table with slush/standing water depth and dry field/obstacle limit weight to obtain slush/standing water weight adjustment.**
2. **Adjust field length available by -110 ft/+100 ft for every 5°C above/below 4°C.**
3. **Find V1(MCG) limit weight for adjusted field length and pressure altitude.**
4. **Max allowable slush/standing water limited weight is lesser of weights from 1 and 3.**

ADVISORY INFORMATION

Slush/Standing Water Takeoff
Maximum Reverse Thrust
V1 Adjustment (KIAS)

WEIGHT (1000 LB)	SLUSH/STANDING WATER DEPTH								
	0.12 INCHES (3 mm)			0.25 INCHES (6 mm)			0.50 INCHES (13 mm)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
190	-17	-12	-7	-11	-6	-1	-2	0	0
180	-18	-13	-8	-12	-7	-2	-2	0	0
170	-19	-14	-9	-13	-8	-3	-2	0	0
160	-20	-15	-10	-15	-10	-5	-3	0	0
150	-22	-17	-12	-16	-11	-6	-5	0	0
140	-23	-18	-13	-18	-13	-8	-7	-2	0
130	-24	-19	-14	-20	-15	-10	-10	-5	0
120	-25	-20	-15	-22	-17	-12	-14	-9	-4
110	-26	-21	-16	-23	-18	-13	-18	-13	-8
100	-26	-21	-16	-24	-19	-14	-20	-15	-10
90	-26	-21	-16	-24	-19	-14	-21	-16	-11

1. **Obtain V1, VR and V2 for the actual weight using the Dry Runway Takeoff Speeds table.**
2. **If V1(MCG) limited, set V1 = V1(MCG). If not V1(MCG) limited, enter V1 Adjustment table with the actual weight to obtain V1 speed adjustment. If adjusted V1 is less than V1(MCG), set V1 = V1(MCG). V1 not to exceed VR.**

ADVISORY INFORMATION

Slush/Standing Water Takeoff

No Reverse Thrust

Weight Adjustments (1000 LB)

DRY FIELD/OBSTACLE LIMIT WEIGHT (1000 LB)	SLUSH/STANDING WATER DEPTH								
	0.12 INCHES (3 mm)			0.25 INCHES (6 mm)			0.50 INCHES (13 mm)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
190	-29.4	-35.9	-42.4	-34.6	-41.1	-47.6	-45.8	-52.3	-58.8
180	-26.9	-33.4	-39.9	-31.4	-37.9	-44.4	-40.9	-47.4	-53.9
170	-24.6	-31.1	-37.6	-28.3	-34.8	-41.3	-36.3	-42.8	-49.3
160	-22.2	-28.7	-35.2	-25.4	-31.9	-38.4	-31.9	-38.4	-44.9
150	-19.9	-26.4	-32.9	-22.5	-29.0	-35.5	-27.8	-34.3	-40.8
140	-17.6	-24.1	-30.6	-19.7	-26.2	-32.7	-24.0	-30.5	-37.0
130	-15.4	-21.9	-28.4	-17.0	-23.5	-30.0	-20.5	-27.0	-33.5
120	-13.1	-19.6	-26.1	-14.4	-20.9	-27.4	-17.3	-23.8	-30.3
110	-11.0	-17.5	-24.0	-11.9	-18.4	-24.9	-14.3	-20.8	-27.3
100	-8.8	-15.3	-21.8	-9.5	-16.0	-22.5	-11.7	-18.2	-24.7
90	-6.6	-13.1	-19.6	-7.2	-13.7	-20.2	-9.3	-15.8	-22.3

V1(MCG) Limit Weight (1000 LB)

ADJUSTED FIELD LENGTH (FT)	SLUSH/STANDING WATER DEPTH								
	0.12 INCHES (3 mm)			0.25 INCHES (6 mm)			0.50 INCHES (13 mm)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
5000							88.2		
5400				84.9			117.5	80.9	
5800	96.5			117.8	76.8		146.9	110.2	73.5
6200	132.5	87.7		151.7	109.5		176.2	139.5	102.9
6600	169.4	123.4	78.9	186.7	143.1	101.2	205.5	168.8	132.2
7000	207.5	160.1	114.4		177.8	134.6		198.2	161.5
7400		197.9	150.8			169.0			190.8
7800			188.4			204.6			

1. **Enter Weight Adjustment table with slush/standing water depth and dry field/obstacle limit weight to obtain slush/standing water weight adjustment.**
2. **Adjust field length available by -130 ft/+120 ft for every 5°C above/below 4°C.**
3. **Find V1(MCG) limit weight for adjusted field length and pressure altitude.**
4. **Max allowable slush/standing water limited weight is lesser of weights from 1 and 3.**

ADVISORY INFORMATION

Slush/Standing Water Takeoff
No Reverse Thrust
V1 Adjustment (KIAS)

WEIGHT (1000 LB)	SLUSH/STANDING WATER DEPTH								
	0.12 INCHES (3 mm)			0.25 INCHES (6 mm)			0.50 INCHES (13 mm)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
190	-23	-16	-8	-15	-7	0	-2	0	0
180	-25	-17	-10	-16	-9	-1	-2	0	0
170	-26	-19	-11	-18	-11	-3	-3	0	0
160	-27	-20	-12	-20	-13	-5	-5	0	0
150	-29	-21	-14	-22	-15	-7	-7	0	0
140	-30	-22	-15	-24	-17	-9	-10	-3	0
130	-31	-24	-16	-26	-19	-11	-14	-7	0
120	-32	-25	-17	-29	-21	-14	-19	-12	-4
110	-33	-26	-18	-30	-23	-15	-24	-16	-9
100	-33	-26	-18	-31	-24	-16	-26	-19	-11
90	-33	-26	-18	-31	-24	-16	-27	-20	-12

1. **Obtain V1, VR and V2 for the actual weight using the Dry Runway Takeoff Speeds table.**
2. **If V1(MCG) limited, set V1 = V1(MCG). If not V1(MCG) limited, enter V1 Adjustment table with the actual weight to obtain V1 speed adjustment. If adjusted V1 is less than V1(MCG), set V1 = V1(MCG). V1 not to exceed VR.**

ADVISORY INFORMATION

Slippery Runway Takeoff
Maximum Reverse Thrust
Weight Adjustment (1000 LB)

DRY FIELD/OBSTACLE LIMIT WEIGHT (1000 LB)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
190	-1.8	-1.8	-1.8	-13.0	-13.0	-13.0	-22.8	-22.8	-22.8
180	-2.5	-2.5	-2.5	-13.0	-13.0	-13.0	-22.1	-22.1	-22.1
170	-3.1	-3.1	-3.1	-12.8	-12.8	-12.8	-21.3	-21.3	-21.3
160	-3.4	-3.4	-3.4	-12.5	-12.5	-12.5	-20.3	-20.3	-20.3
150	-3.6	-3.6	-3.6	-12.0	-12.0	-12.0	-19.1	-19.1	-19.1
140	-3.5	-3.5	-3.5	-11.4	-11.4	-11.4	-17.9	-17.9	-17.9
130	-3.3	-3.3	-3.3	-10.6	-10.6	-10.6	-16.4	-16.4	-16.4
120	-2.9	-2.9	-2.9	-9.6	-9.6	-9.6	-14.9	-14.9	-14.9
110	-2.5	-2.5	-2.5	-8.7	-8.7	-8.7	-13.3	-13.3	-13.3
100	-2.1	-2.1	-2.1	-7.7	-7.7	-7.7	-11.7	-11.7	-11.7
90	-1.6	-1.6	-1.6	-6.7	-6.7	-6.7	-10.2	-10.2	-10.2

V1(MCG) Limit Weight (1000 LB)

ADJUSTED FIELD LENGTH (FT)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
3400	99.9								
3800	143.8	111.0	77.5						
4200	186.8	154.7	122.0	72.7					
4600		197.4	165.4	102.3					
5000			208.0	133.1	98.5				
5400				165.9	129.2	94.8			
5800				201.1	161.7	125.3	87.1		
6200					196.6	157.5	105.3	73.7	
6600						192.1	124.5	91.6	
7000							145.0	110.0	78.2
7400							167.1	129.5	96.1
7800							191.1	150.4	114.8
8200								172.9	134.6
8600								197.5	155.8
9000									178.8
9400									203.9

1. **Enter Weight Adjustment table with reported braking action and dry field/obstacle limit weight to obtain slippery runway weight adjustment.**
2. **Adjust “Good” field length available by -80 ft/+70 ft for every 5°C above/below 4°C.**
   Adjust “Medium” field length available by -80 ft/+70 ft for every 5°C above/below 4°C.
   Adjust “Poor” field length available by -120 ft/+110 ft for every 5°C above/below 4°C.
3. **Find V1(MCG) limit weight for adjusted field length and pressure altitude.**
4. **Max allowable slippery runway limited weight is lesser of weights from 1 and 3.**

ADVISORY INFORMATION

Slippery Runway Takeoff
Maximum Reverse Thrust
V1 Adjustment (KIAS)

WEIGHT (1000 LB)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
190	-6	-3	-1	-15	-13	-10	-27	-25	-22
180	-7	-4	-2	-17	-14	-12	-29	-27	-24
170	-8	-5	-3	-18	-16	-13	-31	-28	-26
160	-8	-6	-3	-20	-17	-15	-33	-30	-28
150	-9	-7	-4	-21	-19	-16	-35	-32	-30
140	-10	-8	-5	-23	-20	-18	-37	-34	-32
130	-11	-9	-6	-24	-21	-19	-39	-36	-34
120	-12	-10	-7	-25	-23	-20	-40	-38	-35
110	-13	-10	-8	-27	-24	-22	-42	-39	-37
100	-14	-11	-9	-28	-25	-23	-43	-40	-38
90	-15	-12	-10	-29	-26	-24	-44	-41	-39

1. **Obtain V1, VR and V2 for the actual weight using the Dry Runway Takeoff Speeds table.**
2. **If V1(MCG) limited, set V1 = V1(MCG). If not V1(MCG) limited, enter V1 Adjustment table with the actual weight to obtain V1 speed adjustment. If adjusted V1 is less than V1(MCG), set V1 = V1(MCG).V1 not to exceed VR.**

ADVISORY INFORMATION

Slippery Runway Takeoff
No Reverse Thrust
Weight Adjustments (1000 LB)

DRY FIELD/OBSTACLE LIMIT WEIGHT (1000 LB)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
190	-3.7	-3.7	-3.7	-17.2	-17.2	-17.2	-28.7	-28.7	-28.7
180	-4.3	-4.3	-4.3	-16.9	-16.9	-16.9	-27.7	-27.7	-27.7
170	-4.8	-4.8	-4.8	-16.5	-16.5	-16.5	-26.5	-26.5	-26.5
160	-5.1	-5.1	-5.1	-15.9	-15.9	-15.9	-25.2	-25.2	-25.2
150	-5.2	-5.2	-5.2	-15.3	-15.3	-15.3	-23.8	-23.8	-23.8
140	-5.2	-5.2	-5.2	-14.5	-14.5	-14.5	-22.2	-22.2	-22.2
130	-5.0	-5.0	-5.0	-13.6	-13.6	-13.6	-20.6	-20.6	-20.6
120	-4.6	-4.6	-4.6	-12.6	-12.6	-12.6	-18.8	-18.8	-18.8
110	-4.2	-4.2	-4.2	-11.5	-11.5	-11.5	-17.0	-17.0	-17.0
100	-3.8	-3.8	-3.8	-10.5	-10.5	-10.5	-15.3	-15.3	-15.3
90	-3.4	-3.4	-3.4	-9.5	-9.5	-9.5	-13.5	-13.5	-13.5

V1(MCG) Limit Weight (1000 LB)

ADJUSTED FIELD LENGTH (FT)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
3800	118.4	78.2							
4200	167.8	131.2	91.8						
4600		179.5	143.7						
5000			191.0						
5400				93.8					
5800				138.3	88.1				
6200				182.0	132.8	82.5			
6600					176.6	127.2			
7000						171.2			
8200							90.7		
8600							117.9	70.7	
9000							147.1	97.3	
9400							178.5	125.0	77.4
9800								154.7	104.1
10200								186.8	132.3
10600									162.5
11000									195.3

1. **Enter Weight Adjustment table with reported braking action and dry field/obstacle limit weight to obtain slippery runway weight adjustment.**
2. **Adjust "Good" field length available by -90 ft/+80 ft for every 5°C above/below 4°C.**
   Adjust "Medium" field length available by -90 ft/+80 ft for every 5°C above/below 4°C.
   Adjust "Poor" field length available by -160 ft/+150 ft for every 5°C above/below 4°C.
3. **Find V1(MCG) limit weight for adjusted field length and pressure altitude.**
4. **Max allowable slippery runway limited weight is lesser of weights from 1 and 3.**

ADVISORY INFORMATION

Slippery Runway Takeoff
No Reverse Thrust
V1 Adjustment (KIAS)

WEIGHT (1000 LB)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
190	-7	-2	0	-20	-15	-10	-37	-32	-27
180	-8	-3	0	-21	-16	-11	-40	-35	-30
170	-9	-4	0	-23	-18	-13	-42	-37	-32
160	-10	-5	0	-25	-20	-15	-45	-40	-35
150	-12	-7	-2	-27	-22	-17	-47	-42	-37
140	-13	-8	-3	-29	-24	-19	-50	-45	-40
130	-14	-9	-4	-31	-26	-21	-52	-47	-42
120	-15	-10	-5	-32	-27	-22	-54	-49	-44
110	-16	-11	-6	-34	-29	-24	-56	-51	-46
100	-17	-12	-7	-36	-31	-26	-57	-52	-47
90	-18	-13	-8	-37	-32	-27	-58	-53	-48

1. **Obtain V1, VR and V2 for the actual weight using the Dry Runway Takeoff Speeds table.**
2. **If V1(MCG) limited, set V1 = V1(MCG). If not V1(MCG) limited, enter V1 Adjustment table with the actual weight to obtain V1 speed adjustment. If adjusted V1 is less than V1(MCG), set V1 = V1(MCG). V1 not to exceed VR.**

Takeoff %N1

Based on engine bleeds for packs on, engine and wing anti-ice on or off

OAT (°C)	AIRPORT PRESSURE ALTITUDE (FT)												
	-2000	-1000	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
60	94.8	95.4	95.8	95.9	96.0	96.1	96.2	96.3	96.2	95.9	95.8	95.7	95.7
55	95.4	96.0	96.5	96.6	96.7	96.8	96.9	97.1	96.9	96.6	96.3	95.7	95.0
50	96.0	96.6	97.1	97.3	97.4	97.6	97.7	97.8	97.7	97.4	97.1	96.6	96.1
45	96.8	97.4	97.8	98.0	98.1	98.3	98.4	98.5	98.4	98.1	97.8	97.5	97.1
40	97.4	98.1	98.6	98.7	98.8	98.9	99.0	99.2	99.1	98.8	98.5	98.4	98.1
35	98.0	98.7	99.4	99.5	99.6	99.7	99.8	99.9	99.8	99.5	99.2	99.1	99.0
30	97.6	98.8	100.3	100.3	100.4	100.4	100.5	100.5	100.4	100.3	100.0	99.9	99.9
25	96.8	98.1	99.5	100.1	100.7	100.8	100.7	100.7	100.7	100.7	100.6	100.6	100.7
20	96.0	97.3	98.8	99.3	99.9	100.2	100.5	100.8	100.8	100.9	100.8	100.8	100.8
15	95.2	96.5	98.0	98.6	99.2	99.5	99.8	100.1	100.5	100.9	101.1	101.1	101.1
10	94.5	95.8	97.2	97.8	98.4	98.7	99.0	99.4	99.7	100.1	100.5	101.0	101.5
5	93.7	95.0	96.4	97.0	97.6	98.0	98.3	98.6	99.0	99.4	99.8	100.3	100.7
0	92.9	94.2	95.6	96.3	96.9	97.2	97.5	97.9	98.2	98.6	99.0	99.5	100.0
-5	92.0	93.4	94.8	95.5	96.1	96.4	96.7	97.1	97.5	97.9	98.3	98.7	99.2
-10	91.2	92.6	94.0	94.7	95.3	95.6	96.0	96.3	96.7	97.1	97.5	98.0	98.4
-15	90.4	91.7	93.2	93.9	94.5	94.8	95.2	95.6	95.9	96.3	96.7	97.2	97.6
-20	89.6	90.9	92.4	93.0	93.7	94.0	94.4	94.8	95.2	95.6	95.9	96.4	96.8
-25	88.7	90.1	91.6	92.2	92.9	93.2	93.6	94.0	94.4	94.8	95.2	95.6	96.0
-30	87.9	89.2	90.7	91.4	92.0	92.4	92.8	93.2	93.6	94.0	94.3	94.8	95.2
-35	87.0	88.4	89.9	90.5	91.2	91.6	91.9	92.4	92.8	93.1	93.5	94.0	94.4
-40	86.1	87.5	89.0	89.7	90.3	90.7	91.1	91.5	91.9	92.3	92.7	93.1	93.6
-45	85.3	86.6	88.2	88.8	89.5	89.9	90.3	90.7	91.1	91.5	91.9	92.3	92.7
-50	84.4	85.7	87.3	87.9	88.6	89.0	89.4	89.9	90.3	90.6	91.0	91.5	91.9

%N1 Adjustments for Engine Bleeds

BLEED CONFIGURATION	AIRPORT PRESSURE ALTITUDE (FT)												
	-2000	-1000	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
PACKS OFF	0.7	0.7	0.7	0.7	0.7	0.7	0.8	0.8	0.8	0.8	0.8	0.9	1.0

Assumed Temperature Reduced Thrust

Maximum Assumed Temperature (Table 1 of 3)

Based on 25% Takeoff Thrust Reduction

OAT (°C)	AIRPORT PRESSURE ALTITUDE (FT)											
	-1000	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
55	73	71	69	67								
50	73	71	69	67	65	63						
45	73	71	69	67	65	63	61	59	57			
40	73	71	69	67	65	63	61	59	57	55		
35	71	71	69	67	65	63	61	59	57	55	53	
30	69	67	67	67	65	63	61	59	57	55	53	51
25	69	67	66	64	65	63	61	59	57	55	53	51
20	69	67	66	64	64	63	61	59	57	55	53	51
15	69	67	66	64	64	63	61	59	57	55	53	51
10 & BELOW	69	67	66	64	64	63	61	59	57	55	53	51

Takeoff %N1 (Table 2 of 3)

Based on engine bleed for packs on, engine and wing anti-ice on or off

ASSUMED TEMP (°C)	AIRPORT PRESSURE ALTITUDE (FT)											
	-1000	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
75	93.4	93.7	94.2	94.7	95.4	96.1	96.9	97.3	97.6	97.8	97.8	97.7
70	94.1	94.4	94.4	94.4	94.7	95.4	96.2	96.6	96.9	97.1	97.1	97.1
65	94.8	95.1	95.2	95.2	95.3	95.4	95.5	96.0	96.2	96.5	96.4	96.4
60	95.4	95.8	95.9	96.0	96.1	96.2	96.3	96.2	95.9	95.8	95.7	95.7
55	96.0	96.5	96.6	96.7	96.8	96.9	97.1	96.9	96.6	96.3	95.7	95.0
50	96.6	97.1	97.3	97.4	97.6	97.7	97.8	97.7	97.4	97.1	96.6	96.1
45	97.4	97.8	98.0	98.1	98.3	98.4	98.5	98.4	98.1	97.8	97.5	97.1
40	98.1	98.6	98.7	98.8	98.9	99.0	99.2	99.1	98.8	98.5	98.4	98.1
35	98.7	99.4	99.5	99.6	99.7	99.8	99.9	99.8	99.5	99.2	99.1	99.0
30	98.8	100.3	100.3	100.4	100.4	100.5	100.5	100.4	100.3	100.0	99.9	99.9
25	98.1	99.5	100.1	100.7	100.8	100.7	100.7	100.7	100.7	100.6	100.6	100.7
20	97.3	98.8	99.3	99.9	100.2	100.5	100.8	100.8	100.9	100.8	100.8	100.8
15	96.5	98.0	98.6	99.2	99.5	99.8	100.1	100.5	100.9	101.1	101.1	101.1
10	95.8	97.2	97.8	98.4	98.7	99.0	99.4	99.7	100.1	100.5	101.0	101.5
MINIMUM ASSUMED TEMP (°C)	32	30	28	26	24	22	20	18	16	15	12	10

With engine bleed for packs off, increase %N1 by 1.0.

Assumed Temperature Reduced Thrust

%N1 Adjustment for Temperature Difference (Table 3 of 3)

ASSUMED TEMP MINUS OAT (°C)	OUTSIDE AIR TEMPERATURE (°C)													
	-40	-20	0	5	10	15	20	25	30	35	40	45	50	55
110	14.9													
100	14.9	10.9												
90	14.0	11.7												
80	12.9	11.6	7.8											
70	11.2	10.7	8.6	7.8	6.3									
60	9.2	9.5	8.5	8.4	7.1	6.3	4.9							
50	7.8	7.8	7.5	7.1	6.9	7.0	5.6	4.9	3.4					
40		6.0	6.2	6.1	5.9	5.8	5.7	5.6	4.7	4.4	5.3			
30		4.6	4.6	4.6	4.6	4.5	4.4	4.3	4.3	4.2	4.1	4.0	3.9	
20			2.9	3.0	3.0	3.0	3.0	3.0	2.9	2.9	2.8	2.8	2.7	2.6
10			1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.4	1.4	1.4	1.4
0			0	0	0	0	0	0	0	0	0	0	0	0

1. **Determine Maximum Assumed Temperature allowed from Table 1.**
2. **Find Maximum %N1 from Table 2 using the desired assumed temperature (no greater than temperature from Table 1).**
3. **Use the difference between assumed temperature and OAT to determine the %N1 adjustment from Table 3.**
4. **Subtract %N1 adjustment from Maximum %N1 in Table 2.**

Takeoff Speeds - Dry Runway (24K Derate)

V1, VR, V2 for Max Takeoff Thrust

WEIGHT (1000 LB)	FLAPS 1			FLAPS 5			FLAPS 10			FLAPS 15			FLAPS 25		
	V1	VR	V2	V1	VR	V2	V1	VR	V2	V1	VR	V2	V1	VR	V2
190	174	174	178	165	167	171									
180	168	170	174	161	162	167									
170	163	164	170	156	157	163	155	155	160						
160	158	159	166	151	152	159	150	150	156	146	147	152	144	144	149
150	152	153	161	145	146	155	144	145	152	141	142	148	138	139	145
140	146	147	156	139	141	150	138	139	147	135	136	144	133	133	141
130	140	141	151	133	134	145	132	133	143	129	130	139	127	127	137
120	133	134	146	127	128	140	126	127	138	123	124	135	121	121	132
110	126	127	140	120	121	134	119	120	132	116	117	129	114	115	127
100	119	119	134	113	114	128	112	113	127	110	110	124	107	108	122
90	111	112	128	106	106	123	105	105	121	103	103	118	100	101	116

Check V1(MCG).

V1, VR, V2 Adjustments*

TEMP		V1							VR							V2						
		PRESS ALT (1000 FT)							PRESS ALT (1000 FT)							PRESS ALT (1000 FT)						
°C	°F	-2	0	2	4	6	8	10	-2	0	2	4	6	8	10	-2	0	2	4	6	8	10
70	158	5	6						5	6						-2	-3					
60	140	4	5	6	7				4	4	6	7				-2	-2	-2	-3			
50	122	3	3	4	5	6	8	9	2	3	4	5	6	8	9	-1	-1	-2	-2	-3	-3	-4
40	104	1	2	3	4	5	6	7	1	2	3	4	5	6	8	0	-1	-1	-2	-2	-3	-3
30	86	0	0	1	3	4	5	6	0	0	1	3	4	5	6	0	0	-1	-1	-2	-2	-2
20	68	0	0	1	1	2	4	5	0	0	1	1	2	4	5	0	0	0	0	-1	-1	-2
-60	-76	0	0	1	1	2	3	4	0	0	1	1	2	3	4	0	0	0	0	-1	-1	-1

Slope and Wind V1 Adjustments*

WEIGHT (1000 LB)	SLOPE (%)					WIND (KTS)							
	-2	-1	0	1	2	-15	-10	-5	0	10	20	30	40
190	-4	-2	0	0	0	-2	-1	-1	0	0	0	0	0
170	-3	-2	0	0	1	-2	-1	-1	0	0	0	1	1
150	-2	-1	0	1	1	-2	-1	0	0	0	1	1	1
130	-1	-1	0	1	1	-1	-1	0	0	0	1	1	1
110	-1	0	0	1	1	-1	-1	0	0	0	0	0	1
90	0	0	0	0	0	-1	-1	0	0	0	0	0	0

***V1 not to exceed VR.**

V1(MCG)

TEMP		PRESSURE ALTITUDE (FT)						
°C	°F	-2000	0	2000	4000	6000	8000	10000
70	158	88	86					
60	140	88	86	84	83			
50	122	90	88	84	83	81	79	77
40	104	94	92	89	85	82	79	77
30	86	97	97	93	89	86	82	79
20	68	98	97	95	93	90	86	82
-60	-76	99	99	96	94	91	89	86

Takeoff Speeds - Wet Runway (24K Derate)

V1, VR, V2 for Max Takeoff Thrust

WEIGHT (1000 LB)	FLAPS 1			FLAPS 5			FLAPS 10			FLAPS 15			FLAPS 25		
	V1	VR	V2	V1	VR	V2	V1	VR	V2	V1	VR	V2	V1	VR	V2
190	169	175	178	160	167	171									
180	163	170	174	155	162	167									
170	157	164	170	149	157	163	149	155	160						
160	151	159	166	143	152	159	143	150	156	140	147	152	138	144	149
150	145	153	161	137	146	155	137	145	152	134	142	148	132	139	145
140	138	147	156	131	141	150	131	139	147	128	136	144	126	133	141
130	131	141	151	125	134	145	124	133	143	122	130	139	119	127	137
120	124	134	146	118	128	140	118	127	138	115	124	135	113	121	132
110	117	127	140	111	121	134	111	120	132	108	117	129	106	115	127
100	109	119	134	104	114	128	103	113	127	101	110	124	99	108	122
90	102	112	128	96	106	123	96	105	121	94	103	118	92	101	116

Check V1(MCG).

V1, VR, V2 Adjustment*

TEMP		V1							VR							V2						
		PRESS ALT (1000 FT)							PRESS ALT (1000 FT)							PRESS ALT (1000 FT)						
°C	°F	-2	0	2	4	6	8	10	-2	0	2	4	6	8	10	-2	0	2	4	6	8	10
70	158	8	9						5	6						-2	-3					
60	140	6	7	8	10				4	4	6	7				-2	-2	-2	-3			
50	122	4	5	6	8	9	11	13	2	3	4	5	6	8	9	-1	-1	-2	-2	-3	-3	-4
40	104	1	2	4	5	7	8	10	1	2	3	4	5	6	8	0	-1	-1	-2	-2	-3	-3
30	86	0	0	2	3	5	6	8	0	0	1	3	4	5	6	0	0	-1	-1	-2	-2	-2
20	68	0	0	1	2	3	4	6	0	0	1	1	2	4	5	0	0	0	0	-1	-1	-2
-60	-76	0	0	1	2	2	4	5	0	0	1	1	2	3	4	0	0	0	0	-1	-1	-1

Slope and Wind V1 Adjustment*

WEIGHT (1000 LB)	SLOPE (%)					WIND (KTS)							
	-2	-1	0	1	2	-15	-10	-5	0	10	20	30	40
190	-6	-3	0	3	6	-3	-2	-1	0	0	1	2	2
180	-5	-3	0	3	5	-3	-2	-1	0	0	1	2	2
170	-5	-3	0	3	5	-3	-2	-1	0	1	1	2	2
160	-5	-2	0	2	5	-3	-2	-1	0	1	1	2	2
150	-4	-2	0	2	4	-4	-2	-1	0	1	1	2	3
140	-4	-2	0	2	4	-4	-2	-1	0	1	1	2	3
130	-3	-2	0	2	4	-4	-2	-1	0	1	2	2	3
120	-3	-1	0	2	3	-4	-3	-1	0	1	2	2	3
110	-3	-1	0	1	3	-4	-3	-1	0	1	2	3	3
100	-2	-1	0	1	2	-4	-3	-1	0	1	2	3	4
90	-2	-1	0	1	2	-5	-3	-1	0	1	2	3	4

***V1 not to exceed VR.**

V1(MCG)

TEMP		PRESSURE ALTITUDE (FT)						
°C	°F	-2000	0	2000	4000	6000	8000	10000
70	158	88	86					
60	140	88	86	84	83			
50	122	90	88	84	83	81	79	77
40	104	94	92	89	85	82	79	77
30	86	97	97	93	89	86	82	79
20	68	98	97	95	93	90	86	82
-60	-76	99	99	96	94	91	89	86

Stab Trim Setting (24K Derate)

Flaps 1 and 5

WEIGHT (1000 LB)	C.G. (%MAC)									
	6	8	12	16	20	24	28	30	33	36
180	8 1/2	8 1/4	7 1/2	7	6 1/4	5 1/2	5	4 3/4	4 1/4	3 3/4
160	8	7 3/4	7	6 1/2	6	5 1/4	4 3/4	4 1/2	4	3 1/2
140	7 1/2	7 1/4	6 3/4	6	5 1/2	5	4 1/4	4	3 3/4	3 1/4
120	7	6 3/4	6	5 1/2	5	4 1/2	4	3 3/4	3 1/4	3
100	6 1/4	6	5 1/2	5	4 1/2	4	3 1/2	3 1/4	2 3/4	2 3/4
70	6 1/4	6	5 1/2	5	4 1/2	4	3 1/2	3 1/4	2 3/4	2 3/4

Flaps 10, 15 and 25

WEIGHT (1000 LB)	C.G. (%MAC)										
	6	8	12	16	20	24	27	30	33	35	36
180	8	7 3/4	7	6 1/4	5 3/4	5	4 1/2	4	3 1/2	3 1/4	3
160	7 1/2	7 1/4	6 1/2	6	5 1/4	4 1/2	4	3 1/2	3 1/4	2 3/4	2 3/4
140	7	6 1/2	6	5 1/2	4 3/4	4 1/4	3 3/4	3 1/4	2 3/4	2 3/4	2 3/4
120	6 1/4	6	5 1/2	4 3/4	4 1/4	3 3/4	3 1/4	2 3/4	2 3/4	2 3/4	2 3/4
100	5 3/4	5 1/2	4 3/4	4 1/4	3 3/4	3 1/4	2 3/4	2 3/4	2 3/4	2 3/4	2 3/4
70	5 3/4	5 1/2	4 3/4	4 1/4	3 3/4	3 1/4	2 3/4	2 3/4	2 3/4	2 3/4	2 3/4

ADVISORY INFORMATION

Slush/Standing Water Takeoff (24K Derate)
Maximum Reverse Thrust
Weight Adjustments (1000 LB)

24K DERATE DRY FIELD/OBSTACLE LIMIT WEIGHT (1000 LB)	SLUSH/STANDING WATER DEPTH								
	0.12 INCHES (3 mm)			0.25 INCHES (6 mm)			0.50 INCHES (13 mm)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
190	-25.2	-29.7	-34.2	-31.1	-35.6	-40.1	-44.6	-49.1	-53.6
180	-23.2	-27.7	-32.2	-28.2	-32.7	-37.2	-39.5	-44.0	-48.5
170	-21.2	-25.7	-30.2	-25.4	-29.9	-34.4	-34.8	-39.3	-43.8
160	-19.1	-23.6	-28.1	-22.6	-27.1	-31.6	-30.3	-34.8	-39.3
150	-17.1	-21.6	-26.1	-20.0	-24.5	-29.0	-26.2	-30.7	-35.2
140	-15.1	-19.6	-24.1	-17.4	-21.9	-26.4	-22.3	-26.8	-31.3
130	-13.1	-17.6	-22.1	-14.9	-19.4	-23.9	-18.8	-23.3	-27.8
120	-11.1	-15.6	-20.1	-12.5	-17.0	-21.5	-15.6	-20.1	-24.6
110	-9.0	-13.5	-18.0	-10.1	-14.6	-19.1	-12.6	-17.1	-21.6
100	-7.0	-11.5	-16.0	-7.8	-12.3	-16.8	-9.6	-14.1	-18.6
90	-5.0	-9.5	-14.0	-5.4	-9.9	-14.4	-6.7	-11.2	-15.7

V1(MCG) Limit Weight (1000 LB)

ADJUSTED FIELD LENGTH (FT)	SLUSH/STANDING WATER DEPTH								
	0.12 INCHES (3 mm)			0.25 INCHES (6 mm)			0.50 INCHES (13 mm)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
3800							79.1		
4200	85.4			92.5			104.6	72.9	
4600	113.1	78.7		120.0	85.9		131.6	98.1	
5000	142.3	106.0	72.0	149.1	113.0	79.3	160.5	124.7	91.7
5400	173.3	134.8	99.1	180.0	141.6	106.1	191.7	153.1	117.9
5800	206.1	165.3	127.5		172.1	134.3		183.6	145.8
6200		197.9	157.5		204.4	164.3			175.8
6600			189.6			196.2			207.8

1. **Enter Weight Adjustment table with slush/standing water depth and 24K Derate dry field/obstacle limit weight to obtain slush/standing water weight adjustment.**
2. **Adjust field length available by -90 ft/+90 ft for every 5°C above/below 4°C.**
3. **Find V1(MCG) limit weight for adjusted field length and pressure altitude.**
4. **Max allowable slush/standing water limited weight is lesser of weights from 1 and 3.**

ADVISORY INFORMATION

Slush/Standing Water Takeoff (24K Derate)
Maximum Reverse Thrust
V1 Adjustment (KIAS)

WEIGHT (1000 LB)	SLUSH/STANDING WATER DEPTH								
	0.12 INCHES (3 mm)			0.25 INCHES (6 mm)			0.50 INCHES (13 mm)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
190	-14	-9	-4	-8	-3	0	0	0	0
180	-15	-10	-5	-9	-4	0	0	0	0
170	-17	-12	-7	-10	-5	0	0	0	0
160	-18	-13	-8	-12	-7	-2	0	0	0
150	-19	-14	-9	-13	-8	-3	0	0	0
140	-20	-15	-10	-15	-10	-5	-2	0	0
130	-21	-16	-11	-17	-12	-7	-7	-2	0
120	-23	-18	-13	-19	-14	-9	-11	-6	-1
110	-24	-19	-14	-21	-16	-11	-14	-9	-4
100	-24	-19	-14	-22	-17	-12	-17	-12	-7
90	-24	-19	-14	-22	-17	-12	-18	-13	-8

1. **Obtain V1, VR and V2 for the actual weight using the 24K Derate Dry Runway Takeoff Speeds table.**
2. **If V1(MCG) limited, set V1 = V1(MCG). If not V1(MCG) limited, enter V1 Adjustment table with the actual weight to obtain V1 speed adjustment. If adjusted V1 is less than V1(MCG), set V1 = V1(MCG). V1 not to exceed VR.**

ADVISORY INFORMATION

Slush/Standing Water Takeoff (24K Derate)

No Reverse Thrust

Weight Adjustments (1000 LB)

24K DERATE DRY FIELD/OBSTACLE LIMIT WEIGHT (1000 LB)	SLUSH/STANDING WATER DEPTH								
	0.12 INCHES (3 mm)			0.25 INCHES (6 mm)			0.50 INCHES (13 mm)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
190	-30.9	-36.9	-42.9	-37.2	-43.2	-49.2	-51.3	-57.3	-63.3
180	-28.2	-34.2	-40.2	-33.5	-39.5	-45.5	-45.2	-51.2	-57.2
170	-25.6	-31.6	-37.6	-30.0	-36.0	-42.0	-39.6	-45.6	-51.6
160	-23.1	-29.1	-35.1	-26.7	-32.7	-38.7	-34.5	-40.5	-46.5
150	-20.7	-26.7	-32.7	-23.6	-29.6	-35.6	-29.8	-35.8	-41.8
140	-18.4	-24.4	-30.4	-20.7	-26.7	-32.7	-25.5	-31.5	-37.5
130	-16.1	-22.1	-28.1	-17.9	-23.9	-29.9	-21.8	-27.8	-33.8
120	-13.8	-19.8	-25.8	-15.3	-21.3	-27.3	-18.4	-24.4	-30.4
110	-11.7	-17.7	-23.7	-12.8	-18.8	-24.8	-15.4	-21.4	-27.4
100	-9.5	-15.5	-21.5	-10.4	-16.4	-22.4	-12.5	-18.5	-24.5
90	-7.3	-13.3	-19.3	-7.9	-13.9	-19.9	-9.5	-15.5	-21.5

V1(MCG) Limit Weight (1000 LB)

ADJUSTED FIELD LENGTH (FT)	SLUSH/STANDING WATER DEPTH								
	0.12 INCHES (3 mm)			0.25 INCHES (6 mm)			0.50 INCHES (13 mm)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
4600							82.1		
5000				83.3			112.0		
5400	99.4			117.7			143.8	93.2	
5800	137.4	76.2		153.7	96.0		178.0	123.7	74.9
6200	176.6	113.5		191.7	131.0	74.9		156.4	104.4
6600		151.9	90.0		167.7	108.9		191.5	135.7
7000		191.7	127.7		206.3	144.5			169.2
7400			166.7			182.0			205.2
7800			206.9						

1. **Enter Weight Adjustment table with slush/standing water depth and 24K Derate dry field/obstacle limit weight to obtain slush/standing water weight adjustment.**
2. **Adjust field length available by -120 ft/+110 ft for every 5°C above/below 4°C.**
3. **Find V1(MCG) limit weight for adjusted field length and pressure altitude.**
4. **Max allowable slush/standing water limited weight is lesser of weights from 1 and 3.**

ADVISORY INFORMATION

Slush/Standing Water Takeoff (24K Derate)
No Reverse Thrust
V1 Adjustment (KIAS)

WEIGHT (1000 LB)	SLUSH/STANDING WATER DEPTH								
	0.12 INCHES (3 mm)			0.25 INCHES (6 mm)			0.50 INCHES (13 mm)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
190	-21	-16	-11	-15	-10	-5	0	0	0
180	-21	-16	-11	-14	-9	-4	0	0	0
170	-22	-17	-12	-14	-9	-4	0	0	0
160	-24	-19	-14	-15	-10	-5	0	0	0
150	-25	-20	-15	-17	-12	-7	-1	0	0
140	-27	-22	-17	-20	-15	-10	-5	0	0
130	-29	-24	-19	-23	-18	-13	-10	-5	0
120	-30	-25	-20	-25	-20	-15	-15	-10	-5
110	-31	-26	-21	-27	-22	-17	-19	-14	-9
100	-31	-26	-21	-29	-24	-19	-23	-18	-13
90	-31	-26	-21	-29	-24	-19	-25	-20	-15

1. **Obtain V1, VR and V2 for the actual weight using the 24K Derate Dry Runway Takeoff Speeds table.**
2. **If V1(MCG) limited, set V1 = V1(MCG). If not V1(MCG) limited, enter V1 Adjustment table with the actual weight to obtain V1 speed adjustment. If adjusted V1 is less than V1(MCG), set V1 = V1(MCG). V1 not to exceed VR.**

ADVISORY INFORMATION

Slippery Runway Takeoff (24K Derate)
Maximum Reverse Thrust
Weight Adjustment (1000 LB)

24K DERATE DRY FIELD/OBSTACLE LIMIT WEIGHT (1000 LB)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
190	-1.6	-1.6	-1.6	-12.5	-12.5	-12.5	-22.5	-22.5	-22.5
180	-2.4	-2.4	-2.4	-12.7	-12.7	-12.7	-21.9	-21.9	-21.9
170	-3.0	-3.0	-3.0	-12.7	-12.7	-12.7	-21.1	-21.1	-21.1
160	-3.4	-3.4	-3.4	-12.4	-12.4	-12.4	-20.2	-20.2	-20.2
150	-3.6	-3.6	-3.6	-12.0	-12.0	-12.0	-19.2	-19.2	-19.2
140	-3.6	-3.6	-3.6	-11.4	-11.4	-11.4	-17.9	-17.9	-17.9
130	-3.4	-3.4	-3.4	-10.6	-10.6	-10.6	-16.6	-16.6	-16.6
120	-3.0	-3.0	-3.0	-9.7	-9.7	-9.7	-15.0	-15.0	-15.0
110	-2.6	-2.6	-2.6	-8.7	-8.7	-8.7	-13.5	-13.5	-13.5
100	-2.1	-2.1	-2.1	-7.7	-7.7	-7.7	-11.9	-11.9	-11.9
90	-1.7	-1.7	-1.7	-6.7	-6.7	-6.7	-10.4	-10.4	-10.4

V1(MCG) Limit Weight (1000 LB)

ADJUSTED FIELD LENGTH (FT)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
3000	71.4								
3400	117.4	77.2							
3800	161.1	123.0	83.0						
4200	202.6	166.4	128.5	88.1					
4600		207.7	171.7	119.4	80.4				
5000				152.2	111.4	72.7			
5400				186.8	143.8	103.5	81.0		
5800					178.0	135.6	99.6		
6200						169.3	119.2	81.0	
6600						204.9	140.2	99.6	
7000							163.0	119.2	81.0
7400							188.0	140.2	99.6
7800								163.0	119.2
8200								188.0	140.2
8600									163.0
9000									188.0

1. **Enter Weight Adjustment table with reported braking action and 24K Derate dry field/obstacle limit weight to obtain slippery runway weight adjustment.**
2. **Adjust "Good" field length available by -80 ft/+70 ft for every 5°C above/below 4°C.**
   Adjust "Medium" field length available by -80 ft/+70 ft for every 5°C above/below 4°C.
   Adjust "Poor" field length available by -110 ft/+100 ft for every 5°C above/below 4°C.
3. **Find V1(MCG) limit weight for adjusted field length and pressure altitude.**
4. **Max allowable slippery runway limited weight is lesser of weights from 1 and 3.**

ADVISORY INFORMATION

Slippery Runway Takeoff (24K Derate)
Maximum Reverse Thrust
V1 Adjustment (KIAS)

WEIGHT (1000 LB)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
190	-5	-2	0	-13	-11	-8	-24	-22	-19
180	-6	-3	-1	-15	-12	-10	-26	-23	-21
170	-7	-4	-2	-16	-13	-11	-27	-25	-22
160	-8	-5	-3	-17	-15	-12	-29	-27	-24
150	-8	-6	-3	-19	-16	-14	-31	-29	-26
140	-9	-7	-4	-20	-18	-15	-33	-31	-28
130	-10	-8	-5	-22	-19	-17	-35	-33	-30
120	-11	-9	-6	-23	-21	-18	-37	-35	-32
110	-12	-9	-7	-25	-22	-20	-39	-36	-34
100	-13	-10	-8	-26	-23	-21	-40	-38	-35
90	-13	-11	-8	-26	-24	-21	-41	-39	-36

1. **Obtain V1, VR and V2 for the actual weight using the 24K Derate Dry Runway Takeoff Speeds table.**
2. **If V1(MCG) limited, set V1 = V1(MCG). If not V1(MCG) limited, enter V1 Adjustment table with the actual weight to obtain V1 speed adjustment. If adjusted V1 is less than V1(MCG), set V1 = V1(MCG). V1 not to exceed VR.**

ADVISORY INFORMATION

Slippery Runway Takeoff (24K Derate)
No Reverse Thrust
Weight Adjustments (1000 LB)

DRY FIELD/OBSTACLE LIMIT WEIGHT (1000 LB)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
190	-3.8	-3.8	-3.8	-17.0	-17.0	-17.0	-29.2	-29.2	-29.2
180	-4.5	-4.5	-4.5	-16.9	-16.9	-16.9	-27.9	-27.9	-27.9
170	-4.9	-4.9	-4.9	-16.6	-16.6	-16.6	-26.5	-26.5	-26.5
160	-5.2	-5.2	-5.2	-16.1	-16.1	-16.1	-25.0	-25.0	-25.0
150	-5.2	-5.2	-5.2	-15.3	-15.3	-15.3	-23.4	-23.4	-23.4
140	-5.0	-5.0	-5.0	-14.4	-14.4	-14.4	-21.6	-21.6	-21.6
130	-4.6	-4.6	-4.6	-13.2	-13.2	-13.2	-19.7	-19.7	-19.7
120	-4.0	-4.0	-4.0	-11.9	-11.9	-11.9	-17.7	-17.7	-17.7
110	-3.3	-3.3	-3.3	-10.5	-10.5	-10.5	-15.7	-15.7	-15.7
100	-2.6	-2.6	-2.6	-9.1	-9.1	-9.1	-13.7	-13.7	-13.7
90	-2.0	-2.0	-2.0	-7.7	-7.7	-7.7	-11.7	-11.7	-11.7

V1(MCG) Limit Weight (1000 LB)

ADJUSTED FIELD LENGTH (FT)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
3400	89.0								
3800	141.8	96.0							
4200	187.9	147.8	102.9						
4600		193.3	153.8						
5000			198.7	81.7					
5400				127.7					
5800				171.9	110.7				
6200					155.5	93.4			
6600					198.6	138.9			
7000						182.6			
7800							95.0		
8200							123.1		
8600							153.9	85.0	
9000							188.3	112.3	
9400								142.0	75.0
9800								174.9	101.9
10200									130.5
10600									162.1
11000									197.7

1. **Enter Weight Adjustment table with reported braking action and 24K Derate dry field/obstacle limit weight to obtain slippery runway weight adjustment.**
2. **Adjust "Good" field length available by -90 ft/+80 ft for every 5°C above/below 4°C.**
   Adjust "Medium" field length available by -90 ft/+80 ft for every 5°C above/below 4°C.
   Adjust "Poor" field length available by -140 ft/+130 ft for every 5°C above/below 4°C.
3. **Find V1(MCG) limit weight for adjusted field length and pressure altitude.**
4. **Max allowable slippery runway limited weight is lesser of weights from 1 and 3.**

ADVISORY INFORMATION

Slippery Runway Takeoff (24K Derate)
No Reverse Thrust
V1 Adjustment (KIAS)

WEIGHT (1000 LB)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
190	-6	-4	-1	-17	-15	-12	-33	-31	-28
180	-7	-5	-2	-18	-16	-13	-35	-33	-30
170	-8	-6	-3	-20	-18	-15	-38	-35	-33
160	-9	-7	-4	-22	-19	-17	-40	-38	-35
150	-10	-8	-5	-24	-21	-19	-43	-40	-38
140	-11	-9	-6	-26	-23	-21	-45	-43	-40
130	-13	-10	-8	-28	-25	-23	-48	-46	-43
120	-14	-11	-9	-30	-27	-25	-50	-48	-45
110	-15	-12	-10	-32	-29	-27	-53	-50	-48
100	-16	-13	-11	-33	-31	-28	-54	-52	-49
90	-17	-14	-12	-34	-32	-29	-55	-53	-50

1. **Obtain V1, VR and V2 for the actual weight using the 24K Derate Dry Runway Takeoff Speeds table.**
2. **If V1(MCG) limited, set V1 = V1(MCG). If not V1(MCG) limited, enter V1 Adjustment table with the actual weight to obtain V1 speed adjustment. If adjusted V1 is less than V1(MCG), set V1 = V1(MCG). V1 not to exceed VR.**

Takeoff %N1 - (24K Derate)

Based on engine bleeds for packs on, engine and wing anti-ice on or off

OAT (°C)	AIRPORT PRESSURE ALTITUDE (FT)												
	-2000	-1000	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
60	90.3	90.8	91.2	91.2	91.1	91.1	91.0	91.1	91.2	91.0	91.2	91.3	91.4
55	91.0	91.6	92.0	92.0	92.0	91.9	91.9	91.9	92.0	91.9	91.7	91.3	90.8
50	91.8	92.4	92.8	92.8	92.8	92.7	92.7	92.7	92.7	92.6	92.6	92.2	91.8
45	92.6	93.2	93.6	93.6	93.6	93.6	93.5	93.5	93.5	93.4	93.3	93.1	92.8
40	93.4	94.0	94.4	94.4	94.4	94.3	94.3	94.2	94.2	94.1	94.1	94.0	93.8
35	94.2	94.8	95.2	95.2	95.2	95.1	95.1	95.0	95.0	94.9	94.8	94.8	94.7
30	93.8	95.0	96.1	96.0	96.0	96.0	95.9	95.8	95.8	95.7	95.7	95.6	95.6
25	93.1	94.3	95.4	95.9	96.4	96.7	96.7	96.6	96.6	96.5	96.4	96.4	96.3
20	92.3	93.5	94.6	95.1	95.7	96.3	96.9	97.6	97.5	97.5	97.4	97.3	97.2
15	91.6	92.7	93.8	94.3	94.9	95.5	96.1	96.8	97.5	98.2	98.6	98.6	98.5
10	90.8	92.0	93.0	93.6	94.1	94.7	95.3	96.0	96.7	97.5	98.2	99.1	100.0
5	90.0	91.2	92.2	92.8	93.3	93.9	94.5	95.2	95.9	96.7	97.4	98.4	99.3
0	89.2	90.4	91.4	92.0	92.5	93.1	93.7	94.4	95.1	95.9	96.7	97.6	98.5
-5	88.4	89.6	90.6	91.2	91.7	92.3	92.9	93.6	94.3	95.1	95.9	96.8	97.7
-10	87.6	88.8	89.8	90.4	90.9	91.5	92.1	92.8	93.5	94.3	95.1	96.1	97.0
-15	86.8	88.0	89.0	89.5	90.0	90.6	91.3	92.0	92.7	93.5	94.3	95.3	96.2
-20	86.0	87.1	88.2	88.7	89.2	89.8	90.5	91.2	91.9	92.6	93.5	94.5	95.4
-25	85.2	86.3	87.3	87.9	88.4	89.0	89.6	90.3	91.0	91.8	92.6	93.7	94.6
-30	84.4	85.5	86.5	87.0	87.5	88.1	88.8	89.5	90.2	91.0	91.8	92.9	93.8
-35	83.5	84.6	85.6	86.2	86.6	87.3	87.9	88.6	89.3	90.1	91.0	92.1	93.0
-40	82.7	83.8	84.8	85.3	85.8	86.4	87.0	87.8	88.5	89.3	90.1	91.2	92.2
-45	81.8	82.9	83.9	84.4	84.9	85.5	86.2	86.9	87.6	88.4	89.3	90.4	91.4
-50	81.0	82.0	83.0	83.5	84.0	84.6	85.3	86.0	86.7	87.5	88.4	89.5	90.5

%N1 Adjustments for Engine Bleeds

BLEED CONFIGURATION	AIRPORT PRESSURE ALTITUDE (FT)												
	-2000	-1000	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
PACKS OFF	0.7	0.7	0.7	0.7	0.7	0.7	0.8	0.8	0.8	0.8	0.8	0.9	1.0

Assumed Temperature Reduced Thrust (24K Derate)

Maximum Assumed Temperature (Table 1 of 3)

Based on 25% Takeoff Thrust Reduction

OAT (°C)	AIRPORT PRESSURE ALTITUDE (FT)											
	-1000	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
55	73	71	69	67								
50	73	71	69	67	65	63						
45	73	71	69	67	65	63	61	59	57			
40	73	71	69	67	65	63	61	59	57	55		
35	67	67	67	67	65	63	61	59	57	55	53	
30	64	61	62	61	61	61	61	59	57	55	53	51
25	64	61	59	57	56	56	57	57	57	55	53	51
20	64	61	59	57	56	54	53	53	53	53	52	51
15	64	61	59	57	56	54	53	52	50	49	48	47
10 & BELOW	64	61	59	57	56	54	53	52	50	48	45	43

Takeoff %N1 (Table 2 of 3)

Based on engine bleed for packs on, engine and wing anti-ice on or off

ASSUMED TEMP (°C)	AIRPORT PRESSURE ALTITUDE (FT)											
	-1000	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
75	88.3	88.6	89.1	89.6	90.2	90.8	91.5	92.2	92.7	93.1	93.3	93.4
70	89.1	89.5	89.4	89.3	89.6	90.1	90.8	91.6	92.0	92.5	92.6	92.7
65	90.0	90.4	90.3	90.2	90.2	90.1	90.2	90.9	91.4	91.8	91.9	92.1
60	90.8	91.2	91.2	91.1	91.1	91.0	91.1	91.2	91.0	91.2	91.3	91.4
55	91.6	92.0	92.0	92.0	91.9	91.9	91.9	92.0	91.9	91.7	91.3	90.8
50	92.4	92.8	92.8	92.8	92.7	92.7	92.7	92.7	92.6	92.6	92.2	91.8
45	93.2	93.6	93.6	93.6	93.6	93.5	93.5	93.5	93.4	93.3	93.1	92.8
40	94.0	94.4	94.4	94.4	94.3	94.3	94.2	94.2	94.1	94.1	94.0	93.8
35	94.8	95.2	95.2	95.2	95.1	95.1	95.0	95.0	94.9	94.8	94.8	94.7
30	95.0	96.1	96.0	96.0	96.0	95.9	95.8	95.8	95.7	95.7	95.6	95.6
25	94.3	95.4	95.9	96.4	96.7	96.7	96.6	96.6	96.5	96.4	96.4	96.3
20	93.5	94.6	95.1	95.7	96.3	96.9	97.6	97.5	97.5	97.4	97.3	97.2
15	92.7	93.8	94.3	94.9	95.5	96.1	96.8	97.5	98.2	98.6	98.6	98.5
10	92.0	93.0	93.6	94.1	94.7	95.3	96.0	96.7	97.5	98.2	99.1	100.0
MINIMUM ASSUMED TEMP (°C)	32	30	28	26	24	22	20	18	16	15	12	10

With engine bleed for packs off, increase %N1 by 1.0

Assumed Temperature Reduced Thrust (24K Derate)
%N1 Adjustment for Temperature Difference (Table 3 of 3)

ASSUMED TEMP MINUS OAT (°C)	OUTSIDE AIR TEMPERATURE (°C)													
	-40	-20	0	5	10	15	20	25	30	35	40	45	50	55
110	12.1													
100	11.3	8.5												
90	11.7	8.9												
80	12.5	8.0	5.5											
70	11.3	8.4	5.9	5.6	4.0									
60	9.7	9.2	4.8	4.7	4.4	4.2	2.6							
50	7.8	7.9	5.3	3.5	3.3	3.6	3.0	2.7	1.2					
40		6.4	6.0	5.5	3.7	3.2	3.7	3.0	2.8	3.0	3.7			
30		4.6	4.6	4.6	4.5	4.3	4.2	4.0	4.1	4.0	3.9	3.8	3.7	
20			3.1	3.1	3.1	3.0	2.9	2.9	2.8	2.7	2.7	2.6	2.6	2.5
10			1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.4	1.4	1.4	1.3	1.3
0			0	0	0	0	0	0	0	0	0	0	0	0

1. **Determine Maximum Assumed Temperature allowed from Table 1.**
2. **Find Maximum %N1 from Table 2 using the desired assumed temperature (no greater than temperature from Table 1).**
3. **Use the difference between assumed temperature and OAT to determine the %N1 adjustment from Table 3.**
4. **Subtract %N1 adjustment from Maximum %N1 in Table 2.**

Takeoff Speeds - Dry Runway (22K Derate)

V1, VR, V2

WEIGHT	FLAPS 1			FLAPS 5			FLAPS 10			FLAPS 15			FLAPS 25		
(1000 LB)	V1	VR	V2	V1	VR	V2	V1	VR	V2	V1	VR	V2	V1	VR	V2
180	170	171	174												
170	165	165	170	158	158	163									
160	159	160	165	152	153	158	151	151	155						
150	154	154	161	147	147	154	146	146	151	143	143	148	140	140	145
140	148	148	156	141	142	150	140	140	147	137	137	144	134	134	141
130	141	142	151	134	135	144	133	134	142	130	131	139	128	128	136
120	134	135	145	128	129	139	127	127	137	124	125	134	122	122	131
110	127	128	139	121	122	134	120	121	132	118	118	129	115	116	126
100	120	120	133	114	115	128	113	114	126	111	111	123	109	109	121
90	112	113	127	107	107	122	106	106	120	104	104	118	102	102	115

Check V1(MCG).

V1, VR, V2 Adjustments*

TEMP		V1							VR							V2						
		PRESS ALT (1000 FT)							PRESS ALT (1000 FT)							PRESS ALT (1000 FT)						
°C	°F	-2	0	2	4	6	8	10	-2	0	2	4	6	8	10	-2	0	2	4	6	8	10
70	158	5	6						5	6						-2	-2					
60	140	4	4	5	6				4	4	5	6				-2	-2	-2	-3			
50	122	2	3	4	5	6	7	8	2	3	4	5	6	7	9	-1	-1	-2	-2	-2	-3	-3
40	104	1	2	3	4	5	6	7	1	2	3	4	5	6	7	0	-1	-1	-1	-2	-2	-3
30	86	0	0	1	2	4	5	6	0	0	1	2	4	5	6	0	0	0	-1	-1	-2	-2
20	68	0	0	0	1	2	4	5	0	0	1	1	2	4	5	0	0	0	0	-1	-1	-2
-60	-76	0	0	0	1	2	3	3	0	0	1	1	2	3	3	0	0	0	0	-1	-1	-1

Slope and Wind V1 Adjustments*

WEIGHT	SLOPE (%)					WIND (KTS)							
(1000 LB)	-2	-1	0	1	2	-15	-10	-5	0	10	20	30	40
190	-4	-2	0	0	0	-1	-1	0	0	0	0	0	0
180	-4	-2	0	0	0	-1	-1	0	0	0	0	0	0
170	-3	-2	0	0	0	-1	-1	0	0	0	0	0	0
160	-3	-1	0	0	0	-1	-1	0	0	0	0	0	0
150	-2	-1	0	0	0	-1	-1	0	0	0	0	0	0
140	-2	-1	0	1	1	-1	-1	0	0	0	0	1	1
130	-1	-1	0	1	1	-1	-1	0	0	0	1	1	1
120	-1	0	0	0	1	-1	-1	0	0	0	0	0	1
110	-1	0	0	0	0	-1	-1	0	0	0	0	0	0
100	0	0	0	0	0	-1	-1	0	0	0	0	0	0
90	0	0	0	0	0	-1	0	0	0	0	0	0	0

***V1 not to exceed VR.**

V1(MCG)

TEMP		PRESSURE ALTITUDE (FT)						
°C	°F	-2000	0	2000	4000	6000	8000	10000
70	158	85	83					
60	140	85	83	82	80			
50	122	87	85	82	80	78	76	74
40	104	91	89	86	83	79	76	74
30	86	94	94	90	87	83	79	76
20	68	94	94	92	90	87	83	80
-60	-76	96	95	93	92	89	87	84

Takeoff Speeds - Wet Runway (22K Derate)

V1, VR, V2

WEIGHT	FLAPS 1			FLAPS 5			FLAPS 10			FLAPS 15			FLAPS 25		
(1000 LB)	V1	VR	V2	V1	VR	V2	V1	VR	V2	V1	VR	V2	V1	VR	V2
180	166	171	174												
170	160	165	170	152	158	163									
160	153	160	165	146	153	158	146	151	155						
150	147	154	161	140	147	154	139	146	151	136	143	148	134	140	145
140	141	148	156	133	142	150	133	140	147	130	137	144	128	134	141
130	133	142	151	127	135	144	126	134	142	124	131	139	121	128	136
120	126	135	145	120	129	139	120	127	137	117	125	134	115	122	131
110	119	128	139	113	122	134	113	121	132	110	118	129	108	116	126
100	112	120	133	106	115	128	106	114	126	103	111	123	101	109	121
90	104	112	127	99	107	122	98	106	120	96	104	118	94	102	115

Check V1(MCG).

V1, VR, V2 Adjustment*

TEMP		V1							VR							V2						
		PRESS ALT (1000 FT)							PRESS ALT (1000 FT)							PRESS ALT (1000 FT)						
°C	°F	-2	0	2	4	6	8	10	-2	0	2	4	6	8	10	-2	0	2	4	6	8	10
70	158	8	9						5	6						-2	-2					
60	140	6	7	8	9				4	4	5	6				-2	-2	-2	-3			
50	122	4	4	6	7	8	10	12	2	3	4	5	6	8	9	-1	-1	-2	-2	-2	-3	-3
40	104	1	2	3	5	6	8	10	1	2	3	4	5	6	7	0	-1	-1	-1	-2	-2	-3
30	86	0	0	1	3	4	6	7	0	0	1	2	4	5	6	0	0	0	-1	-1	-2	-2
20	68	0	0	0	1	2	4	6	0	0	1	1	2	4	5	0	0	0	0	-1	-1	-2
-60	-76	0	0	0	1	2	3	4	0	0	1	1	2	3	4	0	0	0	0	-1	-1	-1

Slope and Wind V1 Adjustment*

WEIGHT	SLOPE (%)					WIND (KTS)							
(1000 LB)	-2	-1	0	1	2	-15	-10	-5	0	10	20	30	40
180	-6	-3	0	3	5	-3	-2	-1	0	0	1	1	2
170	-5	-3	0	3	5	-3	-2	-1	0	0	1	2	2
160	-5	-2	0	3	5	-3	-2	-1	0	1	1	2	2
150	-4	-2	0	2	5	-3	-2	-1	0	1	1	2	2
140	-4	-2	0	2	4	-3	-2	-1	0	1	1	2	3
130	-4	-2	0	2	4	-4	-2	-1	0	1	1	2	3
120	-3	-2	0	2	3	-4	-2	-1	0	1	1	2	3
110	-3	-1	0	1	3	-4	-3	-1	0	1	2	2	3
100	-2	-1	0	1	2	-4	-3	-1	0	1	2	2	3
90	-2	-1	0	1	2	-5	-3	-2	0	1	2	3	3

***V1 not to exceed VR.**

V1(MCG)

TEMP		PRESSURE ALTITUDE (FT)						
°C	°F	-2000	0	2000	4000	6000	8000	10000
70	158	85	83					
60	140	85	83	82	80			
50	122	87	85	82	80	78	76	74
40	104	91	89	86	83	79	76	74
30	86	94	94	90	87	83	79	76
20	68	94	94	92	90	87	83	80
-60	-76	96	95	93	92	89	87	84

Stab Trim Setting (22K Derate)

Flaps 1 and 5

WEIGHT (1000 LB)	C.G. (%MAC)										
	6	7	8	12	16	20	24	28	32	35	36
180	8 1/2	8 1/2	8 1/4	7 3/4	7	6 1/2	5 3/4	5 1/4	4 1/2	4	4
160	8 1/4	8	8	7 1/4	6 3/4	6	5 1/2	4 3/4	4 1/4	3 3/4	3 1/2
140	7 3/4	7 1/2	7 1/2	6 3/4	6 1/4	5 3/4	5	4 1/2	4	3 1/2	3 1/2
120	7 1/4	7	7	6 1/2	5 3/4	5 1/4	4 3/4	4 1/4	3 3/4	3 1/4	3
100	6 1/2	6 1/4	6 1/4	5 3/4	5 1/4	4 3/4	4 1/4	3 3/4	3 1/4	2 3/4	2 3/4
70	6 1/2	6 1/4	6 1/4	5 3/4	5 1/4	4 3/4	4 1/4	3 3/4	3 1/4	2 3/4	2 3/4

Flaps 10, 15 and 25

WEIGHT (1000 LB)	C.G. (%MAC)										
	6	8	12	16	20	24	26	29	31	34	36
180	8	7 3/4	7 1/4	6 1/2	5 3/4	5 1/4	5	4 1/2	4	3 1/2	3 1/4
160	7 3/4	7 1/2	6 3/4	6	5 1/2	4 3/4	4 1/2	4	3 3/4	3 1/4	3
140	7	6 3/4	6 1/4	5 1/2	5	4 1/4	4	3 1/2	3 1/4	2 3/4	2 3/4
120	6 1/2	6 1/4	5 1/2	5	4 1/2	3 3/4	3 1/2	3	2 3/4	2 3/4	2 3/4
100	6	5 3/4	5 1/4	4 1/2	4	3 1/2	3 1/4	2 3/4	2 3/4	2 3/4	2 3/4
70	6	5 3/4	5 1/4	4 1/2	4	3 1/2	3 1/4	2 3/4	2 3/4	2 3/4	2 3/4

ADVISORY INFORMATION

Slush/Standing Water Takeoff (22K Derate)

Maximum Reverse Thrust

Weight Adjustments (1000 LB)

22K DERATE DRY FIELD/OBSTACLE LIMIT WEIGHT (1000 LB)	SLUSH/STANDING WATER DEPTH								
	0.12 INCHES (3 mm)			0.25 INCHES (6 mm)			0.50 INCHES (13 mm)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
190	-25.5	-30.5	-35.5	-31.7	-36.7	-41.7	-49.6	-54.6	-59.6
180	-23.5	-28.5	-33.5	-28.9	-33.9	-38.9	-43.5	-48.5	-53.5
170	-21.5	-26.5	-31.5	-26.1	-31.1	-36.1	-37.9	-42.9	-47.9
160	-19.5	-24.5	-29.5	-23.4	-28.4	-33.4	-32.7	-37.7	-42.7
150	-17.5	-22.5	-27.5	-20.7	-25.7	-30.7	-27.9	-32.9	-37.9
140	-15.5	-20.5	-25.5	-18.1	-23.1	-28.1	-23.7	-28.7	-33.7
130	-13.5	-18.5	-23.5	-15.6	-20.6	-25.6	-19.8	-24.8	-29.8
120	-11.5	-16.5	-21.5	-13.1	-18.1	-23.1	-16.5	-21.5	-26.5
110	-9.5	-14.5	-19.5	-10.7	-15.7	-20.7	-13.4	-18.4	-23.4
100	-7.5	-12.5	-17.5	-8.2	-13.2	-18.2	-10.4	-15.4	-20.4
90	-5.5	-10.5	-15.5	-5.8	-10.8	-15.8	-7.4	-12.4	-17.4

V1(MCG) Limit Weight (1000 LB)

ADJUSTED FIELD LENGTH (FT)	SLUSH/STANDING WATER DEPTH								
	0.12 INCHES (3 mm)			0.25 INCHES (6 mm)			0.50 INCHES (13 mm)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
3800	71.4			78.2			89.5		
4200	99.9			106.2	71.4		116.8	82.9	
4600	129.7	92.6		135.7	99.1		145.7	109.9	76.4
5000	161.3	122.1	85.5	167.1	128.2	92.1	176.5	138.3	103.0
5400	194.8	153.2	114.6	200.5	159.1	120.8	209.1	168.6	131.1
5800		186.2	145.2		192.0	151.2		200.9	160.8
6200			177.8			183.5			192.7

1. **Enter Weight Adjustment table with slush/standing water depth and 22K Derate dry field/obstacle limit weight to obtain slush/standing water weight adjustment.**
2. **Adjust field length available by -90 ft/+90 ft for every 5°C above/below 4°C.**
3. **Find V1(MCG) limit weight for adjusted field length and pressure altitude.**
4. **Max allowable slush/standing water limited weight is lesser of weights from 1 and 3.**

ADVISORY INFORMATION

Slush/Standing Water Takeoff (22K Derate)
Maximum Reverse Thrust
V1 Adjustment (KIAS)

WEIGHT (1000 LB)	SLUSH/STANDING WATER DEPTH								
	0.12 INCHES (3 mm)			0.25 INCHES (6 mm)			0.50 INCHES (13 mm)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
190	-12	-10	-7	-7	-4	-2	0	0	0
180	-13	-11	-8	-7	-5	-2	0	0	0
170	-14	-12	-9	-8	-5	-3	0	0	0
160	-15	-13	-10	-9	-7	-4	0	0	0
150	-17	-14	-12	-11	-8	-6	0	0	0
140	-18	-15	-13	-12	-10	-7	0	0	0
130	-19	-17	-14	-15	-12	-10	-4	-1	0
120	-21	-18	-16	-17	-14	-12	-8	-5	-3
110	-22	-19	-17	-19	-17	-14	-12	-9	-7
100	-22	-20	-17	-20	-18	-15	-15	-12	-10
90	-22	-20	-17	-20	-18	-15	-16	-14	-11

1. **Obtain V1, VR and V2 for the actual weight using the 22K Derate Dry Runway Takeoff Speeds table.**
2. **If V1(MCG) limited, set V1 = V1(MCG). If not V1(MCG) limited, enter V1 Adjustment table with the actual weight to obtain V1 speed adjustment. If adjusted V1 is less than V1(MCG), set V1 = V1(MCG). V1 not to exceed VR.**

ADVISORY INFORMATION

Slush/Standing Water Takeoff (22K Derate)

No Reverse Thrust

Weight Adjustments (1000 LB)

22K DERATE DRY FIELD/OBSTACLE LIMIT WEIGHT (1000 LB)	SLUSH/STANDING WATER DEPTH								
	0.12 INCHES (3 mm)			0.25 INCHES (6 mm)			0.50 INCHES (13 mm)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
190	-31.4	-37.4	-43.4	-38.2	-44.2	-50.2	-50.8	-56.8	-62.8
180	-28.8	-34.8	-40.8	-34.5	-40.5	-46.5	-45.6	-51.6	-57.6
170	-26.2	-32.2	-38.2	-31.0	-37.0	-43.0	-40.6	-46.6	-52.6
160	-23.7	-29.7	-35.7	-27.7	-33.7	-39.7	-35.9	-41.9	-47.9
150	-21.3	-27.3	-33.3	-24.5	-30.5	-36.5	-31.4	-37.4	-43.4
140	-18.9	-24.9	-30.9	-21.5	-27.5	-33.5	-27.1	-33.1	-39.1
130	-16.6	-22.6	-28.6	-18.6	-24.6	-30.6	-23.1	-29.1	-35.1
120	-14.3	-20.3	-26.3	-15.9	-21.9	-27.9	-19.4	-25.4	-31.4
110	-12.1	-18.1	-24.1	-13.3	-19.3	-25.3	-15.8	-21.8	-27.8
100	-9.9	-15.9	-21.9	-10.7	-16.7	-22.7	-12.2	-18.2	-24.2
90	-7.7	-13.7	-19.7	-8.1	-14.1	-20.1	-8.6	-14.6	-20.6

V1(MCG) Limit Weight (1000 LB)

ADJUSTED FIELD LENGTH (FT)	SLUSH/STANDING WATER DEPTH								
	0.12 INCHES (3 mm)			0.25 INCHES (6 mm)			0.50 INCHES (13 mm)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
4600				72.2			100.0		
5000	91.2			108.4			132.5	80.5	
5400	131.1			145.7	85.7		167.0	112.0	
5800	171.6	106.1		184.4	122.2		203.7	145.2	92.1
6200		146.2	81.3		160.0	99.2		180.6	124.2
6600		187.1	121.0		199.3	136.2			158.2
7000			161.4			174.6			194.4
7400			202.6						

1. **Enter Weight Adjustment table with slush/standing water depth and 22K Derate dry field/obstacle limit weight to obtain slush/standing water weight adjustment.**
2. **Adjust field length available by -110 ft/+100 ft for every 5°C above/below 4°C.**
3. **Find V1(MCG) limit weight for adjusted field length and pressure altitude.**
4. **Max allowable slush/standing water limited weight is lesser of weights from 1 and 3.**

ADVISORY INFORMATION

Slush/Standing Water Takeoff (22K Derate)
No Reverse Thrust
V1 Adjustment (KIAS)

WEIGHT (1000 LB)	SLUSH/STANDING WATER DEPTH								
	0.12 INCHES (3 mm)			0.25 INCHES (6 mm)			0.50 INCHES (13 mm)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
190	-21	-16	-11	-14	-9	-4	0	0	0
180	-20	-15	-10	-12	-7	-2	0	0	0
170	-20	-15	-10	-12	-7	-2	0	0	0
160	-21	-16	-11	-12	-7	-2	0	0	0
150	-22	-17	-12	-14	-9	-4	0	0	0
140	-24	-19	-14	-17	-12	-7	-2	0	0
130	-26	-21	-16	-20	-15	-10	-6	-1	0
120	-28	-23	-18	-22	-17	-12	-11	-6	-1
110	-29	-24	-19	-25	-20	-15	-16	-11	-6
100	-30	-25	-20	-26	-21	-16	-20	-15	-10
90	-29	-24	-19	-27	-22	-17	-22	-17	-12

1. **Obtain V1, VR and V2 for the actual weight using the 22K Derate Dry Runway Takeoff Speeds table.**
2. **If V1(MCG) limited, set V1 = V1(MCG). If not V1(MCG) limited, enter V1 Adjustment table with the actual weight to obtain V1 speed adjustment. If adjusted V1 is less than V1(MCG), set V1 = V1(MCG). V1 not to exceed VR.**

ADVISORY INFORMATION

Slippery Runway Takeoff (22K Derate)

Maximum Reverse Thrust

Weight Adjustment (1000 LB)

22K DERATE DRY FIELD/OBSTACLE LIMIT WEIGHT (1000 LB)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
190	-1.5	-1.5	-1.5	-12.3	-12.3	-12.3	-22.4	-22.4	-22.4
180	-2.3	-2.3	-2.3	-12.5	-12.5	-12.5	-21.7	-21.7	-21.7
170	-2.9	-2.9	-2.9	-12.4	-12.4	-12.4	-20.9	-20.9	-20.9
160	-3.3	-3.3	-3.3	-12.2	-12.2	-12.2	-20.0	-20.0	-20.0
150	-3.5	-3.5	-3.5	-11.8	-11.8	-11.8	-19.0	-19.0	-19.0
140	-3.5	-3.5	-3.5	-11.3	-11.3	-11.3	-17.8	-17.8	-17.8
130	-3.4	-3.4	-3.4	-10.5	-10.5	-10.5	-16.5	-16.5	-16.5
120	-3.0	-3.0	-3.0	-9.7	-9.7	-9.7	-15.1	-15.1	-15.1
110	-2.6	-2.6	-2.6	-8.8	-8.8	-8.8	-13.7	-13.7	-13.7
100	-2.2	-2.2	-2.2	-7.9	-7.9	-7.9	-12.2	-12.2	-12.2
90	-1.8	-1.8	-1.8	-6.9	-6.9	-6.9	-10.8	-10.8	-10.8

V1(MCG) Limit Weight (1000 LB)

ADJUSTED FIELD LENGTH (FT)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
3000	85.2								
3400	130.7	91.0							
3800	173.5	136.2	96.9						
4200		178.6	141.7	100.8					
4600			183.8	133.5	92.9				
5000				167.7	125.2	85.0	71.2		
5400				203.8	159.0	116.9	90.4		
5800					194.6	150.4	110.1	71.2	
6200						185.5	131.2	90.4	
6600							154.1	110.1	71.2
7000							179.3	131.2	90.4
7400							207.3	154.1	110.1
7800								179.3	131.2
8200								207.3	154.1
8600									179.3
9000									207.3

1. **Enter Weight Adjustment table with reported braking action and 22K Derate dry field/obstacle limit weight to obtain slippery runway weight adjustment.**
2. **Adjust “Good” field length available by -70 ft/+60 ft for every 5°C above/below 4°C.**
   Adjust “Medium” field length available by -70 ft/+60 ft for every 5°C above/below 4°C.
   Adjust “Poor” field length available by -100 ft/+90 ft for every 5°C above/below 4°C.
3. **Find V1(MCG) limit weight for adjusted field length and pressure altitude.**
4. **Max allowable slippery runway limited weight is lesser of weights from 1 and 3.**

ADVISORY INFORMATION

Slippery Runway Takeoff (22K Derate)
Maximum Reverse Thrust
V1 Adjustment (KIAS)

WEIGHT (1000 LB)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
190	-4	-2	0	-13	-10	-8	-23	-20	-18
180	-5	-3	0	-13	-11	-8	-23	-21	-18
170	-6	-3	-1	-14	-12	-9	-25	-22	-20
160	-7	-4	-2	-15	-13	-10	-26	-24	-21
150	-8	-5	-3	-17	-14	-12	-28	-26	-23
140	-9	-6	-4	-19	-16	-14	-30	-28	-25
130	-9	-7	-4	-20	-18	-15	-33	-30	-28
120	-10	-8	-5	-22	-19	-17	-35	-32	-30
110	-11	-8	-6	-23	-20	-18	-37	-34	-32
100	-12	-9	-7	-24	-21	-19	-38	-36	-33
90	-12	-9	-7	-25	-22	-20	-39	-37	-34

1. **Obtain V1, VR and V2 for the actual weight using the 22K Derate Dry Runway Takeoff Speeds table.**
2. **If V1(MCG) limited, set V1 = V1(MCG). If not V1(MCG) limited, enter V1 Adjustment table with the actual weight to obtain V1 speed adjustment. If adjusted V1 is less than V1(MCG), set V1 = V1(MCG). V1 not to exceed VR.**

ADVISORY INFORMATION

Slippery Runway Takeoff (22K Derate)

No Reverse Thrust

Weight Adjustments (1000 LB)

22K DERATE DRY FIELD/OBSTACLE LIMIT WEIGHT (1000 LB)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
190	-3.2	-3.2	-3.2	-16.2	-16.2	-16.2	-28.6	-28.6	-28.6
180	-4.1	-4.1	-4.1	-16.3	-16.3	-16.3	-27.6	-27.6	-27.6
170	-4.6	-4.6	-4.6	-16.1	-16.1	-16.1	-26.4	-26.4	-26.4
160	-5.0	-5.0	-5.0	-15.8	-15.8	-15.8	-25.0	-25.0	-25.0
150	-5.1	-5.1	-5.1	-15.2	-15.2	-15.2	-23.5	-23.5	-23.5
140	-5.0	-5.0	-5.0	-14.3	-14.3	-14.3	-21.8	-21.8	-21.8
130	-4.6	-4.6	-4.6	-13.3	-13.3	-13.3	-20.0	-20.0	-20.0
120	-4.1	-4.1	-4.1	-12.0	-12.0	-12.0	-18.0	-18.0	-18.0
110	-3.4	-3.4	-3.4	-10.7	-10.7	-10.7	-16.0	-16.0	-16.0
100	-2.8	-2.8	-2.8	-9.4	-9.4	-9.4	-13.9	-13.9	-13.9
90	-2.2	-2.2	-2.2	-8.1	-8.1	-8.1	-11.9	-11.9	-11.9

V1(MCG) Limit Weight (1000 LB)

ADJUSTED FIELD LENGTH (FT)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
3400	108.4								
3800	158.0	115.0							
4200	201.4	163.7	121.5						
4600		206.6	169.3						
5000				108.3					
5400				153.6	90.6				
5800				196.5	137.0	72.8			
6200					180.7	119.9			
6600						164.6			
7000						206.9			
7400							91.3		
7800							120.3		
8200							152.1	80.9	
8600							187.9	109.1	
9000								139.8	70.4
9400								173.9	98.3
9800									128.0
10200									160.7
10600									197.6

1. **Enter Weight Adjustment table with reported braking action and 22K Derate dry field/obstacle limit weight to obtain slippery runway weight adjustment.**
2. **Adjust "Good" field length available by -80 ft/+70 ft for every 5°C above/below 4°C.**
   Adjust "Medium" field length available by -80 ft/+70 ft for every 5°C above/below 4°C.
   Adjust "Poor" field length available by -140 ft/+130 ft for every 5°C above/below 4°C.
3. **Find V1(MCG) limit weight for adjusted field length and pressure altitude.**
4. **Max allowable slippery runway limited weight is lesser of weights from 1 and 3.**

ADVISORY INFORMATION

Slippery Runway Takeoff (22K Derate)
No Reverse Thrust
V1 Adjustment (KIAS)

WEIGHT (1000 LB)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
190	-6	-3	-1	-16	-14	-11	-31	-29	-26
180	-6	-4	-1	-17	-14	-12	-32	-30	-27
170	-7	-5	-2	-18	-16	-13	-34	-32	-29
160	-8	-6	-3	-20	-17	-15	-36	-34	-31
150	-9	-7	-4	-22	-19	-17	-39	-37	-34
140	-10	-8	-5	-24	-21	-19	-42	-39	-37
130	-11	-9	-6	-26	-23	-21	-45	-42	-40
120	-13	-10	-8	-28	-25	-23	-47	-45	-42
110	-13	-11	-8	-29	-27	-24	-50	-47	-45
100	-14	-12	-9	-31	-29	-26	-52	-49	-47
90	-15	-13	-10	-32	-30	-27	-53	-50	-48

1. **Obtain V1, VR and V2 for the actual weight using the 22K Derate Dry Runway Takeoff Speeds table.**
2. **If V1(MCG) limited, set V1 = V1(MCG). If not V1(MCG) limited, enter V1 Adjustment table with the actual weight to obtain V1 speed adjustment. If adjusted V1 is less than V1(MCG), set V1 = V1(MCG). V1 not to exceed VR.**

Takeoff %N1 (22K Derate)

Based on engine bleeds for packs on, engine and wing anti-ice on or off

OAT (°C)	AIRPORT PRESSURE ALTITUDE (FT)												
	-2000	-1000	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
60	87.7	88.3	88.7	88.8	88.9	89.1	89.2	89.2	89.1	88.6	88.3	88.7	89.2
55	88.5	89.1	89.5	89.7	89.8	89.9	90.0	90.0	90.0	89.5	89.0	88.8	88.6
50	89.3	89.8	90.4	90.5	90.6	90.7	90.9	90.8	90.8	90.4	89.9	89.7	89.6
45	90.2	90.7	91.2	91.3	91.4	91.5	91.7	91.6	91.6	91.2	90.8	90.7	90.5
40	91.1	91.6	92.1	92.2	92.3	92.4	92.5	92.4	92.4	92.1	91.7	91.6	91.5
35	91.9	92.5	93.0	93.1	93.2	93.2	93.3	93.3	93.2	92.9	92.5	92.5	92.4
30	91.5	92.6	93.8	93.9	94.0	94.0	94.1	94.0	93.9	93.7	93.4	93.3	93.2
25	90.8	91.9	93.1	93.7	94.4	94.8	94.9	94.8	94.8	94.4	94.0	94.0	94.0
20	90.0	91.1	92.3	93.0	93.6	94.3	95.0	95.6	95.6	95.3	94.9	94.8	94.7
15	89.3	90.4	91.6	92.2	92.8	93.6	94.3	94.8	95.3	95.9	96.1	95.9	95.5
10	88.5	89.6	90.8	91.4	92.1	92.8	93.5	94.0	94.5	95.1	95.7	96.4	97.1
5	87.8	88.9	90.0	90.7	91.3	92.0	92.7	93.2	93.7	94.3	94.9	95.6	96.3
0	87.0	88.1	89.2	89.9	90.5	91.2	91.9	92.4	92.9	93.5	94.1	94.8	95.5
-5	86.2	87.3	88.4	89.1	89.7	90.4	91.1	91.6	92.1	92.7	93.3	94.0	94.7
-10	85.4	86.5	87.6	88.3	88.9	89.6	90.3	90.8	91.3	91.9	92.5	93.2	93.9
-15	84.6	85.7	86.8	87.5	88.1	88.8	89.4	90.0	90.5	91.1	91.7	92.4	93.1
-20	83.8	84.9	86.0	86.6	87.3	87.9	88.6	89.1	89.7	90.3	90.8	91.6	92.3
-25	83.0	84.1	85.2	85.8	86.4	87.1	87.8	88.3	88.8	89.4	90.0	90.7	91.5
-30	82.2	83.3	84.4	85.0	85.6	86.3	86.9	87.4	88.0	88.6	89.2	89.9	90.6
-35	81.4	82.4	83.5	84.1	84.7	85.4	86.1	86.6	87.1	87.7	88.3	89.0	89.8
-40	80.6	81.6	82.7	83.3	83.9	84.5	85.2	85.7	86.2	86.8	87.4	88.2	88.9
-45	79.7	80.7	81.8	82.4	83.0	83.7	84.3	84.8	85.3	86.0	86.6	87.3	88.0
-50	78.9	79.9	80.9	81.5	82.1	82.8	83.4	83.9	84.5	85.1	85.7	86.4	87.2

%N1 Adjustments for Engine Bleeds

BLEED CONFIGURATION	AIRPORT PRESSURE ALTITUDE (FT)												
	-2000	-1000	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
PACKS OFF	0.7	0.7	0.7	0.7	0.7	0.7	0.8	0.8	0.8	0.8	0.9	0.9	0.9

Assumed Temperature Reduced Thrust (22K Derate)
Maximum Assumed Temperature (Table 1 of 3)
Based on 25% Takeoff Thrust Reduction

OAT (°C)	AIRPORT PRESSURE ALTITUDE (FT)											
	-1000	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
55	73	71	69	67								
50	73	71	69	67	65	63						
45	73	71	69	67	65	63	61	59	57			
40	72	71	69	67	65	63	61	59	57	55		
35	66	66	66	66	65	63	61	59	57	55	53	
30	63	61	61	61	61	61	61	59	57	55	53	51
25	63	61	59	57	56	56	56	56	56	55	53	51
20	63	61	59	57	55	53	51	51	51	50	50	50
15	63	61	59	57	55	53	51	50	47	45	45	45
10 & BELOW	63	61	59	57	55	53	51	50	47	45	43	41

Takeoff %N1 (Table 2 of 3)
Based on engine bleeds for packs on, engine and wing anti-ice on or off

ASSUMED TEMP (°C)	AIRPORT PRESSURE ALTITUDE (FT)											
	-1000	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
75	85.7	86.0	86.7	87.4	88.2	88.9	89.5	90.1	90.2	90.2	90.6	91.1
70	86.6	87.0	87.1	87.1	87.5	88.3	88.9	89.4	89.5	89.6	90.0	90.4
65	87.4	87.8	88.0	88.0	88.2	88.3	88.3	88.8	88.9	88.9	89.4	89.8
60	88.3	88.7	88.8	88.9	89.1	89.2	89.2	89.1	88.6	88.3	88.7	89.2
55	89.1	89.5	89.7	89.8	89.9	90.0	90.0	90.0	89.5	89.0	88.8	88.6
50	89.8	90.4	90.5	90.6	90.7	90.9	90.8	90.8	90.4	89.9	89.7	89.6
45	90.7	91.2	91.3	91.4	91.5	91.7	91.6	91.6	91.2	90.8	90.7	90.5
40	91.6	92.1	92.2	92.3	92.4	92.5	92.4	92.4	92.1	91.7	91.6	91.5
35	92.5	93.0	93.1	93.2	93.2	93.3	93.3	93.2	92.9	92.5	92.5	92.4
30	92.6	93.8	93.9	94.0	94.0	94.1	94.0	93.9	93.7	93.4	93.3	93.2
25	91.9	93.1	93.7	94.4	94.8	94.9	94.8	94.8	94.4	94.0	94.0	94.0
20	91.1	92.3	93.0	93.6	94.3	95.0	95.6	95.6	95.3	94.9	94.8	94.7
15	90.4	91.6	92.2	92.8	93.6	94.3	94.8	95.3	95.9	96.1	95.9	95.5
10	89.6	90.8	91.4	92.1	92.8	93.5	94.0	94.5	95.1	95.7	96.4	97.1
MINIMUM ASSUMED TEMP (°C)	32	30	28	26	24	22	20	18	16	15	12	10

With engine bleed for packs off, increase %N1 by 0.9.

Assumed Temperature Reduced Thrust (22K Derate)
%N1 Adjustment for Temperature Difference (Table 3 of 3)

ASSUMED TEMP MINUS OAT (°C)	OUTSIDE AIR TEMPERATURE (°C)													
	-40	-20	0	5	10	15	20	25	30	35	40	45	50	55
110	11.6													
100	10.3	7.9												
90	10.8	8.4												
80	12.2	7.1	5.0											
70	11.0	7.6	5.4	5.2	3.5									
60	9.6	9.0	4.1	4.0	3.9	3.8	2.1							
50	8.0	7.7	4.5	2.8	2.6	2.7	2.6	2.4	0.8					
40		6.2	5.9	4.7	3.0	2.6	2.7	2.8	2.6	2.5	2.9			
30		4.7	4.6	4.5	4.4	4.2	4.1	4.0	4.0	3.9	3.8	3.7	3.6	
20			3.1	3.0	3.0	3.0	2.9	2.8	2.7	2.7	2.6	2.6	2.5	2.4
10			1.5	1.5	1.5	1.5	1.5	1.5	1.4	1.4	1.4	1.3	1.3	1.3
0			0	0	0	0	0	0	0	0	0	0	0	0

1. **Determine Maximum Assumed Temperature allowed from Table 1.**
2. **Find Maximum %N1 from Table 2 using the desired assumed temperature (no greater than temperature from Table 1).**
3. **Use the difference between assumed temperature and OAT to determine the %N1 adjustment from Table 3.**
4. **Subtract %N1 adjustment from Maximum %N1 in Table 2.**

Max Climb %N1

Based on engine bleed for packs on or off and anti-ice off

TAT (°C)	PRESSURE ALTITUDE (FT)/SPEED (KIAS/MACH)									
	0	5000	10000	15000	20000	25000	30000	35000	37000	41000
	280	280	280	280	280	280	280	.78	.78	.78
60	90.2	90.5	90.4	90.6	90.4	92.1	93.8	95.1	95.2	93.5
55	91.0	91.2	91.3	91.4	90.8	91.5	93.1	94.4	94.5	92.8
50	91.7	92.0	92.1	92.2	91.7	91.5	92.4	93.7	93.8	92.1
45	92.4	92.6	92.8	93.0	92.6	92.4	92.4	93.0	93.1	91.4
40	93.1	93.3	93.6	93.8	93.4	93.2	93.2	92.3	92.4	90.7
35	93.6	94.0	94.3	94.5	94.3	94.0	94.0	93.0	92.4	90.8
30	92.9	94.8	95.0	95.2	95.1	94.8	94.7	93.9	93.3	91.8
25	92.2	94.8	95.7	95.9	95.9	95.5	95.4	94.7	94.1	92.8
20	91.4	94.0	96.5	96.7	96.6	96.2	96.1	95.4	94.9	93.7
15	90.6	93.2	95.9	97.5	97.4	96.9	96.7	96.2	95.7	94.6
10	89.9	92.5	95.1	97.8	98.3	97.7	97.4	96.9	96.5	95.6
5	89.1	91.7	94.3	97.0	99.2	98.6	98.1	97.7	97.3	96.5
0	88.3	90.9	93.5	96.2	98.6	99.6	99.1	98.5	98.2	97.5
-5	87.6	90.1	92.7	95.4	97.8	99.6	100.0	99.2	99.0	98.4
-10	86.8	89.3	91.9	94.6	97.1	98.8	100.3	100.2	99.8	99.4
-15	86.0	88.5	91.0	93.8	96.3	98.0	99.6	101.1	100.8	100.4
-20	85.2	87.6	90.2	93.0	95.5	97.2	98.7	100.8	101.3	101.0
-25	84.3	86.8	89.4	92.2	94.7	96.4	97.9	100.0	100.5	100.1
-30	83.5	86.0	88.5	91.3	93.9	95.6	97.1	99.1	99.6	99.3
-35	82.7	85.1	87.7	90.5	93.1	94.8	96.3	98.3	98.8	98.4
-40	81.8	84.3	86.8	89.6	92.3	93.9	95.4	97.4	97.9	97.6

%N1 Adjustments for Engine Bleeds

BLEED CONFIGURATION	PRESSURE ALTITUDE (1000 FT)					
	0	10	20	30	35	41
ENGINE ANTI-ICE	-0.6	-0.8	-0.9	-0.9	-0.8	-0.8
ENGINE & WING ANTI-ICE*	-1.8	-2.1	-2.5	-2.7	-3.0	-3.0

***Dual bleed sources**

Go-around %N1

Based on engine bleed for packs on, engine and wing anti-ice on or off

AIRPORT OAT		TAT (°C)	AIRPORT PRESSURE ALTITUDE (FT)											
°C	°F		-2000	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
57	134	60	95.0	96.2	96.8									
52	125	55	95.9	96.7	96.6	96.8	97.5							
47	116	50	96.6	97.6	97.8	97.8	97.7	97.5	98.2	98.8				
42	108	45	97.4	98.4	98.5	98.6	98.7	98.8	98.7	98.5	98.5	99.0		
37	99	40	98.0	99.1	99.2	99.3	99.4	99.5	99.6	99.5	99.1	98.9	98.8	99.1
32	90	35	98.1	99.9	100.0	100.1	100.1	100.3	100.3	100.2	99.9	99.6	99.6	99.5
27	81	30	97.3	99.8	100.4	100.7	100.7	100.7	100.7	100.7	100.6	100.4	100.4	100.3
22	72	25	96.6	99.1	99.7	100.2	100.6	100.9	100.9	100.9	100.9	100.9	100.9	100.8
17	63	20	95.8	98.3	98.9	99.5	99.8	100.2	100.5	100.9	101.0	101.1	101.0	101.0
12	54	15	95.0	97.5	98.1	98.7	99.1	99.4	99.8	100.1	100.5	100.9	101.3	101.2
7	45	10	94.2	96.8	97.4	98.0	98.3	98.7	99.0	99.4	99.8	100.2	100.5	100.9
2	36	5	93.4	96.0	96.6	97.2	97.6	97.9	98.3	98.7	99.0	99.4	99.8	100.2
-3	27	0	92.6	95.2	95.8	96.4	96.8	97.2	97.5	97.9	98.3	98.7	99.0	99.4
-8	18	-5	91.8	94.4	95.0	95.6	96.0	96.4	96.8	97.2	97.5	97.9	98.3	98.6
-13	9	-10	91.0	93.6	94.2	94.8	95.2	95.6	96.0	96.4	96.8	97.1	97.5	97.9
-17	1	-15	90.2	92.8	93.4	94.0	94.4	94.8	95.2	95.6	96.0	96.4	96.7	97.1
-22	-8	-20	89.3	92.0	92.6	93.2	93.6	94.0	94.4	94.8	95.2	95.6	95.9	96.3
-27	-17	-25	88.5	91.1	91.8	92.4	92.8	93.2	93.6	94.0	94.4	94.8	95.1	95.5
-32	-26	-30	87.6	90.3	90.9	91.6	92.0	92.4	92.8	93.3	93.6	94.0	94.3	94.7
-37	-35	-35	86.8	89.4	90.1	90.7	91.1	91.6	92.0	92.4	92.8	93.2	93.5	93.9
-42	-44	-40	85.9	88.6	89.2	89.9	90.3	90.7	91.2	91.6	92.0	92.4	92.7	93.0
-47	-53	-45	85.0	87.7	88.4	89.0	89.4	89.9	90.3	90.8	91.2	91.5	91.9	92.2
-52	-62	-50	84.1	86.8	87.5	88.2	88.6	89.0	89.5	90.0	90.3	90.7	91.0	91.4

%N1 Adjustments for Engine Bleeds

BLEED CONFIGURATION	PRESSURE ALTITUDE (FT)											
	-2000	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
PACKS OFF	0.7	0.8	0.8	0.8	0.8	0.9	0.9	0.9	0.9	0.9	0.9	0.9
A/C HIGH	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1

Flight With Unreliable Airspeed/ Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

CLIMB (280/.76)

Flaps Up, Set Max Climb Thrust

PRESSURE ALTITUDE (FT)		WEIGHT (1000 LB)					
		80	100	120	140	160	180
40000	**PITCH ATT**	**4.0**	**4.0**	**4.0**	**4.0**		
	V/S (FT/MIN)	1900	1300	700	200		
30000	**PITCH ATT**	**4.0**	**4.0**	**3.5**	**3.5**	**3.5**	**4.0**
	V/S (FT/MIN)	2800	2100	1600	1300	1000	700
20000	**PITCH ATT**	**7.5**	**6.5**	**6.0**	**6.0**	**6.0**	**6.0**
	V/S (FT/MIN)	4600	3600	2900	2400	1900	1600
10000	**PITCH ATT**	**11.5**	**10.0**	**9.0**	**8.0**	**8.0**	**7.5**
	V/S (FT/MIN)	6100	4900	4000	3300	2800	2400
SEA LEVEL	**PITCH ATT**	**15.5**	**13.0**	**11.5**	**10.5**	**10.0**	**9.5**
	V/S (FT/MIN)	7400	5900	4800	4000	3400	3000

CRUISE (.76/280)

Flaps Up, %N1 for Level Flight

PRESSURE ALTITUDE (FT)		WEIGHT (1000 LB)					
		80	100	120	140	160	180
40000	**PITCH ATT**	**1.5**	**2.0**	**3.0**			
	%N1	**83**	**85**	**88**			
35000	**PITCH ATT**	**1.0**	**1.5**	**2.0**	**2.5**	**3.0**	
	%N1	**81**	**83**	**84**	**86**	**90**	
30000	**PITCH ATT**	**0.5**	**1.0**	**1.5**	**2.0**	**2.5**	**3.0**
	%N1	**81**	**82**	**83**	**84**	**86**	**88**
25000	**PITCH ATT**	**0.5**	**1.0**	**1.5**	**2.0**	**2.5**	**3.0**
	%N1	**77**	**78**	**79**	**80**	**82**	**84**
20000	**PITCH ATT**	**0.5**	**1.0**	**2.0**	**2.5**	**3.0**	**3.5**
	%N1	**74**	**74**	**75**	**77**	**78**	**80**
15000	**PITCH ATT**	**0.5**	**1.5**	**2.0**	**2.5**	**3.0**	**3.5**
	%N1	**70**	**71**	**72**	**73**	**74**	**76**

Flight With Unreliable Airspeed/ Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

DESCENT (.76/280)
Flaps Up, Set Idle Thrust

PRESSURE ALTITUDE (FT)		WEIGHT (1000 LB)					
		80	100	120	140	160	180
40000	**PITCH ATT**	**-2.5**	**-1.0**	**-0.5**	**0.0**	**0.5**	**0.5**
	V/S (FT/MIN)	-3000	-2600	-2500	-2600	-2900	-3500
30000	**PITCH ATT**	**-4.0**	**-2.5**	**-1.5**	**-1.0**	**0.5**	**0.5**
	V/S (FT/MIN)	-3400	-2800	-2500	-2300	-2100	-2100
20000	**PITCH ATT**	**-4.0**	**-2.5**	**-1.5**	**-1.0**	**0.0**	**0.5**
	V/S (FT/MIN)	-3100	-2600	-2200	-2000	-1900	-1800
10000	**PITCH ATT**	**-4.0**	**-3.0**	**-1.5**	**-1.0**	**0.0**	**0.5**
	V/S (FT/MIN)	-2800	-2300	-2000	-1800	-1700	-1600
SEA LEVEL	**PITCH ATT**	**-4.5**	**-3.0**	**-2.0**	**-1.0**	**0.0**	**0.5**
	V/S (FT/MIN)	-2600	-2100	-1800	-1700	-1500	-1500

HOLDING (VREF40 + 70)
Flaps Up, %N1 for Level Flight

PRESSURE ALTITUDE (FT)		WEIGHT (1000 LB)					
		80	100	120	140	160	180
15000	**PITCH ATT**	**4.5**	**5.0**	**5.0**	**5.0**	**5.0**	**5.0**
	%N1	**55**	**60**	**64**	**68**	**72**	**75**
	KIAS	175	187	203	220	235	250
10000	**PITCH ATT**	**4.5**	**5.0**	**5.0**	**5.0**	**5.0**	**5.0**
	%N1	**52**	**56**	**60**	**64**	**68**	**70**
	KIAS	175	187	202	219	234	249
5000	**PITCH ATT**	**4.5**	**5.0**	**5.0**	**5.0**	**5.0**	**5.0**
	%N1	**48**	**52**	**57**	**60**	**64**	**67**
	KIAS	175	187	202	218	233	248

Flight With Unreliable Airspeed/ Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

TERMINAL AREA (5000 FT)
%N1 for Level Flight
Airport Altitude = -2000 FT

FLAP POSITION (VREF+INCREMENT)		WEIGHT (1000 LB) 80	100	120	140	160	180
FLAPS UP (GEAR UP) VREF40+70	**PITCH ATT**	**4.5**	**5.0**	**5.5**	**5.5**	**6.0**	**6.5**
	%N1	**46.8**	**51.4**	**55.3**	**58.9**	**62.2**	**65.5**
	KIAS	175	187	199	209	216	225
FLAPS 1 (GEAR UP) VREF40+50	**PITCH ATT**	**4.5**	**5.0**	**5.0**	**5.5**	**6.0**	**6.5**
	%N1	**48.8**	**53.3**	**57.4**	**61.1**	**64.5**	**67.5**
	KIAS	155	167	179	189	196	205
FLAPS 5 (GEAR UP) VREF40+30	**PITCH ATT**	**5.0**	**5.5**	**5.5**	**6.0**	**6.5**	**6.5**
	%N1	**48.4**	**53.4**	**57.8**	**62.0**	**65.6**	**68.9**
	KIAS	135	147	159	169	176	185
FLAPS 10 (GEAR UP) VREF40+30	**PITCH ATT**	**4.5**	**5.0**	**5.0**	**5.5**	**6.0**	**6.0**
	%N1	**51.4**	**56.5**	**61.1**	**65.2**	**68.7**	**72.0**
	KIAS	135	147	159	169	176	185
FLAPS 15 (GEAR UP) VREF40+20	**PITCH ATT**	**5.0**	**5.0**	**5.5**	**5.5**	**6.5**	**6.5**
	%N1	**51.5**	**56.8**	**61.5**	**65.7**	**69.4**	**72.9**
	KIAS	125	137	149	159	166	175
FLAPS 25 (GEAR UP) VREF40+10	**PITCH ATT**	**6.0**	**6.0**	**6.5**	**6.5**	**7.0**	**7.0**
	%N1	**52.1**	**57.7**	**62.6**	**66.9**	**70.6**	**74.2**
	KIAS	115	127	139	149	156	165
FLAPS 15 (GEAR DOWN) VREF40+20	**PITCH ATT**	**5.0**	**5.5**	**5.5**	**6.0**	**6.5**	**6.5**
	%N1	**55.7**	**61.3**	**66.2**	**70.2**	**73.9**	**77.3**
	KIAS	125	137	149	159	166	175

Flight With Unreliable Airspeed/ Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

TERMINAL AREA (5000 FT)
%N1 for Level Flight
Airport Altitude = -1000 FT

FLAP POSITION (VREF+INCREMENT)		WEIGHT (1000 LB)					
		80	100	120	140	160	180
FLAPS UP (GEAR UP) VREF40+70	**PITCH ATT**	**4.5**	**5.0**	**5.5**	**5.5**	**6.0**	**6.5**
	%N1	**47.5**	**52.1**	**56.1**	**59.6**	**63.1**	**66.2**
	KIAS	175	187	199	209	216	225
FLAPS 1 (GEAR UP) VREF40+50	**PITCH ATT**	**4.5**	**5.0**	**5.0**	**5.5**	**6.0**	**6.5**
	%N1	**49.4**	**54.0**	**58.1**	**62.0**	**65.3**	**68.3**
	KIAS	155	167	179	189	196	205
FLAPS 5 (GEAR UP) VREF40+30	**PITCH ATT**	**5.0**	**5.5**	**5.5**	**6.0**	**6.5**	**6.5**
	%N1	**49.1**	**54.1**	**58.6**	**62.8**	**66.4**	**69.7**
	KIAS	135	147	159	169	176	185
FLAPS 10 (GEAR UP) VREF40+30	**PITCH ATT**	**4.5**	**5.0**	**5.0**	**5.5**	**6.0**	**6.0**
	%N1	**52.2**	**57.2**	**62.0**	**66.0**	**69.5**	**72.9**
	KIAS	135	147	159	169	176	185
FLAPS 15 (GEAR UP) VREF40+20	**PITCH ATT**	**5.0**	**5.0**	**5.5**	**5.5**	**6.5**	**6.5**
	%N1	**52.2**	**57.5**	**62.4**	**66.5**	**70.2**	**73.7**
	KIAS	125	137	149	159	166	175
FLAPS 25 (GEAR UP) VREF40+10	**PITCH ATT**	**6.0**	**6.0**	**6.5**	**6.5**	**7.0**	**7.0**
	%N1	**52.8**	**58.5**	**63.4**	**67.6**	**71.5**	**75.0**
	KIAS	115	127	139	149	156	165
FLAPS 15 (GEAR DOWN) VREF40+20	**PITCH ATT**	**5.0**	**5.5**	**5.5**	**6.0**	**6.5**	**6.5**
	%N1	**56.5**	**62.1**	**66.9**	**71.1**	**74.8**	**78.1**
	KIAS	125	137	149	159	166	175

Flight With Unreliable Airspeed/ Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

TERMINAL AREA (5000 FT)

%N1 for Level Flight

Airport Altitude = SEA LEVEL

FLAP POSITION (VREF+INCREMENT)		WEIGHT (1000 LB)					
		80	100	120	140	160	180
FLAPS UP (GEAR UP) VREF40+70	**PITCH ATT**	**4.5**	**5.0**	**5.5**	**5.5**	**6.0**	**6.5**
	%N1	**48.2**	**52.7**	**56.8**	**60.4**	**63.9**	**66.9**
	KIAS	175	187	199	209	216	225
FLAPS 1 (GEAR UP) VREF40+50	**PITCH ATT**	**4.5**	**5.0**	**5.0**	**5.5**	**6.0**	**6.5**
	%N1	**50.1**	**54.8**	**58.9**	**62.8**	**66.0**	**69.1**
	KIAS	155	167	179	189	196	205
FLAPS 5 (GEAR UP) VREF40+30	**PITCH ATT**	**5.0**	**5.5**	**5.5**	**6.0**	**6.5**	**6.5**
	%N1	**49.7**	**54.9**	**59.4**	**63.6**	**67.3**	**70.5**
	KIAS	135	147	159	169	176	185
FLAPS 10 (GEAR UP) VREF40+30	**PITCH ATT**	**4.5**	**5.0**	**5.0**	**5.5**	**6.0**	**6.0**
	%N1	**52.9**	**58.0**	**62.8**	**66.8**	**70.3**	**73.8**
	KIAS	135	147	159	169	176	185
FLAPS 15 (GEAR UP) VREF40+20	**PITCH ATT**	**5.0**	**5.0**	**5.5**	**5.5**	**6.5**	**6.5**
	%N1	**52.9**	**58.3**	**63.1**	**67.3**	**71.1**	**74.6**
	KIAS	125	137	149	159	166	175
FLAPS 25 (GEAR UP) VREF40+10	**PITCH ATT**	**6.0**	**6.0**	**6.5**	**6.5**	**7.0**	**7.0**
	%N1	**53.6**	**59.3**	**64.3**	**68.4**	**72.4**	**75.8**
	KIAS	115	127	139	149	156	165
FLAPS 15 (GEAR DOWN) VREF40+20	**PITCH ATT**	**5.0**	**5.5**	**5.5**	**6.0**	**6.5**	**6.5**
	%N1	**57.2**	**62.9**	**67.7**	**72.0**	**75.6**	**78.9**
	KIAS	125	137	149	159	166	175

Flight With Unreliable Airspeed/ Turbulent Air Penetration
Altitude and/or vertical speed indications may also be unreliable.

TERMINAL AREA (5000 FT)
%N1 for Level Flight
Airport Altitude = 1000 FT

FLAP POSITION (VREF+INCREMENT)		WEIGHT (1000 LB)					
		80	100	120	140	160	180
FLAPS UP (GEAR UP) VREF40+70	**PITCH ATT**	**4.5**	**5.0**	**5.5**	**5.5**	**6.0**	**6.5**
	%N1	**48.9**	**53.4**	**57.5**	**61.2**	**64.7**	**67.7**
	KIAS	175	187	199	209	216	225
FLAPS 1 (GEAR UP) VREF40+50	**PITCH ATT**	**4.5**	**5.0**	**5.0**	**5.5**	**6.0**	**6.5**
	%N1	**50.8**	**55.5**	**59.7**	**63.6**	**66.8**	**69.9**
	KIAS	155	167	179	189	196	205
FLAPS 5 (GEAR UP) VREF40+30	**PITCH ATT**	**5.0**	**5.5**	**5.5**	**6.0**	**6.5**	**6.5**
	%N1	**50.4**	**55.6**	**60.2**	**64.4**	**68.0**	**71.4**
	KIAS	135	147	159	169	176	185
FLAPS 10 (GEAR UP) VREF40+30	**PITCH ATT**	**4.5**	**5.0**	**5.0**	**5.5**	**6.0**	**6.0**
	%N1	**53.6**	**58.8**	**63.6**	**67.6**	**71.2**	**74.6**
	KIAS	135	147	159	169	176	185
FLAPS 15 (GEAR UP) VREF40+20	**PITCH ATT**	**5.0**	**5.0**	**5.5**	**5.5**	**6.5**	**6.5**
	%N1	**53.6**	**59.1**	**63.9**	**68.1**	**72.0**	**75.4**
	KIAS	125	137	149	159	166	175
FLAPS 25 (GEAR UP) VREF40+10	**PITCH ATT**	**6.0**	**6.0**	**6.5**	**6.5**	**7.0**	**7.0**
	%N1	**54.3**	**60.1**	**65.1**	**69.3**	**73.2**	**76.6**
	KIAS	115	127	139	149	156	165
FLAPS 15 (GEAR DOWN) VREF40+20	**PITCH ATT**	**5.0**	**5.5**	**5.5**	**6.0**	**6.5**	**6.5**
	%N1	**58.0**	**63.7**	**68.5**	**72.8**	**76.4**	**79.8**
	KIAS	125	137	149	159	166	175

Flight With Unreliable Airspeed/ Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

TERMINAL AREA (5000 FT)
%N1 for Level Flight
Airport Altitude = 2000 FT

FLAP POSITION (VREF+INCREMENT)		WEIGHT (1000 LB)					
		80	100	120	140	160	180
FLAPS UP (GEAR UP) VREF40+70	**PITCH ATT**	**4.5**	**5.0**	**5.5**	**5.5**	**6.0**	**6.5**
	%N1	**49.7**	**54.1**	**58.2**	**62.1**	**65.5**	**68.4**
	KIAS	175	187	199	209	216	225
FLAPS 1 (GEAR UP) VREF40+50	**PITCH ATT**	**4.5**	**5.0**	**5.0**	**5.5**	**6.0**	**6.5**
	%N1	**51.5**	**56.2**	**60.5**	**64.4**	**67.5**	**70.7**
	KIAS	155	167	179	189	196	205
FLAPS 5 (GEAR UP) VREF40+30	**PITCH ATT**	**5.0**	**5.5**	**5.5**	**6.0**	**6.5**	**6.5**
	%N1	**51.1**	**56.3**	**61.1**	**65.2**	**68.8**	**72.2**
	KIAS	135	147	159	169	176	185
FLAPS 10 (GEAR UP) VREF40+30	**PITCH ATT**	**4.5**	**5.0**	**5.0**	**5.5**	**6.0**	**6.0**
	%N1	**54.3**	**59.6**	**64.4**	**68.4**	**72.1**	**75.4**
	KIAS	135	147	159	169	176	185
FLAPS 15 (GEAR UP) VREF40+20	**PITCH ATT**	**5.0**	**5.0**	**5.5**	**5.5**	**6.5**	**6.5**
	%N1	**54.3**	**59.9**	**64.8**	**68.9**	**72.8**	**76.2**
	KIAS	125	137	149	159	166	175
FLAPS 25 (GEAR UP) VREF40+10	**PITCH ATT**	**6.0**	**6.0**	**6.5**	**6.5**	**7.0**	**7.0**
	%N1	**55.1**	**60.9**	**65.8**	**70.1**	**74.1**	**77.5**
	KIAS	115	127	139	149	156	165
FLAPS 15 (GEAR DOWN) VREF40+20	**PITCH ATT**	**5.0**	**5.5**	**5.5**	**6.0**	**6.5**	**6.5**
	%N1	**58.8**	**64.6**	**69.3**	**73.7**	**77.2**	**80.7**
	KIAS	125	137	149	159	166	175

Flight With Unreliable Airspeed/ Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

TERMINAL AREA (5000 FT)
%N1 for Level Flight
Airport Altitude = 3000 FT

FLAP POSITION (VREF+INCREMENT)		WEIGHT (1000 LB)					
		80	100	120	140	160	180
FLAPS UP (GEAR UP) VREF40+70	**PITCH ATT**	**4.5**	**5.0**	**5.5**	**5.5**	**6.0**	**6.5**
	%N1	**50.3**	**54.9**	**59.0**	**62.9**	**66.2**	**69.2**
	KIAS	175	187	199	209	216	225
FLAPS 1 (GEAR UP) VREF40+50	**PITCH ATT**	**4.5**	**5.0**	**5.0**	**5.5**	**6.0**	**6.5**
	%N1	**52.2**	**57.0**	**61.3**	**65.1**	**68.3**	**71.6**
	KIAS	155	167	179	189	196	205
FLAPS 5 (GEAR UP) VREF40+30	**PITCH ATT**	**5.0**	**5.5**	**5.5**	**6.0**	**6.5**	**6.5**
	%N1	**51.9**	**57.1**	**61.9**	**66.0**	**69.6**	**73.1**
	KIAS	135	147	159	169	176	185
FLAPS 10 (GEAR UP) VREF40+30	**PITCH ATT**	**4.5**	**5.0**	**5.0**	**5.5**	**6.0**	**6.0**
	%N1	**55.0**	**60.4**	**65.2**	**69.2**	**72.9**	**76.2**
	KIAS	135	147	159	169	176	185
FLAPS 15 (GEAR UP) VREF40+20	**PITCH ATT**	**5.0**	**5.0**	**5.5**	**5.5**	**6.5**	**6.5**
	%N1	**55.0**	**60.7**	**65.6**	**69.8**	**73.7**	**77.0**
	KIAS	125	137	149	159	166	175
FLAPS 25 (GEAR UP) VREF40+10	**PITCH ATT**	**6.0**	**6.0**	**6.5**	**6.5**	**7.0**	**7.0**
	%N1	**55.8**	**61.7**	**66.6**	**71.0**	**74.9**	**78.3**
	KIAS	115	127	139	149	156	165
FLAPS 15 (GEAR DOWN) VREF40+20	**PITCH ATT**	**5.0**	**5.5**	**5.5**	**6.0**	**6.5**	**6.5**
	%N1	**59.6**	**65.3**	**70.2**	**74.6**	**78.1**	**81.6**
	KIAS	125	137	149	159	166	175

Flight With Unreliable Airspeed/ Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

TERMINAL AREA (5000 FT)
%N1 for Level Flight
Airport Altitude = 4000 FT

FLAP POSITION (VREF+INCREMENT)		WEIGHT (1000 LB) 80	100	120	140	160	180
FLAPS UP (GEAR UP) VREF40+70	**PITCH ATT**	**4.5**	**5.0**	**5.5**	**5.5**	**6.5**	**6.5**
	%N1	**51.0**	**55.6**	**59.8**	**63.7**	**66.9**	**70.1**
	KIAS	175	187	199	209	216	225
FLAPS 1 (GEAR UP) VREF40+50	**PITCH ATT**	**4.5**	**5.0**	**5.0**	**5.5**	**6.0**	**6.5**
	%N1	**53.0**	**57.7**	**62.1**	**65.9**	**69.1**	**72.4**
	KIAS	155	167	179	189	196	205
FLAPS 5 (GEAR UP) VREF40+30	**PITCH ATT**	**5.0**	**5.5**	**5.5**	**6.0**	**6.5**	**7.0**
	%N1	**52.6**	**57.9**	**62.8**	**66.8**	**70.5**	**73.9**
	KIAS	135	147	159	169	176	185
FLAPS 10 (GEAR UP) VREF40+30	**PITCH ATT**	**4.5**	**5.0**	**5.0**	**5.5**	**6.0**	**6.0**
	%N1	**55.8**	**61.3**	**66.0**	**70.1**	**73.7**	**76.9**
	KIAS	135	147	159	169	176	185
FLAPS 15 (GEAR UP) VREF40+20	**PITCH ATT**	**5.0**	**5.0**	**5.5**	**5.5**	**6.5**	**6.5**
	%N1	**55.8**	**61.6**	**66.4**	**70.6**	**74.5**	**77.8**
	KIAS	125	137	149	159	166	175
FLAPS 25 (GEAR UP) VREF40+10	**PITCH ATT**	**6.0**	**6.0**	**6.5**	**6.5**	**7.0**	**7.0**
	%N1	**56.6**	**62.5**	**67.4**	**71.9**	**75.7**	**79.2**
	KIAS	115	127	139	149	156	165
FLAPS 15 (GEAR DOWN) VREF40+20	**PITCH ATT**	**5.0**	**5.5**	**5.5**	**6.0**	**6.5**	**6.5**
	%N1	**60.4**	**66.1**	**71.1**	**75.4**	**79.0**	**82.4**
	KIAS	125	137	149	159	166	175

Flight With Unreliable Airspeed/ Turbulent Air Penetration
Altitude and/or vertical speed indications may also be unreliable.

TERMINAL AREA (5000 FT)
%N1 for Level Flight
Airport Altitude = 5000 FT

FLAP POSITION (VREF+INCREMENT)		WEIGHT (1000 LB)					
		80	100	120	140	160	180
FLAPS UP (GEAR UP) VREF40+70	**PITCH ATT**	**4.5**	**5.0**	**5.5**	**5.5**	**6.5**	**6.5**
	%N1	**51.7**	**56.3**	**60.6**	**64.5**	**67.7**	**70.9**
	KIAS	175	187	199	209	216	225
FLAPS 1 (GEAR UP) VREF40+50	**PITCH ATT**	**4.5**	**5.0**	**5.0**	**5.5**	**6.0**	**6.5**
	%N1	**53.8**	**58.5**	**62.9**	**66.6**	**70.0**	**73.3**
	KIAS	155	167	179	189	196	205
FLAPS 5 (GEAR UP) VREF40+30	**PITCH ATT**	**5.0**	**5.5**	**5.5**	**6.0**	**6.5**	**7.0**
	%N1	**53.3**	**58.7**	**63.5**	**67.6**	**71.3**	**74.7**
	KIAS	135	147	159	169	176	185
FLAPS 10 (GEAR UP) VREF40+30	**PITCH ATT**	**4.5**	**5.0**	**5.0**	**5.5**	**6.0**	**6.0**
	%N1	**56.5**	**62.1**	**66.8**	**70.9**	**74.5**	**77.8**
	KIAS	135	147	159	169	176	185
FLAPS 15 (GEAR UP) VREF40+20	**PITCH ATT**	**5.0**	**5.0**	**5.5**	**5.5**	**6.5**	**6.5**
	%N1	**56.6**	**62.4**	**67.2**	**71.6**	**75.3**	**78.7**
	KIAS	125	137	149	159	166	175
FLAPS 25 (GEAR UP) VREF40+10	**PITCH ATT**	**6.0**	**6.0**	**6.5**	**6.5**	**7.0**	**7.0**
	%N1	**57.4**	**63.4**	**68.3**	**72.7**	**76.6**	**80.1**
	KIAS	115	127	139	149	156	165
FLAPS 15 (GEAR DOWN) VREF40+20	**PITCH ATT**	**5.0**	**5.5**	**5.5**	**6.0**	**6.5**	**6.5**
	%N1	**61.2**	**66.9**	**71.9**	**76.2**	**79.8**	**83.3**
	KIAS	125	137	149	159	166	175

Flight With Unreliable Airspeed/ Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

TERMINAL AREA (5000 FT)
%N1 for Level Flight
Airport Altitude = 6000 FT

FLAP POSITION (VREF+INCREMENT)		WEIGHT (1000 LB)					
		80	100	120	140	160	180
FLAPS UP (GEAR UP) VREF40+70	**PITCH ATT**	**4.5**	**5.0**	**5.5**	**5.5**	**6.5**	**6.5**
	%N1	**52.3**	**57.1**	**61.4**	**65.3**	**68.5**	**71.7**
	KIAS	175	187	199	209	216	225
FLAPS 1 (GEAR UP) VREF40+50	**PITCH ATT**	**4.5**	**5.0**	**5.0**	**5.5**	**6.0**	**6.5**
	%N1	**54.5**	**59.3**	**63.7**	**67.4**	**70.8**	**74.1**
	KIAS	155	167	179	189	196	205
FLAPS 5 (GEAR UP) VREF40+30	**PITCH ATT**	**5.0**	**5.5**	**5.5**	**6.0**	**6.5**	**7.0**
	%N1	**54.1**	**59.5**	**64.3**	**68.4**	**72.2**	**75.5**
	KIAS	135	147	159	169	176	185
FLAPS 10 (GEAR UP) VREF40+30	**PITCH ATT**	**4.5**	**5.0**	**5.0**	**5.5**	**6.0**	**6.0**
	%N1	**57.3**	**62.9**	**67.6**	**71.8**	**75.3**	**78.6**
	KIAS	135	147	159	169	176	185
FLAPS 15 (GEAR UP) VREF40+20	**PITCH ATT**	**5.0**	**5.0**	**5.5**	**5.5**	**6.5**	**6.5**
	%N1	**57.4**	**63.2**	**68.0**	**72.4**	**76.1**	**79.5**
	KIAS	125	137	149	159	166	175
FLAPS 25 (GEAR UP) VREF40+10	**PITCH ATT**	**6.0**	**6.0**	**6.5**	**6.5**	**7.0**	**7.0**
	%N1	**58.2**	**64.2**	**69.1**	**73.6**	**77.4**	**81.0**
	KIAS	115	127	139	149	156	165
FLAPS 15 (GEAR DOWN) VREF40+20	**PITCH ATT**	**5.0**	**5.5**	**5.5**	**6.0**	**6.5**	**6.5**
	%N1	**62.0**	**67.7**	**72.8**	**77.0**	**80.7**	**84.2**
	KIAS	125	137	149	159	166	175

Flight With Unreliable Airspeed/ Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

TERMINAL AREA (5000 FT)
%N1 for Level Flight
Airport Altitude = 7000 FT

FLAP POSITION (VREF+INCREMENT)		WEIGHT (1000 LB)					
		80	100	120	140	160	180
FLAPS UP (GEAR UP)	**PITCH ATT**	**4.5**	**5.0**	**5.5**	**5.5**	**6.5**	**6.5**
	%N1	**53.1**	**57.8**	**62.3**	**66.0**	**69.3**	**72.5**
VREF40+70	KIAS	175	187	199	210	216	225
FLAPS 1 (GEAR UP)	**PITCH ATT**	**4.5**	**5.0**	**5.0**	**5.5**	**6.0**	**6.5**
	%N1	**55.2**	**60.1**	**64.5**	**68.2**	**71.7**	**74.9**
VREF40+50	KIAS	155	167	179	190	196	205
FLAPS 5 (GEAR UP)	**PITCH ATT**	**5.0**	**5.5**	**5.5**	**6.0**	**6.5**	**7.0**
	%N1	**54.8**	**60.4**	**65.2**	**69.2**	**73.1**	**76.3**
VREF40+30	KIAS	135	147	159	170	176	185
FLAPS 10 (GEAR UP)	**PITCH ATT**	**4.5**	**5.0**	**5.0**	**5.5**	**6.0**	**6.0**
	%N1	**58.1**	**63.7**	**68.4**	**72.7**	**76.1**	**79.5**
VREF40+30	KIAS	135	147	159	170	176	185
FLAPS 15 (GEAR UP)	**PITCH ATT**	**5.0**	**5.0**	**5.5**	**5.5**	**6.5**	**6.5**
	%N1	**58.2**	**64.0**	**68.9**	**73.3**	**76.9**	**80.4**
VREF40+20	KIAS	125	137	149	160	166	175
FLAPS 25 (GEAR UP)	**PITCH ATT**	**6.0**	**6.0**	**6.5**	**6.5**	**7.0**	**7.0**
	%N1	**59.0**	**65.0**	**70.0**	**74.4**	**78.3**	**81.9**
VREF40+10	KIAS	115	127	139	150	156	165
FLAPS 15 (GEAR DOWN)	**PITCH ATT**	**5.0**	**5.5**	**5.5**	**6.0**	**6.5**	**6.5**
	%N1	**62.9**	**68.6**	**73.7**	**77.9**	**81.6**	**85.1**
VREF40+20	KIAS	125	137	149	160	166	175

Flight With Unreliable Airspeed/ Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

TERMINAL AREA (5000 FT)

%N1 for Level Flight

Airport Altitude = 8000 FT

FLAP POSITION (VREF+INCREMENT)		WEIGHT (1000 LB) 80	100	120	140	160	180
FLAPS UP (GEAR UP) VREF40+70	**PITCH ATT**	**4.5**	**5.0**	**5.5**	**5.5**	**6.5**	**6.5**
	%N1	**53.8**	**58.6**	**63.1**	**66.7**	**70.1**	**73.3**
	KIAS	175	187	199	210	216	225
FLAPS 1 (GEAR UP) VREF40+50	**PITCH ATT**	**4.5**	**5.0**	**5.0**	**5.5**	**6.0**	**6.5**
	%N1	**56.0**	**60.9**	**65.2**	**69.1**	**72.6**	**75.7**
	KIAS	155	167	179	190	196	205
FLAPS 5 (GEAR UP) VREF40+30	**PITCH ATT**	**5.0**	**5.5**	**5.5**	**6.0**	**6.5**	**7.0**
	%N1	**55.6**	**61.3**	**65.9**	**70.1**	**73.9**	**77.2**
	KIAS	135	147	159	170	176	185
FLAPS 10 (GEAR UP) VREF40+30	**PITCH ATT**	**4.5**	**5.0**	**5.0**	**5.5**	**6.0**	**6.0**
	%N1	**59.0**	**64.5**	**69.3**	**73.5**	**77.0**	**80.4**
	KIAS	135	147	159	170	176	185
FLAPS 15 (GEAR UP) VREF40+20	**PITCH ATT**	**5.0**	**5.0**	**5.5**	**5.5**	**6.5**	**6.5**
	%N1	**59.0**	**64.8**	**69.8**	**74.1**	**77.8**	**81.3**
	KIAS	125	137	149	160	166	175
FLAPS 25 (GEAR UP) VREF40+10	**PITCH ATT**	**6.0**	**6.0**	**6.5**	**6.5**	**7.0**	**7.0**
	%N1	**59.9**	**65.8**	**70.9**	**75.2**	**79.2**	**82.8**
	KIAS	115	127	139	150	156	165
FLAPS 15 (GEAR DOWN) VREF40+20	**PITCH ATT**	**5.0**	**5.5**	**5.5**	**6.0**	**6.5**	**6.5**
	%N1	**63.7**	**69.5**	**74.5**	**78.8**	**82.5**	**86.0**
	KIAS	125	137	149	160	166	175

Flight With Unreliable Airspeed/ Turbulent Air Penetration
Altitude and/or vertical speed indications may also be unreliable.

TERMINAL AREA (5000 FT)
%N1 for Level Flight
Airport Altitude = 9000 FT

FLAP POSITION (VREF+INCREMENT)		WEIGHT (1000 LB) 80	100	120	140	160	180
FLAPS UP (GEAR UP) VREF40+70	**PITCH ATT**	**4.5**	**5.0**	**5.5**	**5.5**	**6.5**	**6.5**
	%N1	**54.6**	**59.4**	**63.9**	**67.5**	**71.0**	**74.1**
	KIAS	175	187	199	210	216	225
FLAPS 1 (GEAR UP) VREF40+50	**PITCH ATT**	**4.5**	**5.0**	**5.0**	**5.5**	**6.0**	**6.5**
	%N1	**56.7**	**61.8**	**66.0**	**70.0**	**73.4**	**76.6**
	KIAS	155	167	179	190	196	205
FLAPS 5 (GEAR UP) VREF40+30	**PITCH ATT**	**5.0**	**5.5**	**5.5**	**6.0**	**6.5**	**7.0**
	%N1	**56.4**	**62.1**	**66.7**	**71.0**	**74.7**	**78.0**
	KIAS	135	147	159	170	176	185
FLAPS 10 (GEAR UP) VREF40+30	**PITCH ATT**	**4.5**	**5.0**	**5.0**	**5.5**	**6.0**	**6.0**
	%N1	**59.8**	**65.4**	**70.2**	**74.3**	**77.8**	**81.3**
	KIAS	135	147	159	170	176	185
FLAPS 15 (GEAR UP) VREF40+20	**PITCH ATT**	**5.0**	**5.0**	**5.5**	**5.5**	**6.5**	**6.5**
	%N1	**59.9**	**65.6**	**70.7**	**74.9**	**78.7**	**82.2**
	KIAS	125	137	149	160	166	175
FLAPS 25 (GEAR UP) VREF40+10	**PITCH ATT**	**6.0**	**6.0**	**6.5**	**6.5**	**7.0**	**7.0**
	%N1	**60.7**	**66.6**	**71.8**	**76.1**	**80.2**	**83.7**
	KIAS	115	127	139	150	156	165
FLAPS 15 (GEAR DOWN) VREF40+20	**PITCH ATT**	**5.0**	**5.5**	**5.5**	**6.0**	**6.5**	**6.5**
	%N1	**64.5**	**70.4**	**75.3**	**79.7**	**83.4**	**86.9**
	KIAS	125	137	149	160	166	175

Flight With Unreliable Airspeed/ Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

TERMINAL AREA (5000 FT)
%N1 for Level Flight
Airport Altitude = 10000 FT

FLAP POSITION (VREF+INCREMENT)		WEIGHT (1000 LB) 80	100	120	140	160	180
FLAPS UP (GEAR UP) VREF40+70	**PITCH ATT**	**4.5**	**5.0**	**5.5**	**5.5**	**6.5**	**6.5**
	%N1	**55.3**	**60.3**	**64.7**	**68.3**	**71.8**	**74.9**
	KIAS	175	187	199	210	216	225
FLAPS 1 (GEAR UP) VREF40+50	**PITCH ATT**	**4.5**	**5.0**	**5.0**	**5.5**	**6.0**	**6.5**
	%N1	**57.5**	**62.6**	**66.8**	**70.8**	**74.2**	**77.4**
	KIAS	155	167	179	190	196	205
FLAPS 5 (GEAR UP) VREF40+30	**PITCH ATT**	**5.0**	**5.5**	**5.5**	**6.0**	**6.5**	**7.0**
	%N1	**57.2**	**62.9**	**67.6**	**71.9**	**75.5**	**79.0**
	KIAS	135	147	159	170	176	185
FLAPS 10 (GEAR UP) VREF40+30	**PITCH ATT**	**4.5**	**5.0**	**5.0**	**5.5**	**6.0**	**6.0**
	%N1	**60.7**	**66.2**	**71.1**	**75.1**	**78.8**	**82.2**
	KIAS	135	147	159	170	176	185
FLAPS 15 (GEAR UP) VREF40+20	**PITCH ATT**	**5.0**	**5.0**	**5.5**	**5.5**	**6.5**	**6.5**
	%N1	**60.7**	**66.5**	**71.6**	**75.7**	**79.6**	**83.1**
	KIAS	125	137	149	160	166	175
FLAPS 25 (GEAR UP) VREF40+10	**PITCH ATT**	**6.0**	**6.0**	**6.5**	**6.5**	**7.0**	**7.0**
	%N1	**61.5**	**67.4**	**72.7**	**77.0**	**81.0**	**84.6**
	KIAS	115	127	139	150	156	165
FLAPS 15 (GEAR DOWN) VREF40+20	**PITCH ATT**	**5.0**	**5.5**	**5.5**	**6.0**	**6.5**	**6.5**
	%N1	**65.3**	**71.3**	**76.2**	**80.6**	**84.3**	**87.9**
	KIAS	125	137	149	160	166	175

Flight With Unreliable Airspeed/ Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

TERMINAL AREA (5000 FT)
%N1 for Level Flight
Airport Altitude = 11000 FT

FLAP POSITION (VREF+INCREMENT)		WEIGHT (1000 LB) 80	100	120	140	160	180
FLAPS UP (GEAR UP) VREF40+70	**PITCH ATT**	**4.5**	**5.0**	**5.5**	**5.5**	**6.5**	**6.5**
	%N1	**56.1**	**61.2**	**65.4**	**69.1**	**72.6**	**75.7**
	KIAS	175	188	199	210	216	226
FLAPS 1 (GEAR UP) VREF40+50	**PITCH ATT**	**4.5**	**5.0**	**5.0**	**5.5**	**6.0**	**6.5**
	%N1	**58.4**	**63.4**	**67.7**	**71.7**	**75.0**	**78.3**
	KIAS	155	168	179	190	196	206
FLAPS 5 (GEAR UP) VREF40+30	**PITCH ATT**	**5.0**	**5.5**	**5.5**	**6.0**	**6.5**	**7.0**
	%N1	**58.3**	**63.8**	**68.6**	**72.7**	**76.4**	**79.9**
	KIAS	135	148	159	170	176	186
FLAPS 10 (GEAR UP) VREF40+30	**PITCH ATT**	**4.5**	**5.0**	**5.0**	**5.5**	**6.0**	**6.0**
	%N1	**61.7**	**67.2**	**72.0**	**76.0**	**79.7**	**83.2**
	KIAS	135	148	159	170	176	186
FLAPS 15 (GEAR UP) VREF40+20	**PITCH ATT**	**5.0**	**5.0**	**5.5**	**5.5**	**6.5**	**6.5**
	%N1	**61.8**	**67.5**	**72.5**	**76.7**	**80.6**	**84.1**
	KIAS	125	138	149	160	166	176
FLAPS 25 (GEAR UP) VREF40+10	**PITCH ATT**	**6.0**	**6.0**	**6.5**	**6.5**	**7.0**	**7.0**
	%N1	**62.7**	**68.6**	**73.7**	**78.1**	**82.1**	**85.6**
	KIAS	115	128	139	150	156	166
FLAPS 15 (GEAR DOWN) VREF40+20	**PITCH ATT**	**5.0**	**5.5**	**5.5**	**6.0**	**6.5**	**6.5**
	%N1	**66.4**	**72.3**	**77.2**	**81.6**	**85.3**	**89.0**
	KIAS	125	138	149	160	166	176

Flight With Unreliable Airspeed/ Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

TERMINAL AREA (5000 FT)
%N1 for Level Flight
Airport Altitude = 12000 FT

FLAP POSITION (VREF+INCREMENT)		WEIGHT (1000 LB) 80	100	120	140	160	180
FLAPS UP (GEAR UP) VREF40+70	**PITCH ATT**	**4.5**	**5.0**	**5.5**	**6.0**	**6.5**	**6.5**
	%N1	**56.8**	**62.1**	**66.1**	**70.0**	**73.4**	**76.5**
	KIAS	175	188	199	210	216	226
FLAPS 1 (GEAR UP) VREF40+50	**PITCH ATT**	**4.5**	**5.0**	**5.5**	**5.5**	**6.0**	**6.5**
	%N1	**59.4**	**64.2**	**68.6**	**72.6**	**75.9**	**79.1**
	KIAS	155	168	179	190	196	206
FLAPS 5 (GEAR UP) VREF40+30	**PITCH ATT**	**5.0**	**5.5**	**5.5**	**6.0**	**6.5**	**7.0**
	%N1	**59.4**	**64.7**	**69.5**	**73.6**	**77.4**	**80.9**
	KIAS	135	148	159	170	176	186
FLAPS 10 (GEAR UP) VREF40+30	**PITCH ATT**	**4.5**	**5.0**	**5.0**	**5.5**	**6.0**	**6.0**
	%N1	**62.7**	**68.2**	**72.9**	**76.9**	**80.7**	**84.1**
	KIAS	135	148	159	170	176	186
FLAPS 15 (GEAR UP) VREF40+20	**PITCH ATT**	**5.0**	**5.0**	**5.5**	**5.5**	**6.5**	**6.5**
	%N1	**62.8**	**68.6**	**73.5**	**77.7**	**81.6**	**85.1**
	KIAS	125	138	149	160	166	176
FLAPS 25 (GEAR UP) VREF40+10	**PITCH ATT**	**6.0**	**6.0**	**6.5**	**6.5**	**7.0**	**7.0**
	%N1	**63.7**	**69.8**	**74.6**	**79.1**	**83.1**	**86.7**
	KIAS	115	128	139	150	156	166
FLAPS 15 (GEAR DOWN) VREF40+20	**PITCH ATT**	**5.0**	**5.5**	**5.5**	**6.0**	**6.5**	**6.5**
	%N1	**67.5**	**73.3**	**78.3**	**82.6**	**86.3**	**90.1**
	KIAS	125	138	149	160	166	176

Flight With Unreliable Airspeed/ Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

TERMINAL AREA (5000 FT)
%N1 for Level Flight
Airport Altitude = 13000 FT

FLAP POSITION (VREF+INCREMENT)		WEIGHT (1000 LB) 80	100	120	140	160	180
FLAPS UP (GEAR UP) VREF40+70	**PITCH ATT**	**4.5**	**5.0**	**5.5**	**6.0**	**6.5**	**6.5**
	%N1	**57.7**	**62.9**	**66.9**	**70.9**	**74.2**	**77.4**
	KIAS	175	188	199	210	217	226
FLAPS 1 (GEAR UP) VREF40+50	**PITCH ATT**	**4.5**	**5.0**	**5.5**	**5.5**	**6.0**	**6.5**
	%N1	**60.5**	**65.1**	**69.6**	**73.4**	**76.7**	**80.0**
	KIAS	155	168	179	190	197	206
FLAPS 5 (GEAR UP) VREF40+30	**PITCH ATT**	**5.0**	**5.5**	**5.5**	**6.0**	**6.5**	**7.0**
	%N1	**60.4**	**65.6**	**70.5**	**74.5**	**78.3**	**81.8**
	KIAS	135	148	159	170	177	186
FLAPS 10 (GEAR UP) VREF40+30	**PITCH ATT**	**4.5**	**5.0**	**5.0**	**5.5**	**6.0**	**6.0**
	%N1	**63.6**	**69.2**	**73.8**	**77.9**	**81.6**	**85.0**
	KIAS	135	148	159	170	177	186
FLAPS 15 (GEAR UP) VREF40+20	**PITCH ATT**	**5.0**	**5.0**	**5.5**	**5.5**	**6.5**	**6.5**
	%N1	**63.8**	**69.7**	**74.3**	**78.7**	**82.6**	**86.0**
	KIAS	125	138	149	160	167	176
FLAPS 25 (GEAR UP) VREF40+10	**PITCH ATT**	**6.0**	**6.0**	**6.5**	**6.5**	**7.0**	**7.0**
	%N1	**64.8**	**70.8**	**75.7**	**80.1**	**84.1**	**87.7**
	KIAS	115	128	139	150	157	166
FLAPS 15 (GEAR DOWN) VREF40+20	**PITCH ATT**	**5.0**	**5.5**	**5.5**	**6.0**	**6.5**	**6.5**
	%N1	**68.7**	**74.3**	**79.3**	**83.6**	**87.4**	**91.4**
	KIAS	125	138	149	160	167	176

Flight With Unreliable Airspeed/ Turbulent Air Penetration
Altitude and/or vertical speed indications may also be unreliable.

TERMINAL AREA (5000 FT)
%N1 for Level Flight
Airport Altitude = 14000 FT

FLAP POSITION (VREF+INCREMENT)		WEIGHT (1000 LB) 80	100	120	140	160	180
FLAPS UP (GEAR UP) VREF40+70	**PITCH ATT**	**4.5**	**5.0**	**5.5**	**6.0**	**6.5**	**6.5**
	%N1	**58.5**	**63.6**	**67.7**	**71.6**	**75.0**	**78.3**
	KIAS	175	188	199	210	217	226
FLAPS 1 (GEAR UP) VREF40+50	**PITCH ATT**	**4.5**	**5.0**	**5.5**	**5.5**	**6.0**	**6.5**
	%N1	**61.3**	**65.9**	**70.4**	**74.2**	**77.6**	**80.9**
	KIAS	155	168	179	190	197	206
FLAPS 5 (GEAR UP) VREF40+30	**PITCH ATT**	**5.0**	**5.5**	**5.5**	**6.0**	**6.5**	**7.0**
	%N1	**61.4**	**66.6**	**71.4**	**75.4**	**79.3**	**82.7**
	KIAS	135	148	159	170	177	186
FLAPS 10 (GEAR UP) VREF40+30	**PITCH ATT**	**4.5**	**5.0**	**5.0**	**5.5**	**6.0**	**6.0**
	%N1	**64.6**	**70.2**	**74.7**	**78.9**	**82.6**	**86.0**
	KIAS	135	148	159	170	177	186
FLAPS 15 (GEAR UP) VREF40+20	**PITCH ATT**	**5.0**	**5.0**	**5.5**	**5.5**	**6.5**	**6.5**
	%N1	**64.8**	**70.7**	**75.3**	**79.6**	**83.5**	**87.1**
	KIAS	125	138	149	160	167	176
FLAPS 25 (GEAR UP) VREF40+10	**PITCH ATT**	**6.0**	**6.0**	**6.5**	**6.5**	**7.0**	**7.0**
	%N1	**65.9**	**71.8**	**76.7**	**81.1**	**85.1**	**88.8**
	KIAS	115	128	139	150	157	166
FLAPS 15 (GEAR DOWN) VREF40+20	**PITCH ATT**	**5.0**	**5.5**	**5.5**	**6.0**	**6.5**	**6.5**
	%N1	**69.8**	**75.2**	**80.3**	**84.5**	**88.5**	**93.0**
	KIAS	125	138	149	160	167	176

Flight With Unreliable Airspeed/ Turbulent Air Penetration
Altitude and/or vertical speed indications may also be unreliable.

TERMINAL AREA (5000 FT)
%N1 for Level Flight
Airport Altitude = 14500 FT

FLAP POSITION (VREF+INCREMENT)		WEIGHT (1000 LB)					
		80	100	120	140	160	180
FLAPS UP (GEAR UP) VREF40+70	**PITCH ATT**	**4.5**	**5.0**	**5.5**	**6.0**	**6.5**	**6.5**
	%N1	**59.0**	**63.9**	**68.1**	**72.1**	**75.4**	**78.8**
	KIAS	175	188	199	210	217	226
FLAPS 1 (GEAR UP) VREF40+50	**PITCH ATT**	**4.5**	**5.0**	**5.5**	**5.5**	**6.0**	**6.5**
	%N1	**61.7**	**66.3**	**70.8**	**74.6**	**78.0**	**81.3**
	KIAS	155	168	179	190	197	206
FLAPS 5 (GEAR UP) VREF40+30	**PITCH ATT**	**5.0**	**5.5**	**5.5**	**6.0**	**6.5**	**7.0**
	%N1	**61.8**	**67.1**	**71.9**	**75.8**	**79.7**	**83.1**
	KIAS	135	148	159	170	177	186
FLAPS 10 (GEAR UP) VREF40+30	**PITCH ATT**	**4.5**	**5.0**	**5.0**	**5.5**	**6.0**	**6.5**
	%N1	**65.0**	**70.7**	**75.1**	**79.3**	**83.0**	**86.4**
	KIAS	135	148	159	170	177	186
FLAPS 15 (GEAR UP) VREF40+20	**PITCH ATT**	**5.0**	**5.0**	**5.5**	**5.5**	**6.5**	**6.5**
	%N1	**65.3**	**71.2**	**75.8**	**80.1**	**84.0**	**87.6**
	KIAS	125	138	149	160	167	176
FLAPS 25 (GEAR UP) VREF40+10	**PITCH ATT**	**6.0**	**6.0**	**6.5**	**6.5**	**7.0**	**7.0**
	%N1	**66.5**	**72.3**	**77.3**	**81.6**	**85.6**	**89.3**
	KIAS	115	128	139	150	157	166
FLAPS 15 (GEAR DOWN) VREF40+20	**PITCH ATT**	**5.0**	**5.5**	**5.5**	**6.0**	**6.5**	**6.5**
	%N1	**70.3**	**75.8**	**80.8**	**85.0**	**89.0**	**94.0**
	KIAS	125	138	149	160	167	176

Flight With Unreliable Airspeed/ Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

FINAL APPROACH (1500 FT)

Gear Down, %N1 for 3° Glideslope

Airport Altitude = -2000 FT

FLAP POSITION (VREF+INCREMENT)		WEIGHT (1000 LB) 80	100	120	140	160	180
FLAPS 15 (VREF15 + 10)	**PITCH ATT**	**1.5**	**1.5**	**1.5**	**2.0**	**2.5**	**2.5**
	%N1	**41.6**	**45.8**	**49.6**	**53.0**	**55.6**	**58.4**
	KIAS	129	143	156	168	176	186
FLAPS 30 (VREF30 + 10)	**PITCH ATT**	**0.0**	**0.0**	**0.5**	**0.5**	**1.0**	**1.0**
	%N1	**45.2**	**49.8**	**54.0**	**57.6**	**60.4**	**63.5**
	KIAS	122	135	147	159	166	175
FLAPS 40 (VREF40 + 10)	**PITCH ATT**	**-1.0**	**-1.0**	**-0.5**	**-0.5**	**0.0**	**0.0**
	%N1	**49.7**	**54.8**	**59.3**	**63.3**	**66.3**	**69.3**
	KIAS	114	127	139	149	156	165

Flap placard speed exceeded in shaded area.

Airport Altitude = -1000 FT

FLAP POSITION (VREF+INCREMENT)		WEIGHT (1000 LB) 80	100	120	140	160	180
FLAPS 15 (VREF15 + 10)	**PITCH ATT**	**1.5**	**1.5**	**1.5**	**2.0**	**2.5**	**2.5**
	%N1	**42.1**	**46.5**	**50.3**	**53.7**	**56.3**	**59.1**
	KIAS	129	143	156	168	176	186
FLAPS 30 (VREF30 + 10)	**PITCH ATT**	**0.0**	**0.0**	**0.5**	**0.5**	**1.0**	**1.0**
	%N1	**45.8**	**50.5**	**54.6**	**58.3**	**61.2**	**64.3**
	KIAS	122	135	148	159	166	175
FLAPS 40 (VREF40 + 10)	**PITCH ATT**	**-1.0**	**-1.0**	**-0.5**	**-0.5**	**0.0**	**0.0**
	%N1	**50.4**	**55.6**	**60.0**	**64.1**	**67.0**	**70.1**
	KIAS	114	127	139	149	156	165

Flap placard speed exceeded in shaded area.

Flight With Unreliable Airspeed/ Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

FINAL APPROACH (1500 FT)

Gear Down, %N1 for 3° Glideslope

Airport Altitude = SEA LEVEL

FLAP POSITION (VREF+INCREMENT)		WEIGHT (1000 LB)					
		80	100	120	140	160	180
FLAPS 15 (VREF15 + 10)	**PITCH ATT**	**1.5**	**1.5**	**1.5**	**2.0**	**2.5**	**2.5**
	%N1	**42.7**	**47.1**	**50.9**	**54.5**	**57.0**	**59.8**
	KIAS	129	143	156	168	176	186
FLAPS 30 (VREF30 + 10)	**PITCH ATT**	**0.0**	**0.0**	**0.5**	**0.5**	**1.0**	**1.0**
	%N1	**46.5**	**51.2**	**55.3**	**59.0**	**62.0**	**65.0**
	KIAS	122	135	148	159	166	175
FLAPS 40 (VREF40 + 10)	**PITCH ATT**	**-1.0**	**-1.0**	**-0.5**	**-0.5**	**0.0**	**0.0**
	%N1	**51.1**	**56.3**	**60.8**	**64.9**	**67.8**	**70.9**
	KIAS	114	127	139	149	156	165

Flap placard speed exceeded in shaded area.

Airport Altitude = 1000 FT

FLAP POSITION (VREF+INCREMENT)		WEIGHT (1000 LB)					
		80	100	120	140	160	180
FLAPS 15 (VREF15 + 10)	**PITCH ATT**	**1.5**	**1.5**	**1.5**	**2.0**	**2.5**	**2.5**
	%N1	**43.2**	**47.8**	**51.6**	**55.1**	**57.7**	**60.6**
	KIAS	129	143	156	168	176	186
FLAPS 30 (VREF30 + 10)	**PITCH ATT**	**0.0**	**0.0**	**0.5**	**0.5**	**1.0**	**1.0**
	%N1	**47.1**	**51.9**	**56.0**	**59.8**	**62.8**	**65.8**
	KIAS	122	135	148	159	166	175
FLAPS 40 (VREF40 + 10)	**PITCH ATT**	**-1.0**	**-1.0**	**-0.5**	**-0.5**	**0.0**	**0.0**
	%N1	**51.8**	**57.0**	**61.6**	**65.7**	**68.5**	**71.8**
	KIAS	114	127	139	149	156	165

Flap placard speed exceeded in shaded area.

Flight With Unreliable Airspeed/ Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

FINAL APPROACH (1500 FT)

Gear Down, %N1 for 3° Glideslope

Airport Altitude = 2000 FT

FLAP POSITION (VREF+INCREMENT)		WEIGHT (1000 LB)					
		80	100	120	140	160	180
FLAPS 15 (VREF15 + 10)	**PITCH ATT**	**1.5**	**1.5**	**1.5**	**2.0**	**2.5**	**2.5**
	%N1	**43.8**	**48.4**	**52.3**	**55.8**	**58.4**	**61.4**
	KIAS	129	143	156	168	176	186
FLAPS 30 (VREF30 + 10)	**PITCH ATT**	**0.0**	**0.0**	**0.5**	**0.5**	**1.0**	**1.0**
	%N1	**47.7**	**52.6**	**56.7**	**60.6**	**63.6**	**66.6**
	KIAS	122	135	148	159	166	176
FLAPS 40 (VREF40 + 10)	**PITCH ATT**	**-1.0**	**-1.0**	**-0.5**	**-0.5**	**0.0**	**0.0**
	%N1	**52.5**	**57.8**	**62.4**	**66.4**	**69.3**	**72.6**
	KIAS	115	127	139	149	156	165

Flap placard speed exceeded in shaded area.

Airport Altitude = 3000 FT

FLAP POSITION (VREF+INCREMENT)		WEIGHT (1000 LB)					
		80	100	120	140	160	180
FLAPS 15 (VREF15 + 10)	**PITCH ATT**	**1.5**	**1.5**	**1.5**	**2.0**	**2.5**	**2.5**
	%N1	**44.4**	**49.0**	**53.0**	**56.6**	**59.2**	**62.2**
	KIAS	129	143	156	168	176	186
FLAPS 30 (VREF30 + 10)	**PITCH ATT**	**0.0**	**0.0**	**0.5**	**0.5**	**1.0**	**1.0**
	%N1	**48.4**	**53.3**	**57.5**	**61.4**	**64.3**	**67.4**
	KIAS	122	135	148	159	166	176
FLAPS 40 (VREF40 + 10)	**PITCH ATT**	**-1.0**	**-1.0**	**-0.5**	**-0.5**	**0.0**	**0.0**
	%N1	**53.2**	**58.6**	**63.2**	**67.2**	**70.1**	**73.5**
	KIAS	115	127	139	149	156	165

Flap placard speed exceeded in shaded area.

Flight With Unreliable Airspeed/ Turbulent Air Penetration
Altitude and/or vertical speed indications may also be unreliable.

FINAL APPROACH (1500 FT)
Gear Down, %N1 for 3° Glideslope
Airport Altitude = 4000 FT

FLAP POSITION (VREF+INCREMENT)		WEIGHT (1000 LB) 80	100	120	140	160	180
FLAPS 15 (VREF15 + 10)	**PITCH ATT**	**1.5**	**1.5**	**1.5**	**2.0**	**2.5**	**2.5**
	%N1	**45.1**	**49.6**	**53.7**	**57.3**	**59.9**	**63.0**
	KIAS	129	143	156	168	176	186
FLAPS 30 (VREF30 + 10)	**PITCH ATT**	**0.0**	**0.0**	**0.5**	**0.5**	**1.0**	**1.0**
	%N1	**49.0**	**54.0**	**58.2**	**62.2**	**65.1**	**68.1**
	KIAS	122	135	148	159	166	176
FLAPS 40 (VREF40 + 10)	**PITCH ATT**	**-1.0**	**-1.0**	**-0.5**	**-0.5**	**0.0**	**0.0**
	%N1	**54.0**	**59.3**	**64.0**	**68.0**	**71.0**	**74.3**
	KIAS	115	127	139	149	156	165

Flap placard speed exceeded in shaded area.

Airport Altitude = 5000 FT

FLAP POSITION (VREF+INCREMENT)		WEIGHT (1000 LB) 80	100	120	140	160	180
FLAPS 15 (VREF15 + 10)	**PITCH ATT**	**1.5**	**1.5**	**1.5**	**2.0**	**2.5**	**2.5**
	%N1	**45.7**	**50.3**	**54.4**	**58.0**	**60.7**	**63.7**
	KIAS	129	143	156	168	176	186
FLAPS 30 (VREF30 + 10)	**PITCH ATT**	**0.0**	**0.0**	**0.5**	**0.5**	**1.0**	**1.0**
	%N1	**49.7**	**54.7**	**59.0**	**63.0**	**65.9**	**68.9**
	KIAS	122	135	148	159	166	176
FLAPS 40 (VREF40 + 10)	**PITCH ATT**	**-1.0**	**-1.0**	**-0.5**	**-0.5**	**0.0**	**0.0**
	%N1	**54.7**	**60.1**	**64.8**	**68.8**	**71.9**	**75.1**
	KIAS	115	127	139	149	156	165

Flap placard speed exceeded in shaded area.

Flight With Unreliable Airspeed/ Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

FINAL APPROACH (1500 FT)

Gear Down, %N1 for 3° Glideslope

Airport Altitude = 6000 FT

FLAP POSITION (VREF+INCREMENT)		WEIGHT (1000 LB) 80	100	120	140	160	180
FLAPS 15 (VREF15 + 10)	**PITCH ATT**	**1.5**	**1.5**	**1.5**	**2.0**	**2.5**	**2.5**
	%N1	**46.4**	**51.0**	**55.1**	**58.7**	**61.5**	**64.5**
	KIAS	129	143	156	168	176	186
FLAPS 30 (VREF30 + 10)	**PITCH ATT**	**0.0**	**0.0**	**0.5**	**0.5**	**1.0**	**1.0**
	%N1	**50.4**	**55.4**	**59.8**	**63.8**	**66.6**	**69.7**
	KIAS	122	135	148	159	166	176
FLAPS 40 (VREF40 + 10)	**PITCH ATT**	**-1.0**	**-1.0**	**-0.5**	**-0.5**	**0.0**	**0.0**
	%N1	**55.4**	**60.9**	**65.6**	**69.6**	**72.7**	**75.9**
	KIAS	115	127	139	149	156	165

Flap placard speed exceeded in shaded area.

Airport Altitude = 7000 FT

FLAP POSITION (VREF+INCREMENT)		WEIGHT (1000 LB) 80	100	120	140	160	180
FLAPS 15 (VREF15 + 10)	**PITCH ATT**	**1.5**	**1.5**	**1.5**	**2.0**	**2.5**	**2.5**
	%N1	**47.1**	**51.7**	**55.8**	**59.5**	**62.3**	**65.1**
	KIAS	129	144	157	169	176	186
FLAPS 30 (VREF30 + 10)	**PITCH ATT**	**0.0**	**0.0**	**0.5**	**0.5**	**1.0**	**1.0**
	%N1	**51.1**	**56.1**	**60.6**	**64.5**	**67.4**	**70.5**
	KIAS	122	135	148	159	166	176
FLAPS 40 (VREF40 + 10)	**PITCH ATT**	**-1.0**	**-1.0**	**-0.5**	**-0.5**	**0.0**	**0.0**
	%N1	**56.2**	**61.7**	**66.3**	**70.4**	**73.5**	**76.7**
	KIAS	115	127	139	149	156	165

Flap placard speed exceeded in shaded area.

Flight With Unreliable Airspeed/ Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

FINAL APPROACH (1500 FT)

Gear Down, %N1 for 3° Glideslope

Airport Altitude = 8000 FT

FLAP POSITION (VREF+INCREMENT)		WEIGHT (1000 LB) 80	100	120	140	160	180
FLAPS 15 (VREF15 + 10)	**PITCH ATT**	**1.5**	**1.5**	**1.5**	**2.0**	**2.5**	**2.5**
	%N1	**47.7**	**52.4**	**56.5**	**60.3**	**63.1**	**65.8**
	KIAS	129	144	157	169	176	186
FLAPS 30 (VREF30 + 10)	**PITCH ATT**	**0.0**	**0.0**	**0.5**	**0.5**	**1.0**	**1.0**
	%N1	**51.8**	**56.9**	**61.4**	**65.3**	**68.2**	**71.3**
	KIAS	122	136	148	159	166	176
FLAPS 40 (VREF40 + 10)	**PITCH ATT**	**-1.0**	**-1.0**	**-0.5**	**-0.5**	**0.0**	**0.0**
	%N1	**57.0**	**62.5**	**67.1**	**71.3**	**74.4**	**77.5**
	KIAS	115	127	139	149	156	165

Flap placard speed exceeded in shaded area.

Airport Altitude = 9000 FT

FLAP POSITION (VREF+INCREMENT)		WEIGHT (1000 LB) 80	100	120	140	160	180
FLAPS 15 (VREF15 + 10)	**PITCH ATT**	**1.5**	**1.5**	**1.5**	**2.0**	**2.5**	**2.5**
	%N1	**48.3**	**53.2**	**57.3**	**61.1**	**63.8**	**66.6**
	KIAS	129	144	157	169	176	186
FLAPS 30 (VREF30 + 10)	**PITCH ATT**	**0.0**	**0.0**	**0.5**	**0.5**	**1.0**	**1.0**
	%N1	**52.5**	**57.6**	**62.2**	**66.1**	**69.0**	**72.1**
	KIAS	122	136	148	159	166	176
FLAPS 40 (VREF40 + 10)	**PITCH ATT**	**-1.0**	**-1.0**	**-0.5**	**-0.5**	**0.0**	**0.0**
	%N1	**57.7**	**63.3**	**67.9**	**72.1**	**75.1**	**78.3**
	KIAS	115	127	139	149	156	165

Flap placard speed exceeded in shaded area.

Flight With Unreliable Airspeed/ Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

FINAL APPROACH (1500 FT)

Gear Down, %N1 for 3° Glideslope

Airport Altitude = 10000 FT

FLAP POSITION (VREF+INCREMENT)		WEIGHT (1000 LB)					
		80	100	120	140	160	180
FLAPS 15 (VREF15 + 10)	**PITCH ATT**	**1.5**	**1.5**	**1.5**	**2.0**	**2.5**	**2.5**
	%N1	**49.0**	**53.9**	**58.0**	**61.8**	**64.5**	**67.3**
	KIAS	129	144	157	169	176	187
FLAPS 30 (VREF30 + 10)	**PITCH ATT**	**0.0**	**0.0**	**0.5**	**0.5**	**1.0**	**1.0**
	%N1	**53.3**	**58.4**	**63.0**	**66.9**	**69.8**	**72.9**
	KIAS	122	136	148	159	166	176
FLAPS 40 (VREF40 + 10)	**PITCH ATT**	**-1.0**	**-1.0**	**-0.5**	**-0.5**	**0.0**	**0.0**
	%N1	**58.5**	**64.2**	**68.8**	**73.0**	**75.9**	**79.2**
	KIAS	115	127	139	149	156	165

Flap placard speed exceeded in shaded area.

Airport Altitude = 11000 FT

FLAP POSITION (VREF+INCREMENT)		WEIGHT (1000 LB)					
		80	100	120	140	160	180
FLAPS 15 (VREF15 + 10)	**PITCH ATT**	**1.5**	**1.5**	**1.5**	**2.0**	**2.5**	**2.5**
	%N1	**49.7**	**54.6**	**58.8**	**62.6**	**65.2**	**68.1**
	KIAS	129	144	157	169	176	187
FLAPS 30 (VREF30 + 10)	**PITCH ATT**	**0.0**	**0.0**	**0.5**	**0.5**	**1.0**	**1.0**
	%N1	**54.0**	**59.3**	**63.8**	**67.6**	**70.6**	**73.7**
	KIAS	122	136	148	159	166	176
FLAPS 40 (VREF40 + 10)	**PITCH ATT**	**-1.0**	**-1.0**	**-0.5**	**-0.5**	**0.0**	**0.0**
	%N1	**59.4**	**64.9**	**69.6**	**73.8**	**76.8**	**80.0**
	KIAS	115	127	139	149	156	165

Flap placard speed exceeded in shaded area.

Flight With Unreliable Airspeed/ Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

FINAL APPROACH (1500 FT)

Gear Down, %N1 for 3° Glideslope

Airport Altitude = 12000 FT

FLAP POSITION (VREF+INCREMENT)		WEIGHT (1000 LB)					
		80	100	120	140	160	180
FLAPS 15 (VREF15 + 10)	**PITCH ATT**	**1.5**	**1.5**	**1.5**	**2.0**	**2.5**	**2.5**
	%N1	**50.4**	**55.3**	**59.6**	**63.4**	**65.9**	**68.9**
	KIAS	129	144	157	169	176	187
FLAPS 30 (VREF30 + 10)	**PITCH ATT**	**0.0**	**0.0**	**0.5**	**0.5**	**1.0**	**1.0**
	%N1	**54.7**	**60.1**	**64.6**	**68.4**	**71.4**	**74.5**
	KIAS	122	136	148	159	166	176
FLAPS 40 (VREF40 + 10)	**PITCH ATT**	**-1.0**	**-1.0**	**-0.5**	**-0.5**	**0.0**	**0.0**
	%N1	**60.2**	**65.7**	**70.5**	**74.6**	**77.6**	**80.9**
	KIAS	115	127	139	150	156	165

Flap placard speed exceeded in shaded area.

Airport Altitude = 13000 FT

FLAP POSITION (VREF+INCREMENT)		WEIGHT (1000 LB)					
		80	100	120	140	160	180
FLAPS 15 (VREF15 + 10)	**PITCH ATT**	**1.5**	**1.5**	**1.5**	**2.0**	**2.5**	**2.5**
	%N1	**51.1**	**56.0**	**60.4**	**64.1**	**66.7**	**69.7**
	KIAS	129	144	157	169	176	187
FLAPS 30 (VREF30 + 10)	**PITCH ATT**	**0.0**	**0.0**	**0.5**	**0.5**	**1.0**	**1.0**
	%N1	**55.5**	**60.9**	**65.4**	**69.3**	**72.2**	**75.2**
	KIAS	122	136	148	159	166	176
FLAPS 40 (VREF40 + 10)	**PITCH ATT**	**-1.0**	**-1.0**	**-0.5**	**-0.5**	**0.0**	**0.0**
	%N1	**61.0**	**66.5**	**71.4**	**75.4**	**78.5**	**81.7**
	KIAS	115	127	139	150	156	165

Flap placard speed exceeded in shaded area.

Flight With Unreliable Airspeed/ Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

FINAL APPROACH (1500 FT)

Gear Down, %N1 for 3° Glideslope

Airport Altitude = 14000 FT

FLAP POSITION (VREF+INCREMENT)		WEIGHT (1000 LB) 80	100	120	140	160	180
FLAPS 15 (VREF15 + 10)	**PITCH ATT**	**1.5**	**1.5**	**1.5**	**2.0**	**2.5**	**2.5**
	%N1	**52.0**	**56.9**	**61.3**	**64.8**	**67.5**	**70.5**
	KIAS	129	144	157	169	177	187
FLAPS 30 (VREF30 + 10)	**PITCH ATT**	**0.0**	**0.0**	**0.5**	**0.5**	**1.0**	**1.0**
	%N1	**56.4**	**61.8**	**66.2**	**70.2**	**73.1**	**76.0**
	KIAS	122	136	148	159	167	176
FLAPS 40 (VREF40 + 10)	**PITCH ATT**	**-1.0**	**-1.0**	**-0.5**	**-0.5**	**0.0**	**0.0**
	%N1	**62.0**	**67.5**	**72.3**	**76.3**	**79.4**	**82.7**
	KIAS	115	127	139	150	156	165

Flap placard speed exceeded in shaded area.

Airport Altitude = 14500 FT

FLAP POSITION (VREF+INCREMENT)		WEIGHT (1000 LB) 80	100	120	140	160	180
FLAPS 15 (VREF15 + 10)	**PITCH ATT**	**1.5**	**1.5**	**1.5**	**2.0**	**2.5**	**2.5**
	%N1	**52.4**	**57.3**	**61.7**	**65.2**	**67.9**	**70.9**
	KIAS	129	144	157	169	177	187
FLAPS 30 (VREF30 + 10)	**PITCH ATT**	**0.0**	**0.0**	**0.5**	**0.5**	**1.0**	**1.0**
	%N1	**56.9**	**62.3**	**66.7**	**70.6**	**73.5**	**76.5**
	KIAS	122	136	148	159	167	176
FLAPS 40 (VREF40 + 10)	**PITCH ATT**	**-1.0**	**-1.0**	**-0.5**	**-0.5**	**0.0**	**0.0**
	%N1	**62.5**	**68.0**	**72.8**	**76.8**	**79.9**	**83.2**
	KIAS	115	127	139	150	156	166

Flap placard speed exceeded in shaded area.

Flight With Unreliable Airspeed/ Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

GO-AROUND

Flaps 1, Gear Up, Set Go-Around Thrust

PRESSURE ALTITUDE (FT)		WEIGHT (1000 LB)					
		80	100	120	140	160	180
14000	**PITCH ATT**	**18.5**	**15.0**	**13.0**	**11.5**	**11.0**	**10.0**
	V/S (FT/MIN)	4800	3800	3100	2500	2100	1700
	KIAS	155	167	179	190	196	205
10000	**PITCH ATT**	**21.0**	**17.0**	**14.5**	**13.0**	**12.0**	**11.5**
	V/S (FT/MIN)	5300	4200	3500	2900	2400	2100
	KIAS	155	167	179	189	196	205
5000	**PITCH ATT**	**25.0**	**20.5**	**17.0**	**15.0**	**14.0**	**12.5**
	V/S (FT/MIN)	6100	5000	4100	3500	2900	2500
	KIAS	155	167	179	189	196	205
SEA LEVEL	**PITCH ATT**	**29.5**	**23.5**	**20.0**	**17.5**	**16.0**	**14.5**
	V/S (FT/MIN)	6900	5600	4700	4000	3400	2900
	KIAS	154	167	179	189	196	205
-2000	**PITCH ATT**	**30.0**	**24.0**	**20.0**	**17.5**	**16.0**	**14.5**
	V/S (FT/MIN)	6700	5500	4600	3900	3400	2900
	KIAS	154	167	179	189	196	205

Flaps 5, Gear Up, Set Go-Around Thrust

PRESSURE ALTITUDE (FT)		WEIGHT (1000 LB)					
		80	100	120	140	160	180
14000	**PITCH ATT**	**19.5**	**15.5**	**13.5**	**12.0**	**11.0**	**10.5**
	V/S (FT/MIN)	4300	3400	2700	2200	1800	1500
	KIAS	135	147	159	170	176	185
10000	**PITCH ATT**	**22.0**	**18.0**	**15.0**	**13.5**	**12.5**	**11.5**
	V/S (FT/MIN)	4800	3800	3100	2600	2100	1800
	KIAS	135	147	159	169	176	185
5000	**PITCH ATT**	**26.5**	**21.0**	**18.0**	**15.5**	**14.5**	**13.0**
	V/S (FT/MIN)	5500	4500	3700	3100	2600	2200
	KIAS	135	147	159	169	176	185
SEA LEVEL	**PITCH ATT**	**31.0**	**24.5**	**20.5**	**18.0**	**16.0**	**14.5**
	V/S (FT/MIN)	6200	5100	4200	3600	3100	2700
	KIAS	134	147	159	169	176	185
-2000	**PITCH ATT**	**31.0**	**24.5**	**20.5**	**18.0**	**16.5**	**15.0**
	V/S (FT/MIN)	6100	5000	4200	3600	3000	2600
	KIAS	134	147	159	169	176	185

Only authorized operators may use Flaps 5 for a Go-Around in conjunction with the Alternate Go-Around and Missed Approach Procedure.

Flight With Unreliable Airspeed/ Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

GO-AROUND

Flaps 15, Gear Up, Set Go-Around Thrust

PRESSURE ALTITUDE (FT)		WEIGHT (1000 LB)					
		80	100	120	140	160	180
14000	**PITCH ATT**	**18.5**	**15.0**	**12.5**	**11.0**	**10.0**	**9.5**
	V/S (FT/MIN)	3800	3000	2400	1900	1400	1100
	KIAS	125	137	149	160	166	175
10000	**PITCH ATT**	**21.5**	**17.0**	**14.5**	**12.5**	**11.5**	**10.5**
	V/S (FT/MIN)	4300	3400	2700	2200	1800	1400
	KIAS	125	137	149	159	166	175
5000	**PITCH ATT**	**25.5**	**20.5**	**17.0**	**14.5**	**13.5**	**12.0**
	V/S (FT/MIN)	5000	4100	3300	2800	2300	1900
	KIAS	125	137	149	159	166	175
SEA LEVEL	**PITCH ATT**	**30.5**	**24.0**	**20.0**	**17.0**	**15.5**	**14.0**
	V/S (FT/MIN)	5700	4600	3800	3200	2700	2300
	KIAS	124	137	149	159	166	175
-2000	**PITCH ATT**	**30.5**	**24.0**	**20.0**	**17.0**	**15.5**	**14.0**
	V/S (FT/MIN)	5600	4500	3800	3200	2700	2300
	KIAS	124	137	149	159	166	175

Intentionally
Blank

Performance Inflight — Chapter PI
All Engine — Section 61

Long Range Cruise Maximum Operating Altitude
Max Cruise Thrust

ISA + 10°C and Below

WEIGHT (1000 LB)	OPTIMUM ALT (FT)	TAT (°C)	MARGIN TO INITIAL BUFFET 'G' (BANK ANGLE)				
			1.20 (33°)	1.25 (36°)	1.30 (39°)	1.40 (44°)	1.50 (48°)
190	30000	-5	31900*	31900*	31900*	31500	30100
180	31200	-7	33500*	33500*	33500*	32600	31300
170	32400	-10	35000*	35000*	35000*	33900	32500
160	33700	-13	36300*	36300*	36300*	35100	33800
150	35100	-16	37600*	37600*	37600*	36500	35100
140	36500	-18	38900*	38900*	38900*	37900	36600
130	38100	-18	40300*	40300*	40300*	39500	38100
120	39700	-18	41000	41000	41000	41000	39800
110	41000	-18	41000	41000	41000	41000	41000
100	41000	-18	41000	41000	41000	41000	41000
90	41000	-18	41000	41000	41000	41000	41000

ISA + 15°C

WEIGHT (1000 LB)	OPTIMUM ALT (FT)	TAT (°C)	MARGIN TO INITIAL BUFFET 'G' (BANK ANGLE)				
			1.20 (33°)	1.25 (36°)	1.30 (39°)	1.40 (44°)	1.50 (48°)
190	30000	1	29300*	29300*	29300*	29300*	29300*
180	31200	-2	31500*	31500*	31500*	31500*	31300
170	32400	-4	33600*	33600*	33600*	33600*	32500
160	33700	-7	35300*	35300*	35300*	35100	33800
150	35100	-10	36700*	36700*	36700*	36500	35100
140	36500	-13	38000*	38000*	38000*	37900	36600
130	38100	-13	39300*	39300*	39300*	39300*	38100
120	39700	-13	40700*	40700*	40700*	40700*	39800
110	41000	-13	41000	41000	41000	41000	41000
100	41000	-13	41000	41000	41000	41000	41000
90	41000	-13	41000	41000	41000	41000	41000

ISA + 20°C

WEIGHT (1000 LB)	OPTIMUM ALT (FT)	TAT (°C)	MARGIN TO INITIAL BUFFET 'G' (BANK ANGLE)				
			1.20 (33°)	1.25 (36°)	1.30 (39°)	1.40 (44°)	1.50 (48°)
190	30000	7	26000*	26000*	26000*	26000*	26000*
180	31200	4	28200*	28200*	28200*	28200*	28200*
170	32400	1	30600*	30600*	30600*	30600*	30600*
160	33700	-2	33200*	33200*	33200*	33200*	33200*
150	35100	-5	35200*	35200*	35200*	35200*	35100
140	36500	-7	36600*	36600*	36600*	36600*	36600
130	38100	-7	38000*	38000*	38000*	38000*	38000*
120	39700	-7	39400*	39400*	39400*	39400*	39400*
110	41000	-7	40900*	40900*	40900*	40900*	40900*
100	41000	-7	41000	41000	41000	41000	41000
90	41000	-7	41000	41000	41000	41000	41000

***Denotes altitude thrust limited in level flight, 100 fpm residual rate of climb.**

Long Range Cruise Control

WEIGHT (1000 LB)		PRESSURE ALTITUDE (1000 FT)									
		23	25	27	29	31	33	35	37	39	41
180	%N1	84.6	85.9	87.1	88.3	89.5	91.5				
	MACH	.723	.744	.762	.778	.790	.796				
	KIAS	315	312	307	301	293	283				
	FF/ENG	3555	3520	3493	3465	3440	3458				
170	%N1	83.3	84.7	86.0	87.2	88.3	89.8	92.7			
	MACH	.704	.730	.751	.768	.783	.793	.796			
	KIAS	307	306	302	297	290	282	270			
	FF/ENG	3359	3343	3323	3294	3258	3252	3312			
160	%N1	81.8	83.4	84.7	86.0	87.2	88.4	90.2			
	MACH	.683	.713	.737	.756	.773	.787	.795			
	KIAS	297	298	296	292	287	280	270			
	FF/ENG	3150	3154	3147	3126	3088	3059	3064			
150	%N1	80.4	81.9	83.4	84.7	86.0	87.1	88.5	91.1		
	MACH	.664	.691	.720	.743	.762	.778	.790	.796		
	KIAS	288	288	289	286	282	276	268	258		
	FF/ENG	2954	2949	2965	2952	2923	2884	2866	2909		
140	%N1	78.9	80.3	81.8	83.3	84.6	85.9	87.0	89.0	92.9	
	MACH	.645	.669	.698	.726	.748	.766	.782	.793	.796	
	KIAS	280	279	279	280	276	271	265	257	246	
	FF/ENG	2761	2751	2765	2775	2754	2719	2684	2699	2786	
130	%N1	77.3	78.7	80.1	81.6	83.1	84.4	85.7	87.3	89.9	
	MACH	.626	.649	.673	.703	.730	.752	.770	.785	.794	
	KIAS	271	270	269	270	269	266	261	254	246	
	FF/ENG	2578	2558	2563	2579	2578	2554	2517	2513	2543	
120	%N1	75.6	77.0	78.3	79.8	81.3	82.8	84.1	85.7	87.8	90.6
	MACH	.607	.628	.651	.676	.707	.733	.754	.773	.787	.795
	KIAS	262	261	259	259	260	259	255	250	243	235
	FF/ENG	2407	2373	2369	2375	2387	2378	2355	2342	2350	2384
110	%N1	73.7	75.2	76.5	77.9	79.3	80.9	82.4	84.1	86.1	88.3
	MACH	.584	.607	.628	.651	.677	.709	.735	.756	.774	.788
	KIAS	252	251	250	249	248	249	248	244	239	233
	FF/ENG	2232	2202	2183	2182	2183	2191	2181	2174	2176	2185
100	%N1	71.6	73.1	74.6	75.9	77.3	78.7	80.4	82.2	84.4	86.4
	MACH	.559	.582	.605	.627	.650	.677	.708	.735	.756	.774
	KIAS	241	240	240	239	238	237	238	237	233	228
	FF/ENG	2058	2028	2011	1997	1992	1990	1995	1999	2006	2007
90	%N1	69.2	70.8	72.2	73.7	75.1	76.5	78.0	80.0	82.2	84.4
	MACH	.533	.555	.577	.601	.623	.647	.673	.705	.733	.755
	KIAS	229	229	228	228	227	226	225	226	225	222
	FF/ENG	1883	1856	1840	1826	1811	1827	1820	1833	1850	1858

Shaded area approximates optimum altitude.

Long Range Cruise Enroute Fuel and Time - Low Altitudes

Ground to Air Miles Conversions

AIR DISTANCE (NM)					GROUND DISTANCE (NM)	AIR DISTANCE (NM)				
HEADWIND COMPONENT (KTS)						TAILWIND COMPONENT (KTS)				
100	80	60	40	20		20	40	60	80	100
291	267	246	229	214	200	190	181	173	166	159
438	402	370	344	321	300	285	272	260	249	240
585	537	494	458	427	400	381	363	347	333	320
732	672	618	573	534	500	476	454	434	416	400
880	807	742	688	641	600	572	545	521	500	480
1028	942	866	803	749	700	667	636	608	583	561
1177	1078	991	918	856	800	762	727	695	667	641
1326	1215	1116	1034	963	900	858	818	783	750	720
1476	1351	1241	1149	1070	1000	953	909	869	833	800
1626	1488	1367	1265	1178	1100	1048	1000	956	916	880
1777	1625	1492	1380	1285	1200	1143	1091	1043	999	960
1928	1763	1618	1496	1392	1300	1239	1182	1130	1082	1040
2080	1901	1744	1612	1500	1400	1334	1273	1217	1165	1119
2232	2040	1870	1729	1608	1500	1429	1363	1303	1248	1199
2385	2178	1997	1845	1715	1600	1524	1454	1390	1331	1278
2539	2318	2123	1961	1823	1700	1619	1545	1476	1414	1358
2693	2457	2250	2077	1931	1800	1714	1635	1563	1496	1437
2847	2597	2377	2194	2038	1900	1809	1726	1649	1579	1516
3002	2737	2504	2311	2146	2000	1905	1816	1735	1662	1595

Reference Fuel And Time Required at Check Point

AIR DIST (NM)	PRESSURE ALTITUDE (1000 FT)									
	10		14		20		24		28	
	FUEL (1000 LB)	TIME (HR:MIN)	FUEL (1000 LB)	TIME (HR:MIN)	FUEL (1000 LB)	TIME (HR:MIN)	FUEL (1000 LB)	TIME (HR:MIN)	FUEL (1000 LB)	TIME (HR:MIN)
200	3.3	0:41	2.9	0:40	2.5	0:37	2.2	0:36	2.0	0:35
300	5.0	1:01	4.5	0:58	3.9	0:54	3.5	0:52	3.2	0:50
400	6.7	1:20	6.1	1:16	5.3	1:11	4.8	1:08	4.5	1:05
500	8.5	1:39	7.7	1:34	6.8	1:27	6.1	1:23	5.7	1:20
600	10.2	1:59	9.3	1:53	8.2	1:44	7.4	1:39	6.9	1:35
700	11.9	2:19	10.9	2:11	9.6	2:01	8.7	1:55	8.2	1:50
800	13.6	2:38	12.5	2:30	11.0	2:18	10.0	2:11	9.4	2:05
900	15.2	2:58	14.1	2:49	12.4	2:35	11.3	2:27	10.6	2:20
1000	16.9	3:19	15.6	3:08	13.8	2:52	12.6	2:43	11.8	2:35
1100	18.6	3:39	17.2	3:27	15.2	3:10	13.8	3:00	13.0	2:50
1200	20.2	3:59	18.7	3:46	16.5	3:27	15.1	3:16	14.2	3:06
1300	21.9	4:20	20.2	4:05	17.9	3:45	16.3	3:32	15.3	3:21
1400	23.5	4:40	21.8	4:24	19.3	4:02	17.6	3:49	16.5	3:37
1500	25.2	5:01	23.3	4:44	20.6	4:20	18.8	4:05	17.7	3:52
1600	26.8	5:22	24.8	5:04	22.0	4:38	20.1	4:22	18.9	4:08
1700	28.4	5:43	26.3	5:23	23.3	4:55	21.3	4:39	20.0	4:24
1800	30.0	6:04	27.8	5:43	24.7	5:13	22.5	4:55	21.2	4:39
1900	31.6	6:26	29.3	6:03	26.0	5:32	23.8	5:12	22.3	4:55
2000	33.2	6:47	30.7	6:23	27.3	5:50	25.0	5:29	23.5	5:11

Long Range Cruise Enroute Fuel and Time - Low Altitudes

Fuel Required Adjustments (1000 LB)

REFERENCE FUEL REQUIRED (1000 LB)	WEIGHT AT CHECK POINT (1000 LB)				
	90	110	130	150	170
2	-0.2	-0.1	0.0	0.1	0.2
4	-0.4	-0.2	0.0	0.2	0.5
6	-0.7	-0.3	0.0	0.4	0.8
8	-0.9	-0.5	0.0	0.6	1.2
10	-1.2	-0.6	0.0	0.7	1.5
12	-1.4	-0.7	0.0	0.9	1.8
14	-1.7	-0.8	0.0	1.1	2.2
16	-1.9	-0.9	0.0	1.3	2.5
18	-2.2	-1.1	0.0	1.4	2.8
20	-2.4	-1.2	0.0	1.6	3.2
22	-2.7	-1.3	0.0	1.8	3.5
24	-2.9	-1.5	0.0	2.0	3.8
26	-3.1	-1.6	0.0	2.1	4.2
28	-3.4	-1.7	0.0	2.3	4.5
30	-3.6	-1.8	0.0	2.5	4.9
32	-3.8	-2.0	0.0	2.7	5.2
34	-4.0	-2.1	0.0	2.9	5.6

Long Range Cruise Enroute Fuel and Time - High Altitudes
Ground to Air Miles Conversions

AIR DISTANCE (NM)					GROUND DISTANCE (NM)	AIR DISTANCE (NM)				
HEADWIND COMPONENT (KTS)						TAILWIND COMPONENT (KTS)				
100	80	60	40	20		20	40	60	80	100
534	501	471	445	421	400	383	367	352	338	325
800	750	706	667	632	600	574	550	528	508	489
1066	1000	941	889	842	800	766	734	704	678	653
1332	1250	1176	1111	1053	1000	957	918	881	848	817
1599	1501	1411	1333	1264	1200	1149	1102	1058	1018	981
1867	1752	1647	1556	1474	1400	1341	1286	1235	1188	1145
2136	2004	1884	1779	1685	1600	1533	1470	1411	1358	1309
2406	2256	2121	2002	1897	1800	1724	1653	1588	1528	1473
2676	2509	2359	2226	2108	2000	1916	1837	1764	1698	1637
2947	2763	2596	2450	2319	2200	2107	2021	1941	1868	1801
3219	3017	2834	2673	2530	2400	2299	2204	2117	2038	1965
3492	3271	3072	2897	2742	2600	2490	2388	2294	2207	2129
3765	3527	3311	3122	2953	2800	2682	2572	2470	2377	2292
4040	3783	3550	3346	3165	3000	2873	2756	2647	2546	2455
4316	4039	3790	3571	3377	3200	3065	2940	2823	2716	2618
4592	4297	4030	3796	3589	3400	3257	3123	3000	2886	2781
4869	4554	4270	4021	3801	3600	3448	3306	3175	3055	2944
5148	4813	4511	4247	4013	3800	3639	3489	3351	3223	3107
5427	5072	4752	4473	4225	4000	3830	3672	3526	3392	3270
5708	5333	4994	4699	4438	4200	4022	3856	3703	3561	3432
5990	5594	5237	4926	4650	4400	4213	4039	3878	3730	3595
6274	5856	5480	5153	4863	4600	4405	4223	4054	3899	3757
6558	6119	5724	5380	5076	4800	4596	4405	4229	4067	3920
6844	6383	5968	5608	5289	5000	4786	4588	4404	4236	4082

Long Range Cruise Enroute Fuel and Time - High Altitudes

Reference Fuel And Time Required at Check Point

AIR DIST (NM)	PRESSURE ALTITUDE (1000 FT)									
	29		31		33		35		37 & ABOVE	
	FUEL (1000 LB)	TIME (HR:MIN)	FUEL (1000 LB)	TIME (HR:MIN)	FUEL (1000 LB)	TIME (HR:MIN)	FUEL (1000 LB)	TIME (HR:MIN)	FUEL (1000 LB)	TIME (HR:MIN)
400	4.4	1:04	4.2	1:02	4.1	1:01	3.9	1:01	3.8	1:00
600	6.8	1:33	6.6	1:31	6.3	1:29	6.1	1:28	6.0	1:27
800	9.2	2:03	8.9	2:00	8.6	1:57	8.3	1:56	8.1	1:54
1000	11.6	2:33	11.2	2:28	10.9	2:25	10.5	2:23	10.3	2:21
1200	13.9	3:03	13.5	2:58	13.1	2:53	12.7	2:51	12.4	2:48
1400	16.3	3:34	15.8	3:27	15.3	3:22	14.8	3:18	14.5	3:15
1600	18.6	4:04	18.0	3:57	17.4	3:50	16.9	3:46	16.5	3:43
1800	20.8	4:35	20.2	4:27	19.6	4:19	19.0	4:14	18.6	4:10
2000	23.1	5:07	22.4	4:57	21.7	4:48	21.1	4:43	20.6	4:38
2200	25.3	5:38	24.6	5:27	23.8	5:18	23.1	5:11	22.6	5:05
2400	27.5	6:10	26.7	5:58	25.9	5:47	25.2	5:40	24.6	5:33
2600	29.7	6:42	28.9	6:29	28.0	6:17	27.2	6:09	26.5	6:01
2800	31.9	7:15	31.0	7:01	30.0	6:48	29.2	6:38	28.5	6:29
3000	34.0	7:47	33.1	7:32	32.1	7:18	31.1	7:07	30.4	6:57
3200	36.1	8:20	35.1	8:04	34.1	7:49	33.1	7:37	32.3	7:26
3400	38.2	8:53	37.1	8:36	36.0	8:20	35.0	8:06	34.2	7:55
3600	40.3	9:27	39.2	9:09	38.0	8:51	36.9	8:37	36.0	8:24
3800	42.4	10:01	41.1	9:42	40.0	9:23	38.8	9:07	37.9	8:53
4000	44.4	10:35	43.1	10:14	41.9	9:55	40.7	9:38	39.7	9:22
4200	46.4	11:10	45.1	10:48	43.8	10:27	42.6	10:09	41.5	9:52
4400	48.5	11:45	47.1	11:22	45.7	11:00	44.4	10:40	43.3	10:22
4600	50.5	12:20	49.0	11:56	47.6	11:33	46.2	11:12	45.1	10:52
4800	52.5	12:56	50.9	12:30	49.5	12:06	48.0	11:44	46.8	11:23
5000	54.5	13:32	52.9	13:04	51.3	12:39	49.9	12:16	48.6	11:53

Fuel Required Adjustments (1000 LB)

REFERENCE FUEL REQUIRED (1000 LB)	WEIGHT AT CHECK POINT (1000 LB)				
	90	110	130	150	170
5	-0.7	-0.4	0.0	2.0	4.7
10	-1.4	-0.8	0.0	3.1	7.8
15	-2.1	-1.2	0.0	4.1	10.6
20	-2.8	-1.6	0.0	5.0	12.9
25	-3.6	-2.0	0.0	5.7	14.8
30	-4.3	-2.4	0.0	6.4	16.3
35	-5.1	-2.7	0.0	6.8	17.3
40	-5.8	-3.1	0.0	7.2	18.0
45	-6.6	-3.4	0.0	7.4	18.2
50	-7.4	-3.7	0.0	7.5	18.0
55	-8.2	-4.0	0.0	7.4	17.3

Long Range Cruise Wind-Altitude Trade

PRESSURE ALTITUDE (1000 FT)	CRUISE WEIGHT (1000 LB)								
	180	170	160	150	140	130	120	110	100
41						16	3	0	7
39				31	11	1	1	7	19
37			20	6	0	1	8	19	32
35	28	11	3	0	3	10	20	32	46
33	5	0	1	5	12	22	34	46	58
31	0	2	8	15	25	35	47	58	68
29	5	11	19	28	38	48	58	68	76
27	15	23	31	41	50	59	68	76	83
25	27	35	44	53	61	69	76	82	87

The above wind factor tables are for calculation of wind required to maintain present range capability at new pressure altitude, i.e., break-even wind.

Method:
1. **Read wind factors for present and new altitudes from table.**
2. **Determine difference (new altitude wind factor minus present altitude wind factor); this difference may be negative or positive.**
3. **Break-even wind at new altitude is present altitude wind plus difference from step 2.**

Descent

.78/280/250

PRESSURE ALTITUDE (FT)	TIME (MIN)	FUEL (LB)	DISTANCE (NM)				
			LANDING WEIGHT (1000 LB)				
			90	110	130	150	170
41000	26	760	101	116	127	134	137
39000	25	750	96	110	121	129	132
37000	24	740	92	105	115	123	127
35000	24	730	87	100	110	118	122
33000	23	720	84	96	106	113	117
31000	22	710	79	91	100	107	111
29000	21	690	75	86	94	100	104
27000	20	680	70	80	88	93	97
25000	19	660	65	75	82	87	90
23000	18	640	61	69	76	81	83
21000	17	620	56	64	70	74	77
19000	16	590	52	59	64	68	70
17000	15	570	48	54	58	61	63
15000	14	540	43	48	52	55	57
10000	10	450	30	33	35	37	37
5000	7	350	18	19	20	20	21
1500	4	270	9	9	9	9	9

Allowances for a straight-in approach are included.

Holding
Flaps Up

WEIGHT (1000 LB)		PRESSURE ALTITUDE (FT)								
		1500	5000	10000	15000	20000	25000	30000	35000	41000
190	%N1	65.6	68.0	72.0	76.0	80.4	84.8	89.3		
	KIAS	254	254	255	257	259	261	264		
	FF/ENG	3450	3400	3380	3360	3340	3380	3520		
180	%N1	64.1	66.8	70.5	74.6	79.0	83.4	87.7		
	KIAS	247	247	249	250	252	254	257		
	FF/ENG	3280	3230	3200	3190	3150	3180	3290		
170	%N1	62.5	65.5	69.0	73.2	77.5	81.9	86.2	92.5	
	KIAS	240	241	242	243	244	246	249	252	
	FF/ENG	3120	3060	3030	3010	2960	2980	3070	3320	
160	%N1	60.9	63.9	67.5	71.7	75.8	80.3	84.6	89.8	
	KIAS	232	233	234	235	237	239	241	244	
	FF/ENG	2960	2900	2860	2840	2790	2790	2870	3020	
150	%N1	59.3	62.1	66.0	69.9	74.1	78.6	83.0	87.8	
	KIAS	225	226	227	228	229	231	233	236	
	FF/ENG	2790	2740	2700	2670	2620	2600	2670	2770	
140	%N1	57.7	60.3	64.4	68.1	72.4	76.9	81.2	85.8	
	KIAS	218	218	219	220	221	223	225	227	
	FF/ENG	2630	2580	2530	2490	2460	2410	2470	2540	
130	%N1	56.0	58.5	62.6	66.3	70.6	74.9	79.3	83.8	94.2
	KIAS	209	210	211	212	213	214	216	218	222
	FF/ENG	2470	2420	2370	2330	2290	2240	2280	2330	2680
120	%N1	54.2	56.6	60.4	64.5	68.5	72.8	77.3	81.8	90.1
	KIAS	201	202	202	203	204	205	207	209	212
	FF/ENG	2310	2250	2210	2160	2120	2070	2100	2140	2350
110	%N1	52.2	54.6	58.2	62.5	66.2	70.7	75.1	79.6	87.3
	KIAS	193	193	194	194	195	196	198	200	203
	FF/ENG	2160	2090	2050	2000	1960	1910	1940	1970	2110
100	%N1	50.1	52.5	56.1	60.0	64.0	68.3	72.5	77.2	84.6
	KIAS	187	187	187	187	187	187	188	190	192
	FF/ENG	2010	1940	1890	1880	1830	1790	1770	1780	1890
90	%N1	48.0	50.4	53.9	57.5	61.8	65.6	70.0	74.6	81.9
	KIAS	181	181	181	181	181	181	181	181	182
	FF/ENG	1900	1840	1770	1720	1680	1640	1620	1610	1680

This table includes 5% additional fuel for holding in a racetrack pattern.

Intentionally
Blank

Performance Inflight — Chapter PI
Advisory Information — Section 62

ADVISORY INFORMATION

Normal Configuration Landing Distance

Flaps 15

BRAKING CONFIGURATION	REF DIST 145000 LB LANDING WEIGHT	WT ADJ PER 10000 LB ABV/BLW 145000 LB	ALT ADJ PER 1000 FT STD/HIGH*	WIND ADJ PER 10 KTS HEAD/ TAIL WIND	SLOPE ADJ PER 1% DOWN/ UP HILL	TEMP ADJ PER 10°C ABV/ BLW ISA	APP SPD ADJ PER 5 KTS ABOVE VREF15	REVERSE THRUST ADJ ONE REV	REVERSE THRUST ADJ NO REV
Dry Runway									
MAX MANUAL	3450	250/-190	80/110	-120/420	40/-40	80/-80	110	80	170
AUTOBRAKE MAX	4490	210/-220	110/140	-160/520	0/0	110/-110	200	0	10
AUTOBRAKE 3	6490	330/-370	180/240	-260/870	0/0	180/-180	340	0	0
AUTOBRAKE 2	8230	480/-520	260/350	-360/1200	120/-170	240/-240	310	340	340
AUTOBRAKE 1	9050	570/-600	310/410	-420/1410	250/-290	270/-270	300	860	1300
Good Reported Braking Action									
MAX MANUAL	4760	240/-250	130/180	-200/690	110/-100	120/-120	160	270	600
AUTOBRAKE MAX	5090	260/-270	140/190	-210/720	110/-90	130/-130	190	290	650
AUTOBRAKE 3	6500	330/-370	180/240	-260/890	20/-10	180/-180	340	10	50
AUTOBRAKE 2	8230	480/-520	260/350	-360/1200	120/-170	240/-240	310	340	340
AUTOBRAKE 1	9050	570/-600	310/410	-420/1410	250/-290	270/-270	300	860	1300
Medium Reported Braking Action									
MAX MANUAL	6600	390/-390	210/280	-320/1150	300/-240	180/-180	210	730	1760
AUTOBRAKE MAX	6740	390/-410	210/290	-330/1160	280/-220	180/-190	240	740	1780
AUTOBRAKE 3	7150	400/-420	220/300	-340/1200	210/-140	200/-210	330	490	1470
AUTOBRAKE 2	8410	490/-530	260/360	-390/1350	230/-220	240/-250	310	480	920
AUTOBRAKE 1	9100	570/-610	310/410	-430/1460	320/-310	270/-270	300	910	1510
Poor Reported Braking Action									
MAX MANUAL	8680	560/-560	300/420	-490/1820	710/-470	240/-260	250	1560	4190
AUTOBRAKE MAX	8690	560/-560	300/420	-490/1820	720/-470	240/-260	260	1550	4180
AUTOBRAKE 3	8770	570/-560	300/420	-490/1820	690/-430	240/-260	310	1560	4210
AUTOBRAKE 2	9360	590/-600	320/440	-510/1880	670/-450	260/-280	310	1340	3650
AUTOBRAKE 1	9760	630/-650	330/470	-530/1940	690/-490	280/-290	290	1510	3750

Reference distance is based on sea level, standard day, no wind or slope, VREF15, two-engine detent No. 2 reverse thrust, and auto speedbrakes.
For max manual braking and manual speedbrakes, increase reference landing distance by 210 ft.
For autobrake and manual speedbrakes, increase reference landing distance by 170 ft.
Reference Distance includes an air distance allowance of 1000 ft from threshold to touchdown.
Actual (unfactored) distances are shown.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Normal Configuration Landing Distance

Flaps 30

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	145000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 145000 LB	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF30	ONE REV	NO REV
Dry Runway									
MAX MANUAL	3250	190/-160	70/100	-120/400	40/-40	70/-70	110	70	150
AUTOBRAKE MAX	4120	180/-200	100/130	-150/490	0/0	100/-100	190	0	10
AUTOBRAKE 3	5890	300/-330	160/210	-250/830	0/-10	160/-160	310	0	0
AUTOBRAKE 2	7440	420/-450	230/300	-340/1140	110/-140	220/-220	300	260	260
AUTOBRAKE 1	8180	500/-530	270/360	-390/1340	220/-250	240/-240	280	680	1060
Good Reported Braking Action									
MAX MANUAL	4490	220/-230	120/160	-190/680	110/-100	110/-110	160	240	530
AUTOBRAKE MAX	4790	240/-250	130/170	-200/700	100/-90	120/-120	190	260	580
AUTOBRAKE 3	5900	300/-330	160/210	-250/840	30/-20	160/-160	310	10	50
AUTOBRAKE 2	7440	420/-450	230/300	-340/1140	110/-140	220/-220	300	260	260
AUTOBRAKE 1	8180	500/-530	270/360	-390/1340	220/-250	240/-240	280	680	1060
Medium Reported Braking Action									
MAX MANUAL	6140	350/-360	190/260	-310/1110	280/-220	160/-170	210	630	1510
AUTOBRAKE MAX	6270	360/-370	190/260	-310/1130	260/-210	170/-170	240	640	1530
AUTOBRAKE 3	6560	360/-380	190/270	-320/1150	210/-150	180/-190	300	460	1330
AUTOBRAKE 2	7620	430/-460	230/320	-370/1290	220/-200	220/-220	290	400	790
AUTOBRAKE 1	8230	500/-530	270/360	-400/1390	300/-270	240/-240	280	730	1250
Poor Reported Braking Action									
MAX MANUAL	7990	500/-500	270/380	-470/1760	670/-440	220/-230	250	1330	3490
AUTOBRAKE MAX	8010	510/-500	270/380	-470/1760	680/-440	220/-230	260	1330	3490
AUTOBRAKE 3	8080	510/-510	270/380	-470/1760	660/-420	220/-240	280	1340	3520
AUTOBRAKE 2	8550	530/-540	280/400	-490/1810	630/-420	240/-250	290	1150	3070
AUTOBRAKE 1	8880	560/-570	290/410	-500/1860	660/-450	250/-260	280	1270	3150

Reference distance is based on sea level, standard day, no wind or slope, VREF30, two-engine detent No. 2 reverse thrust, and auto speedbrakes.
For max manual braking and manual speedbrakes, increase reference landing distance by 190 ft.
For autobrake and manual speedbrakes, increase reference landing distance by 160 ft.
Reference Distance includes an air distance allowance of 1000 ft from threshold to touchdown.
Actual (unfactored) distances are shown.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Normal Configuration Landing Distance
Flaps 40

BRAKING CONFIGURATION	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
	145000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 145000 LB	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF40	ONE REV	NO REV
Dry Runway									
MAX MANUAL	3050	160/-140	70/90	-110/390	40/-40	70/-70	110	60	120
AUTOBRAKE MAX	3770	160/-170	80/110	-140/470	0/0	100/-100	180	0	10
AUTOBRAKE 3	5300	260/-290	140/190	-230/780	0/0	160/-160	300	0	0
AUTOBRAKE 2	6770	370/-400	200/270	-320/1080	70/-110	220/-220	300	120	120
AUTOBRAKE 1	7530	450/-480	240/320	-380/1280	180/-220	240/-240	280	520	740
Good Reported Braking Action									
MAX MANUAL	4220	200/-210	110/150	-190/660	110/-90	110/-110	160	210	470
AUTOBRAKE MAX	4490	220/-230	120/160	-200/680	100/-80	120/-120	190	230	500
AUTOBRAKE 3	5330	260/-290	140/190	-230/790	30/-10	160/-160	300	10	50
AUTOBRAKE 2	6770	370/-400	200/270	-320/1080	70/-110	220/-220	300	120	120
AUTOBRAKE 1	7530	450/-480	240/320	-380/1280	180/-220	240/-240	280	520	740
Medium Reported Braking Action									
MAX MANUAL	5750	320/-330	170/240	-300/1090	270/-210	160/-170	210	560	1330
AUTOBRAKE MAX	5840	330/-340	180/240	-300/1090	250/-200	170/-170	240	560	1330
AUTOBRAKE 3	6010	330/-340	180/240	-310/1110	220/-150	180/-190	300	480	1280
AUTOBRAKE 2	6970	380/-410	210/280	-350/1230	190/-180	220/-220	300	260	640
AUTOBRAKE 1	7570	450/-480	240/320	-380/1340	260/-240	240/-240	280	570	930
Poor Reported Braking Action									
MAX MANUAL	7480	460/-460	240/340	-450/1710	650/-430	220/-230	250	1180	3060
AUTOBRAKE MAX	7500	470/-460	240/350	-450/1720	660/-430	220/-230	250	1180	3070
AUTOBRAKE 3	7540	470/-470	250/350	-450/1720	640/-410	220/-240	270	1190	3080
AUTOBRAKE 2	7900	480/-490	250/360	-470/1760	610/-390	240/-250	300	970	2730
AUTOBRAKE 1	8230	500/-520	270/370	-480/1810	620/-430	250/-260	280	1100	2690

Reference distance is based on sea level, standard day, no wind or slope, VREF40, two-engine detent No. 2 reverse thrust, and auto speedbrakes.
For max manual braking and manual speedbrakes, increase reference landing distance by 180 ft.
For autobrake and manual speedbrakes, increase reference landing distance by 150 ft.
Reference Distance includes an air distance allowance of 1000 ft from threshold to touchdown.
Actual (unfactored) distances are shown.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

Airspeed Unreliable (Flaps 15)

VREF15

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	145000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 145000 LB	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	3660	230/-200	90/110	-130/430	50/-40	80/-80	N/A	100	210
AUTOBRAKE MAX	4890	210/-230	120/150	-170/550	0/0	120/-120	N/A	0	20
AUTOBRAKE 2	8730	490/-550	290/370	-370/1230	180/-200	260/-260	N/A	630	740

Good Reported Braking Action

MAX MANUAL	5030	240/-260	140/180	-200/710	120/-100	130/-130	N/A	310	700
AUTOBRAKE MAX	5420	250/-280	150/190	-210/740	110/-70	140/-140	N/A	330	770
AUTOBRAKE 2	8730	490/-550	290/370	-370/1230	180/-200	260/-260	N/A	630	740

Medium Reported Braking Action

MAX MANUAL	6910	380/-410	220/290	-330/1160	290/-240	190/-190	N/A	820	2010
AUTOBRAKE MAX	7090	390/-420	230/300	-330/1180	280/-220	190/-200	N/A	830	2060
AUTOBRAKE 3	7760	390/-440	230/310	-350/1240	190/-170	220/-230	N/A	480	1500

Poor Reported Braking Action

MAX MANUAL	8960	550/-570	310/430	-490/1820	690/-460	250/-260	N/A	1690	4640
AUTOBRAKE MAX	8990	550/-570	310/430	-490/1820	690/-440	250/-270	N/A	1680	4620
AUTOBRAKE 3	9210	540/-570	310/430	-490/1840	640/-430	260/-270	N/A	1590	4570

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 1000 ft from threshold to touchdown.
Actual (unfactored) distances are shown.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

Airspeed Unreliable (Flaps 30)

VREF30

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	145000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 145000 LB	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	3470	170/-170	80/100	-120/420	40/-40	80/-80	N/A	80	180
AUTOBRAKE MAX	4500	180/-210	110/140	-160/520	0/0	110/-110	N/A	0	10
AUTOBRAKE 2	7930	440/-480	250/330	-350/1170	150/-180	230/-230	N/A	500	610

Good Reported Braking Action

MAX MANUAL	4770	220/-240	130/170	-200/690	110/-100	120/-120	N/A	280	630
AUTOBRAKE MAX	5120	240/-260	140/180	-210/720	110/-90	130/-130	N/A	310	690
AUTOBRAKE 2	7930	440/-480	250/330	-350/1170	150/-180	230/-230	N/A	500	610

Medium Reported Braking Action

MAX MANUAL	6460	350/-370	200/270	-320/1130	280/-220	170/-180	N/A	710	1730
AUTOBRAKE MAX	6640	360/-380	210/280	-320/1140	260/-210	180/-180	N/A	730	1770
AUTOBRAKE 3	7120	360/-390	210/280	-340/1190	200/-170	200/-200	N/A	450	1360

Poor Reported Braking Action

MAX MANUAL	8290	500/-510	280/380	-470/1760	650/-440	230/-240	N/A	1450	3870
AUTOBRAKE MAX	8340	500/-520	280/390	-470/1770	650/-420	230/-240	N/A	1440	3860
AUTOBRAKE 3	8480	500/-520	280/390	-470/1780	620/-410	230/-250	N/A	1390	3840

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 1000 ft from threshold to touchdown.
Actual (unfactored) distances are shown.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance
Airspeed Unreliable (Flaps 40)
VREF40

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	145000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 145000 LB	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV
Dry Runway									
MAX MANUAL	3270	160/-150	70/100	-120/400	40/-40	70/-70	N/A	70	150
AUTOBRAKE MAX	4140	160/-180	100/120	-150/490	10/0	100/-100	N/A	0	10
AUTOBRAKE 2	7300	390/-430	220/290	-330/1120	130/-150	210/-210	N/A	350	380
Good Reported Braking Action									
MAX MANUAL	4510	200/-230	120/160	-190/680	110/-100	110/-110	N/A	250	560
AUTOBRAKE MAX	4830	220/-240	130/170	-200/710	100/-90	120/-120	N/A	270	610
AUTOBRAKE 2	7300	390/-430	220/290	-330/1120	130/-150	210/-210	N/A	350	380
Medium Reported Braking Action									
MAX MANUAL	6080	320/-340	180/250	-310/1110	270/-220	160/-170	N/A	640	1540
AUTOBRAKE MAX	6230	330/-350	190/250	-310/1120	260/-200	170/-170	N/A	650	1560
AUTOBRAKE 3	6550	320/-360	190/260	-320/1150	200/-160	180/-180	N/A	450	1330
Poor Reported Braking Action									
MAX MANUAL	7800	460/-480	260/350	-460/1730	640/-420	210/-230	N/A	1290	3410
AUTOBRAKE MAX	7830	460/-480	260/360	-460/1730	640/-410	210/-230	N/A	1290	3400
AUTOBRAKE 3	7920	460/-480	260/360	-460/1740	620/-410	220/-230	N/A	1300	3440

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 1000 ft from threshold to touchdown.
Actual (unfactored) distances are shown.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

All Flaps Up Landing

VREF40 + 55

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	145000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 145000 LB	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV
Dry Runway									
MAX MANUAL	4430	540/-250	170/350	-150/690	60/-50	110/-110	150	140	300
AUTOBRAKE MAX	6130	250/-250	160/240	-200/650	20/-20	160/-160	240	20	70
AUTOBRAKE 2	11260	570/-650	380/490	-430/1410	240/-270	350/-350	340	840	970
Good Reported Braking Action									
MAX MANUAL	5850	250/-280	170/220	-220/760	130/-120	160/-160	150	350	800
AUTOBRAKE MAX	6630	260/-290	180/240	-240/810	100/-80	180/-180	230	280	710
AUTOBRAKE 2	11260	570/-650	380/490	-430/1410	240/-270	350/-350	340	840	970
Medium Reported Braking Action									
MAX MANUAL	8350	430/-460	270/360	-360/1270	350/-280	240/-240	220	1010	2460
AUTOBRAKE MAX	8640	430/-470	280/370	-370/1290	330/-270	250/-250	240	1030	2530
AUTOBRAKE 3	9810	410/-490	300/400	-400/1380	220/-190	290/-300	370	540	1630
Poor Reported Braking Action									
MAX MANUAL	11190	650/-680	400/550	-550/2000	840/-580	330/-340	270	2220	6100
AUTOBRAKE MAX	11200	640/-670	410/550	-550/2000	830/-550	330/-340	300	2210	6070
AUTOBRAKE 3	11560	610/-660	400/550	-560/2030	760/-500	340/-360	370	1980	5890

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 1000 ft from threshold to touchdown.
Actual (unfactored) distances are shown.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance
ANTISKID INOPERATIVE (Flaps 15)
VREF15

BRAKING CONFIGURATION	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
	145000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 145000 LB	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	6130	310/-340	170/230	-270/960	190/-160	150/-160	200	490	1170
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Good Reported Braking Action

MAX MANUAL	6890	370/-400	210/280	-330/1170	280/-220	180/-180	220	730	1790
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Medium Reported Braking Action

MAX MANUAL	8820	530/-550	290/400	-490/1810	670/-440	230/-250	260	1550	4270
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Poor Reported Braking Action

MAX MANUAL	11740	770/-780	410/590	-810/3320	2070/-1000	280/-360	300	3650	12820
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 1000 ft from threshold to touchdown.
Actual (unfactored) distances are shown.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

ANTISKID INOPERATIVE (Flaps 30)

VREF30

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	145000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 145000 LB	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	5730	280/-310	160/210	-260/930	180/-150	140/-150	200	430	1010
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Good Reported Braking Action

MAX MANUAL	6410	340/-360	190/250	-320/1130	260/-210	160/-170	220	630	1530
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Medium Reported Braking Action

MAX MANUAL	8150	480/-500	260/360	-470/1760	630/-420	210/-230	250	1320	3550
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Poor Reported Braking Action

MAX MANUAL	10790	690/-700	360/520	-770/3220	1940/-940	260/-330	280	3110	10490
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 1000 ft from threshold to touchdown.
Actual (unfactored) distances are shown.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

ANTISKID INOPERATIVE (Flaps 40)

VREF40

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	145000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 145000 LB	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	5370	260/-280	140/190	-260/910	180/-150	130/-130	200	380	880
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Good Reported Braking Action

MAX MANUAL	6000	310/-330	170/230	-310/1100	260/-200	150/-160	220	550	1330
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Medium Reported Braking Action

MAX MANUAL	7620	440/-460	240/330	-450/1720	610/-400	190/-210	250	1170	3100
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Poor Reported Braking Action

MAX MANUAL	10120	640/-650	330/480	-750/3160	1880/-910	240/-310	280	2810	9280
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 1000 ft from threshold to touchdown.
Actual (unfactored) distances are shown.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance
Jammed or Restricted Flight Controls (Flaps 15)
VREF15

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	145000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 145000 LB	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	3440	210/-180	80/100	-120/420	40/-40	80/-80	110	80	180
AUTOBRAKE MAX	4490	200/-220	110/140	-160/520	0/0	110/-110	200	0	10
AUTOBRAKE 2	8120	460/-520	260/340	-360/1190	140/-170	240/-240	300	430	440

Good Reported Braking Action

MAX MANUAL	4720	230/-250	130/170	-200/690	110/-100	120/-120	160	280	640
AUTOBRAKE MAX	5040	240/-270	140/180	-210/710	100/-80	130/-130	190	310	700
AUTOBRAKE 2	8120	460/-520	260/340	-360/1190	140/-170	240/-240	300	430	440

Medium Reported Braking Action

MAX MANUAL	6490	370/-390	200/270	-320/1130	280/-230	170/-180	210	760	1870
AUTOBRAKE MAX	6620	370/-400	210/280	-320/1140	260/-210	180/-180	240	770	1900
AUTOBRAKE 3	7100	370/-410	210/290	-340/1190	190/-130	200/-200	330	480	1520

Poor Reported Braking Action

MAX MANUAL	8460	530/-540	290/400	-480/1780	680/-450	230/-250	250	1600	4400
AUTOBRAKE MAX	8470	530/-540	290/400	-480/1780	680/-450	230/-250	260	1590	4400
AUTOBRAKE 3	8580	530/-550	290/400	-480/1790	640/-400	240/-250	320	1570	4400

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 1000 ft from threshold to touchdown.
Actual (unfactored) distances are shown.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

LEADING EDGE FLAPS TRANSIT (Flaps 15)

VREF15 + 15

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	145000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 145000 LB	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV
Dry Runway									
MAX MANUAL	3860	230/-210	90/130	-130/450	50/-50	90/-90	120	110	240
AUTOBRAKE MAX	5160	210/-240	130/160	-170/570	10/-10	130/-130	210	0	20
AUTOBRAKE 2	9350	520/-580	310/400	-390/1280	190/-220	280/-280	310	620	670
Good Reported Braking Action									
MAX MANUAL	5350	260/-280	150/200	-210/740	130/-110	140/-140	170	360	810
AUTOBRAKE MAX	5770	270/-300	160/210	-220/770	120/-100	150/-150	200	390	900
AUTOBRAKE 2	9350	520/-580	310/400	-390/1280	190/-220	280/-280	310	620	670
Medium Reported Braking Action									
MAX MANUAL	7390	410/-440	240/320	-340/1210	320/-260	210/-210	220	940	2350
AUTOBRAKE MAX	7560	420/-450	250/330	-340/1220	300/-240	210/-210	240	950	2380
AUTOBRAKE 3	8190	410/-460	250/340	-360/1270	210/-160	230/-240	350	570	1850
Poor Reported Braking Action									
MAX MANUAL	9610	590/-610	340/470	-510/1880	750/-500	270/-290	260	1940	5430
AUTOBRAKE MAX	9610	600/-610	340/470	-510/1880	760/-500	270/-290	270	1930	5420
AUTOBRAKE 3	9770	590/-610	340/470	-510/1890	700/-440	280/-290	340	1870	5380

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 1000 ft from threshold to touchdown.
Actual (unfactored) distances are shown.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance
LOSS OF SYSTEM A (Flaps 15)
VREF15

BRAKING CONFIGURATION	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
	145000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 145000 LB	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV
Dry Runway									
MAX MANUAL	3850	210/-190	90/120	-130/450	60/-50	90/-90	150	130	210
AUTOBRAKE MAX	4480	190/-220	110/140	-160/520	0/0	110/-110	200	10	20
AUTOBRAKE 2	8600	450/-530	260/330	-370/1240	0/-60	260/-260	450	0	0
Good Reported Braking Action									
MAX MANUAL	5580	280/-310	160/210	-230/780	160/-140	150/-150	230	470	960
AUTOBRAKE MAX	5630	290/-320	160/220	-230/780	140/-110	150/-150	240	470	960
AUTOBRAKE 2	8600	450/-530	260/330	-370/1240	0/-60	260/-260	450	0	0
Medium Reported Braking Action									
MAX MANUAL	7690	450/-470	250/340	-360/1260	390/-310	210/-220	290	1210	2900
AUTOBRAKE MAX	7640	440/-470	250/350	-360/1260	400/-320	210/-220	290	1190	2870
AUTOBRAKE 3	7640	450/-460	250/340	-360/1260	400/-260	210/-220	310	1190	2870
Poor Reported Braking Action									
MAX MANUAL	9950	640/-660	360/500	-530/1960	880/-580	280/-290	340	2420	6890
AUTOBRAKE MAX	9940	640/-660	360/500	-530/1960	890/-590	280/-290	340	2420	6870
AUTOBRAKE 3	9940	640/-660	360/500	-530/1960	890/-590	280/-290	340	2420	6870

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 1000 ft from threshold to touchdown.
Actual (unfactored) distances are shown.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

LOSS OF SYSTEM A (Flaps 30)

VREF30

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	145000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 145000 LB	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV
Dry Runway									
MAX MANUAL	3610	190/-170	80/110	-130/430	50/-50	80/-80	150	110	180
AUTOBRAKE MAX	4120	170/-200	100/120	-150/490	10/0	100/-100	190	30	50
AUTOBRAKE 2	7750	390/-470	230/290	-350/1170	0/-40	230/-230	430	0	0
Good Reported Braking Action									
MAX MANUAL	5220	250/-280	150/200	-220/760	160/-140	130/-140	230	410	820
AUTOBRAKE MAX	5270	260/-290	150/200	-220/760	140/-120	140/-140	240	410	830
AUTOBRAKE 2	7750	390/-470	230/290	-350/1170	0/-40	230/-230	430	0	0
Medium Reported Braking Action									
MAX MANUAL	7100	400/-430	230/310	-350/1220	370/-290	190/-200	280	1020	2410
AUTOBRAKE MAX	7070	400/-430	230/310	-350/1220	380/-300	190/-200	290	1020	2390
AUTOBRAKE 3	7070	400/-430	230/310	-350/1220	380/-270	190/-200	300	1020	2390
Poor Reported Braking Action									
MAX MANUAL	9120	570/-590	320/440	-510/1890	820/-540	250/-270	320	2020	5540
AUTOBRAKE MAX	9120	580/-590	320/450	-510/1890	840/-550	250/-270	320	2020	5540
AUTOBRAKE 3	9120	580/-590	320/450	-510/1890	840/-550	250/-270	320	2020	5540

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 1000 ft from threshold to touchdown.
Actual (unfactored) distances are shown.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance
LOSS OF SYSTEM A (Flaps 40)
VREF40

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	145000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 145000 LB	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	3380	170/-150	80/100	-120/410	50/-50	70/-80	170	90	150
AUTOBRAKE MAX	3790	160/-170	90/110	-140/470	10/-10	90/-90	180	40	70
AUTOBRAKE 2	6920	350/-400	200/260	-320/1100	0/-10	200/-200	420	0	0

Good Reported Braking Action

MAX MANUAL	4860	230/-250	130/180	-210/730	150/-130	120/-120	230	360	700
AUTOBRAKE MAX	4890	230/-260	140/180	-210/740	130/-110	120/-130	240	350	700
AUTOBRAKE 2	6920	350/-400	200/260	-320/1100	0/-10	200/-200	420	0	0

Medium Reported Braking Action

MAX MANUAL	6570	360/-390	210/280	-330/1180	350/-280	180/-180	280	880	2030
AUTOBRAKE MAX	6560	360/-390	210/280	-330/1180	360/-280	180/-180	280	880	2020
AUTOBRAKE 3	6560	360/-390	210/280	-330/1180	360/-270	180/-180	290	880	2020

Poor Reported Braking Action

MAX MANUAL	8420	520/-530	290/400	-490/1830	790/-510	230/-240	310	1740	4620
AUTOBRAKE MAX	8430	520/-530	290/400	-490/1840	800/-520	230/-250	310	1740	4620
AUTOBRAKE 3	8430	520/-530	290/400	-490/1840	800/-520	230/-250	310	1740	4620

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 1000 ft from threshold to touchdown.
Actual (unfactored) distances are shown.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance
LOSS OF SYSTEM A AND SYSTEM B (Flaps 15)
VREF15

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	145000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 145000 LB	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV
Dry Runway									
MAX MANUAL	5410	230/-270	140/180	-200/660	130/-110	130/-140	260	-20	240
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								
Good Reported Braking Action									
MAX MANUAL	7880	400/-440	230/310	-330/1130	340/-280	210/-210	340	350	1560
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								
Medium Reported Braking Action									
MAX MANUAL	10410	600/-630	340/470	-490/1740	720/-540	280/-290	400	1260	4880
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								
Poor Reported Braking Action									
MAX MANUAL	12900	820/-830	460/650	-700/2590	1580/-900	340/-370	430	2780	11450
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 1000 ft from threshold to touchdown.
Actual (unfactored) distances are shown.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

LOSS OF SYSTEM B (Flaps 15)

VREF15

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	145000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 145000 LB	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	3900	170/-190	90/120	-140/490	60/-60	90/-90	130	140	240
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Good Reported Braking Action

MAX MANUAL	5590	280/-310	160/210	-240/850	170/-150	150/-150	190	470	980
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Medium Reported Braking Action

MAX MANUAL	7580	440/-460	250/340	-380/1370	410/-320	210/-210	250	1150	2770
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Poor Reported Braking Action

MAX MANUAL	9680	620/-630	340/480	-560/2110	990/-590	260/-290	280	2240	6280
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 1000 ft from threshold to touchdown.
Actual (unfactored) distances are shown.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

MANUAL REVERSION (Flaps 15)

VREF15

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	145000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 145000 LB	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	5410	230/-270	140/180	-200/660	130/-110	130/-140	260	-20	240
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Good Reported Braking Action

MAX MANUAL	7880	400/-440	230/310	-330/1130	340/-280	210/-210	340	350	1560
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Medium Reported Braking Action

MAX MANUAL	10410	600/-630	340/470	-490/1740	720/-540	280/-290	400	1260	4880
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Poor Reported Braking Action

MAX MANUAL	12900	820/-830	460/650	-700/2590	1580/-900	340/-370	430	2780	11450
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 1000 ft from threshold to touchdown.
Actual (unfactored) distances are shown.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

One Engine Inoperative Landing (Flaps 15)

VREF15

BRAKING CONFIGURATION	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
	145000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 145000 LB	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	3490	220/-190	80/100	-130/430	50/-40	80/-80	120	0	90
AUTOBRAKE MAX	4490	200/-220	110/140	-160/520	10/0	110/-110	200	0	10
AUTOBRAKE 2	8510	450/-520	260/330	-370/1230	40/-110	260/-260	380	0	30

Good Reported Braking Action

MAX MANUAL	4930	240/-260	130/180	-210/720	130/-110	130/-130	170	0	340
AUTOBRAKE MAX	5300	250/-290	140/180	-220/750	120/-100	140/-140	200	0	380
AUTOBRAKE 2	8510	450/-520	260/330	-370/1230	40/-110	260/-260	380	0	30

Medium Reported Braking Action

MAX MANUAL	7100	400/-430	220/290	-350/1230	360/-290	200/-200	230	0	1060
AUTOBRAKE MAX	7260	400/-440	220/290	-350/1250	340/-270	210/-210	270	0	1080
AUTOBRAKE 3	7480	400/-450	230/300	-360/1270	300/-220	210/-220	320	0	950

Poor Reported Braking Action

MAX MANUAL	9730	600/-630	330/440	-550/2010	960/-610	280/-290	290	0	2580
AUTOBRAKE MAX	9720	600/-630	330/440	-550/2010	970/-600	290/-290	320	0	2580
AUTOBRAKE 3	9840	600/-640	330/440	-550/2020	940/-610	290/-300	310	0	2610

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 1000 ft from threshold to touchdown.
Actual (unfactored) distances are shown.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

One Engine Inoperative Landing (Flaps 30)

VREF30

BRAKING CONFIGURATION	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	145000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 145000 LB	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV
Dry Runway									
MAX MANUAL	3280	170/-170	70/100	-120/410	40/-40	70/-70	120	0	80
AUTOBRAKE MAX	4120	170/-200	100/120	-150/500	10/0	100/-100	190	0	0
AUTOBRAKE 2	7640	400/-450	230/290	-340/1160	40/-100	230/-230	350	0	30
Good Reported Braking Action									
MAX MANUAL	4630	220/-240	120/160	-200/700	120/-110	120/-120	170	0	300
AUTOBRAKE MAX	4970	230/-260	130/170	-210/730	120/-100	130/-130	200	0	330
AUTOBRAKE 2	7640	400/-450	230/290	-340/1160	40/-100	230/-230	350	0	30
Medium Reported Braking Action									
MAX MANUAL	6560	360/-390	200/260	-330/1190	340/-270	180/-180	230	0	900
AUTOBRAKE MAX	6710	360/-400	200/270	-340/1200	320/-250	190/-190	260	0	910
AUTOBRAKE 3	6860	370/-400	200/270	-340/1220	290/-230	190/-200	290	0	850
Poor Reported Braking Action									
MAX MANUAL	8860	530/-560	290/390	-520/1930	880/-560	250/-260	280	0	2110
AUTOBRAKE MAX	8870	540/-560	290/390	-520/1930	890/-540	260/-270	300	0	2110
AUTOBRAKE 3	8980	540/-570	290/390	-520/1940	870/-570	260/-270	280	0	2140

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 1000 ft from threshold to touchdown.
Actual (unfactored) distances are shown.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

Stabilizer Trim Inoperative (Flaps 15)

VREF15

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	145000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 145000 LB	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	3440	210/-180	80/100	-120/420	40/-40	80/-80	110	80	180
AUTOBRAKE MAX	4490	200/-220	110/140	-160/520	0/0	110/-110	200	0	10
AUTOBRAKE 2	8120	460/-520	260/340	-360/1190	140/-170	240/-240	300	430	440

Good Reported Braking Action

MAX MANUAL	4720	230/-250	130/170	-200/690	110/-100	120/-120	160	280	640
AUTOBRAKE MAX	5040	240/-270	140/180	-210/710	100/-80	130/-130	190	310	700
AUTOBRAKE 2	8120	460/-520	260/340	-360/1190	140/-170	240/-240	300	430	440

Medium Reported Braking Action

MAX MANUAL	6490	370/-390	200/270	-320/1130	280/-230	170/-180	210	760	1870
AUTOBRAKE MAX	6620	370/-400	210/280	-320/1140	260/-210	180/-180	240	770	1900
AUTOBRAKE 3	7100	370/-410	210/290	-340/1190	190/-130	200/-200	330	480	1520

Poor Reported Braking Action

MAX MANUAL	8460	530/-540	290/400	-480/1780	680/-450	230/-250	250	1600	4400
AUTOBRAKE MAX	8470	530/-540	290/400	-480/1780	680/-450	230/-250	260	1590	4400
AUTOBRAKE 3	8580	530/-550	290/400	-480/1790	640/-400	240/-250	320	1570	4400

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 1000 ft from threshold to touchdown.
Actual (unfactored) distances are shown.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance
Trailing Edge Flap Asymmetry (1 ≤ Flap Lever <15)
VREF40 + 30

BRAKING CONFIGURATION	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
	145000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 145000 LB	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV
Dry Runway									
MAX MANUAL	3680	270/-190	90/140	-130/440	50/-40	80/-90	110	90	200
AUTOBRAKE MAX	5010	190/-210	120/160	-170/560	10/-10	130/-130	210	10	20
AUTOBRAKE 2	9070	460/-530	290/380	-380/1260	180/-200	270/-270	320	560	590
Good Reported Braking Action									
MAX MANUAL	5050	220/-250	140/180	-200/710	120/-100	130/-130	150	300	680
AUTOBRAKE MAX	5530	230/-260	150/200	-220/740	100/-80	140/-140	210	310	740
AUTOBRAKE 2	9080	460/-530	290/380	-380/1260	180/-210	270/-270	310	560	590
Medium Reported Braking Action									
MAX MANUAL	7040	370/-390	220/300	-330/1170	300/-240	190/-200	210	840	2060
AUTOBRAKE MAX	7240	370/-400	230/310	-340/1190	280/-230	200/-200	240	850	2100
AUTOBRAKE 3	7920	360/-410	240/320	-360/1250	200/-140	230/-230	350	490	1540
Poor Reported Braking Action									
MAX MANUAL	9280	540/-560	320/440	-500/1850	730/-490	260/-270	260	1800	4950
AUTOBRAKE MAX	9270	540/-560	320/450	-500/1850	730/-470	260/-280	270	1780	4930
AUTOBRAKE 3	9450	530/-550	320/440	-500/1860	670/-420	270/-280	340	1720	4900

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 1000 ft from threshold to touchdown.
Actual (unfactored) distances are shown.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance
Trailing Edge Flap Asymmetry (Flap Lever 15 or 25)
VREF15

BRAKING CONFIGURATION	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
	145000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 145000 LB	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	3440	210/-180	80/100	-120/420	40/-40	80/-80	110	80	180
AUTOBRAKE MAX	4490	200/-220	110/140	-160/520	0/0	110/-110	200	0	10
AUTOBRAKE 2	8120	460/-520	260/340	-360/1190	140/-170	240/-240	300	430	440

Good Reported Braking Action

MAX MANUAL	4720	230/-250	130/170	-200/690	110/-100	120/-120	160	280	640
AUTOBRAKE MAX	5040	240/-270	140/180	-210/710	100/-80	130/-130	190	310	700
AUTOBRAKE 2	8120	460/-520	260/340	-360/1190	140/-170	240/-240	300	430	440

Medium Reported Braking Action

MAX MANUAL	6490	370/-390	200/270	-320/1130	280/-230	170/-180	210	760	1870
AUTOBRAKE MAX	6620	370/-400	210/280	-320/1140	260/-210	180/-180	240	770	1900
AUTOBRAKE 3	7100	370/-410	210/290	-340/1190	190/-130	200/-200	330	480	1520

Poor Reported Braking Action

MAX MANUAL	8460	530/-540	290/400	-480/1780	680/-450	230/-250	250	1600	4400
AUTOBRAKE MAX	8470	530/-540	290/400	-480/1780	680/-450	230/-250	260	1590	4400
AUTOBRAKE 3	8580	530/-550	290/400	-480/1790	640/-400	240/-250	320	1570	4400

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 1000 ft from threshold to touchdown.
Actual (unfactored) distances are shown.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance
Trailing Edge Flap Asymmetry (Flap Lever 30)
VREF30

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	145000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 145000 LB	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	3240	160/-160	70/90	-120/400	40/-40	70/-70	110	70	160
AUTOBRAKE MAX	4120	170/-200	100/120	-150/490	0/0	100/-100	190	0	10
AUTOBRAKE 2	7360	410/-460	230/300	-340/1130	120/-150	210/-210	290	330	340

Good Reported Braking Action

MAX MANUAL	4450	210/-230	120/160	-190/670	110/-90	110/-110	160	250	560
AUTOBRAKE MAX	4750	220/-250	130/170	-200/700	100/-90	120/-120	190	270	620
AUTOBRAKE 2	7360	410/-460	230/300	-340/1130	120/-150	210/-210	290	330	340

Medium Reported Braking Action

MAX MANUAL	6050	330/-350	180/250	-310/1100	270/-210	160/-170	200	660	1600
AUTOBRAKE MAX	6170	340/-360	190/250	-310/1110	250/-200	160/-170	230	670	1620
AUTOBRAKE 3	6510	340/-370	190/260	-320/1140	190/-140	180/-180	300	450	1380

Poor Reported Braking Action

MAX MANUAL	7820	480/-490	260/360	-460/1730	640/-420	210/-230	240	1370	3670
AUTOBRAKE MAX	7840	480/-490	260/360	-460/1730	650/-420	210/-230	250	1360	3660
AUTOBRAKE 3	7910	480/-500	260/360	-460/1730	620/-390	210/-230	280	1370	3690

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 1000 ft from threshold to touchdown.
Actual (unfactored) distances are shown.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance
Trailing Edge Flap Disagree (1 ≤ Indicated Flaps <15)
VREF40 + 30

BRAKING CONFIGURATION	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
	145000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 145000 LB	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV
Dry Runway									
MAX MANUAL	3680	270/-190	90/140	-130/440	50/-40	80/-90	110	90	200
AUTOBRAKE MAX	5010	190/-210	120/160	-170/560	10/-10	130/-130	210	10	20
AUTOBRAKE 2	9070	460/-530	290/380	-380/1260	180/-200	270/-270	320	560	590
Good Reported Braking Action									
MAX MANUAL	5050	220/-250	140/180	-200/710	120/-100	130/-130	150	300	680
AUTOBRAKE MAX	5530	230/-260	150/200	-220/740	100/-80	140/-140	210	310	740
AUTOBRAKE 2	9080	460/-530	290/380	-380/1260	180/-210	270/-270	310	560	590
Medium Reported Braking Action									
MAX MANUAL	7040	370/-390	220/300	-330/1170	300/-240	190/-200	210	840	2060
AUTOBRAKE MAX	7240	370/-400	230/310	-340/1190	280/-230	200/-200	240	850	2100
AUTOBRAKE 3	7920	360/-410	240/320	-360/1250	200/-140	230/-230	350	490	1540
Poor Reported Braking Action									
MAX MANUAL	9280	540/-560	320/440	-500/1850	730/-490	260/-270	260	1800	4950
AUTOBRAKE MAX	9270	540/-560	320/450	-500/1850	730/-470	260/-280	270	1780	4930
AUTOBRAKE 3	9450	530/-550	320/440	-500/1860	670/-420	270/-280	340	1720	4900

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 1000 ft from threshold to touchdown.
Actual (unfactored) distances are shown.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

Trailing Edge Flap Disagree (15 ≤ Indicated Flaps <30)

VREF15

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	145000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 145000 LB	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	3440	210/-180	80/100	-120/420	40/-40	80/-80	110	80	180
AUTOBRAKE MAX	4490	200/-220	110/140	-160/520	0/0	110/-110	200	0	10
AUTOBRAKE 2	8120	460/-520	260/340	-360/1190	140/-170	240/-240	300	430	440

Good Reported Braking Action

MAX MANUAL	4720	230/-250	130/170	-200/690	110/-100	120/-120	160	280	640
AUTOBRAKE MAX	5040	240/-270	140/180	-210/710	100/-80	130/-130	190	310	700
AUTOBRAKE 2	8120	460/-520	260/340	-360/1190	140/-170	240/-240	300	430	440

Medium Reported Braking Action

MAX MANUAL	6490	370/-390	200/270	-320/1130	280/-230	170/-180	210	760	1870
AUTOBRAKE MAX	6620	370/-400	210/280	-320/1140	260/-210	180/-180	240	770	1900
AUTOBRAKE 3	7100	370/-410	210/290	-340/1190	190/-130	200/-200	330	480	1520

Poor Reported Braking Action

MAX MANUAL	8460	530/-540	290/400	-480/1780	680/-450	230/-250	250	1600	4400
AUTOBRAKE MAX	8470	530/-540	290/400	-480/1780	680/-450	230/-250	260	1590	4400
AUTOBRAKE 3	8580	530/-550	290/400	-480/1790	640/-400	240/-250	320	1570	4400

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 1000 ft from threshold to touchdown.
Actual (unfactored) distances are shown.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

Trailing Edge Flap Disagree (30 ≤ Indicated Flaps <40)

VREF30

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	145000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 145000 LB	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	3240	160/-160	70/90	-120/400	40/-40	70/-70	110	70	160
AUTOBRAKE MAX	4120	170/-200	100/120	-150/490	0/0	100/-100	190	0	10
AUTOBRAKE 2	7360	410/-460	230/300	-340/1130	120/-150	210/-210	290	330	340

Good Reported Braking Action

MAX MANUAL	4450	210/-230	120/160	-190/670	110/-90	110/-110	160	250	560
AUTOBRAKE MAX	4750	220/-250	130/170	-200/700	100/-90	120/-120	190	270	620
AUTOBRAKE 2	7360	410/-460	230/300	-340/1130	120/-150	210/-210	290	330	340

Medium Reported Braking Action

MAX MANUAL	6050	330/-350	180/250	-310/1100	270/-210	160/-170	200	660	1600
AUTOBRAKE MAX	6170	340/-360	190/250	-310/1110	250/-200	160/-170	230	670	1620
AUTOBRAKE 3	6510	340/-370	190/260	-320/1140	190/-140	180/-180	300	450	1380

Poor Reported Braking Action

MAX MANUAL	7820	480/-490	260/360	-460/1730	640/-420	210/-230	240	1370	3670
AUTOBRAKE MAX	7840	480/-490	260/360	-460/1730	650/-420	210/-230	250	1360	3660
AUTOBRAKE 3	7910	480/-500	260/360	-460/1730	620/-390	210/-230	280	1370	3690

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 1000 ft from threshold to touchdown.
Actual (unfactored) distances are shown.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

Trailing Edge Flaps Up Landing

VREF40 + 40

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	145000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 145000 LB	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	3940	310/-210	90/240	-140/470	50/-50	90/-90	140	110	230
AUTOBRAKE MAX	5450	220/-230	130/170	-180/600	20/-10	140/-140	220	10	40
AUTOBRAKE 2	9850	500/-570	320/420	-400/1320	210/-230	300/-300	310	680	790

Good Reported Braking Action

MAX MANUAL	5300	230/-250	150/190	-210/720	120/-100	140/-140	150	300	680
AUTOBRAKE MAX	5940	240/-270	160/210	-230/770	90/-70	160/-160	220	260	650
AUTOBRAKE 2	9850	500/-570	320/420	-400/1320	210/-230	300/-300	310	680	790

Medium Reported Braking Action

MAX MANUAL	7470	380/-410	240/320	-340/1200	310/-250	210/-210	210	850	2060
AUTOBRAKE MAX	7730	390/-420	250/330	-350/1220	300/-240	220/-220	230	870	2120
AUTOBRAKE 3	8640	380/-440	260/350	-370/1300	200/-180	250/-260	330	480	1420

Poor Reported Braking Action

MAX MANUAL	9920	570/-600	350/480	-520/1900	760/-510	280/-300	260	1850	5020
AUTOBRAKE MAX	9950	570/-600	350/480	-520/1900	750/-490	280/-300	290	1840	4990
AUTOBRAKE 3	10220	550/-590	350/480	-520/1930	690/-460	290/-310	330	1690	4890

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 1000 ft from threshold to touchdown.
Actual (unfactored) distances are shown.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Recommended Brake Cooling Schedule

Reference Brake Energy Per Brake (Millions of Foot Pounds)

		WIND CORRECTED BRAKES ON SPEED (KIAS)																	
		80			100			120			140			160			180		
WEIGHT (1000 LB)	OAT (°C)	PRESSURE ALTITUDE (1000 FT)																	
		0	5	10	0	5	10	0	5	10	0	5	10	0	5	10	0	5	10
180	0	16.1	18.2	20.7	23.6	26.7	30.5	32.3	36.6	42.0	41.8	47.5	54.9	52.1	59.4	69.0	61.8	70.7	82.6
	10	16.7	18.8	21.4	24.4	27.6	31.6	33.4	37.8	43.4	43.2	49.1	56.7	53.8	61.4	71.3	63.9	73.1	85.3
	15	16.9	19.1	21.7	24.8	28.0	32.0	33.8	38.4	44.1	43.8	49.8	57.5	54.6	62.3	72.3	64.8	74.1	86.6
	20	17.2	19.4	22.0	25.1	28.4	32.5	34.3	38.9	44.6	44.4	50.5	58.3	55.3	63.1	73.3	65.7	75.1	87.7
	30	17.6	19.9	22.6	25.8	29.1	33.3	35.2	39.9	45.8	45.5	51.8	59.8	56.7	64.7	75.1	67.3	77.0	89.8
	40	17.8	20.1	22.8	26.1	29.5	33.7	35.7	40.5	46.5	46.3	52.7	60.9	57.7	66.0	76.7	68.7	78.7	92.0
	50	17.8	20.1	22.9	26.2	29.6	33.9	35.9	40.8	47.0	46.7	53.3	61.8	58.6	67.1	78.4	69.9	80.4	94.5
160	0	14.8	16.7	19.0	21.5	24.3	27.8	29.3	33.2	38.0	37.8	43.0	49.5	47.0	53.6	62.0	56.5	64.6	75.2
	10	15.3	17.2	19.6	22.2	25.1	28.7	30.2	34.3	39.3	39.1	44.4	51.1	48.6	55.4	64.1	58.4	66.7	77.7
	15	15.5	17.5	19.9	22.6	25.5	29.1	30.7	34.8	39.9	39.7	45.0	51.9	49.3	56.2	65.0	59.3	67.7	78.8
	20	15.7	17.7	20.2	22.9	25.9	29.5	31.1	35.2	40.4	40.2	45.6	52.6	50.0	56.9	65.9	60.0	68.6	79.8
	30	16.1	18.2	20.7	23.5	26.5	30.3	31.9	36.1	41.4	41.2	46.8	53.9	51.2	58.3	67.5	61.5	70.3	81.8
	40	16.3	18.4	20.9	23.7	26.8	30.7	32.3	36.6	42.0	41.8	47.6	54.8	52.1	59.4	68.9	62.7	71.7	83.7
	50	16.3	18.4	20.9	23.8	26.9	30.8	32.5	36.9	42.4	42.2	48.1	55.6	52.8	60.3	70.2	63.7	73.1	85.7
140	0	13.5	15.2	17.2	19.4	21.9	25.0	26.2	29.7	34.0	33.7	38.3	44.0	41.9	47.6	55.0	50.7	57.8	67.0
	10	13.9	15.7	17.8	20.1	22.7	25.8	27.1	30.7	35.1	34.9	39.5	45.4	43.3	49.2	56.8	52.4	59.7	69.3
	15	14.1	15.9	18.1	20.4	23.0	26.2	27.5	31.1	35.6	35.4	40.1	46.1	43.9	49.9	57.7	53.1	60.6	70.3
	20	14.3	16.1	18.3	20.6	23.3	26.6	27.9	31.6	36.1	35.9	40.7	46.7	44.5	50.6	58.4	53.8	61.4	71.2
	30	14.7	16.6	18.8	21.2	23.9	27.3	28.6	32.4	37.0	36.8	41.7	47.9	45.6	51.9	59.9	55.2	62.9	73.0
	40	14.8	16.7	19.0	21.4	24.2	27.6	29.0	32.8	37.5	37.3	42.3	48.7	46.4	52.8	61.0	56.2	64.1	74.5
	50	14.8	16.7	19.0	21.4	24.3	27.7	29.1	33.0	37.8	37.6	42.7	49.2	46.8	53.4	62.0	57.0	65.2	76.1
120	0	12.1	13.7	15.5	17.3	19.5	22.2	23.2	26.2	30.0	29.6	33.6	38.5	36.6	41.6	47.9	44.1	50.2	58.0
	10	12.5	14.1	16.0	17.9	20.2	23.0	24.0	27.1	31.0	30.6	34.7	39.8	37.8	42.9	49.4	45.6	51.9	60.0
	15	12.7	14.3	16.3	18.2	20.5	23.3	24.3	27.5	31.4	31.1	35.2	40.4	38.4	43.6	50.2	46.2	52.6	60.8
	20	12.9	14.5	16.5	18.4	20.8	23.6	24.7	27.9	31.8	31.5	35.7	40.9	38.9	44.2	50.8	46.9	53.3	61.6
	30	13.2	14.9	16.9	18.9	21.3	24.3	25.3	28.6	32.7	32.3	36.6	42.0	39.9	45.3	52.1	48.1	54.7	63.2
	40	13.4	15.1	17.1	19.1	21.5	24.5	25.6	28.9	33.1	32.7	37.1	42.6	40.5	46.0	53.0	48.8	55.6	64.4
	50	13.3	15.0	17.1	19.1	21.6	24.6	25.7	29.1	33.3	32.9	37.4	43.0	40.8	46.5	53.7	49.4	56.4	65.5
100	0	10.8	12.2	13.8	15.2	17.2	19.5	20.2	22.8	26.0	25.6	28.9	33.1	31.4	35.5	40.8	37.6	42.7	49.1
	10	11.2	12.6	14.3	15.7	17.7	20.2	20.8	23.5	26.8	26.4	29.9	34.2	32.4	36.7	42.1	38.8	44.1	50.8
	15	11.4	12.8	14.5	16.0	18.0	20.5	21.1	23.9	27.2	26.8	30.3	34.7	32.9	37.3	42.8	39.4	44.7	51.5
	20	11.5	13.0	14.7	16.2	18.2	20.7	21.4	24.2	27.6	27.2	30.7	35.1	33.3	37.8	43.3	39.9	45.3	52.2
	30	11.8	13.3	15.1	16.6	18.7	21.3	22.0	24.8	28.3	27.9	31.5	36.0	34.2	38.7	44.4	40.9	46.5	53.5
	40	11.9	13.4	15.2	16.8	18.9	21.5	22.2	25.1	28.7	28.2	31.9	36.5	34.6	39.3	45.1	41.6	47.2	54.5
	50	11.9	13.4	15.2	16.8	18.9	21.5	22.3	25.2	28.8	28.3	32.1	36.8	34.9	39.6	45.6	41.9	47.7	55.2
90	0	10.2	11.5	13.0	14.2	16.0	18.2	18.6	21.0	24.0	23.5	26.6	30.4	28.7	32.5	37.3	34.3	38.9	44.8
	10	10.5	11.9	13.4	14.6	16.5	18.8	19.3	21.7	24.8	24.3	27.5	31.4	29.7	33.6	38.5	35.5	40.2	46.2
	15	10.7	12.0	13.6	14.9	16.7	19.0	19.5	22.1	25.1	24.7	27.9	31.8	30.1	34.1	39.1	36.0	40.8	46.9
	20	10.8	12.2	13.8	15.1	17.0	19.3	19.8	22.4	25.5	25.0	28.3	32.3	30.5	34.6	39.6	36.5	41.4	47.6
	30	11.1	12.5	14.2	15.5	17.4	19.8	20.3	22.9	26.1	25.6	29.0	33.1	31.3	35.5	40.6	37.4	42.4	48.8
	40	11.2	12.6	14.3	15.6	17.6	20.0	20.5	23.2	26.4	25.9	29.3	33.5	31.7	36.0	41.2	37.9	43.1	49.6
	50	11.2	12.6	14.3	15.6	17.6	20.0	20.6	23.3	26.5	26.0	29.5	33.7	31.9	36.2	41.6	38.2	43.5	50.1

***To correct for wind, enter table with the brakes on speed minus one half the headwind or plus 1.5 times the tailwind. If ground speed is used for brakes on speed, ignore wind and enter table with sea level, 15°C.**

ADVISORY INFORMATION

Recommended Brake Cooling Schedule

Adjusted Brake Energy Per Brake (Millions of Foot Pounds)

No Reverse Thrust

		REFERENCE BRAKE ENERGY PER BRAKE (MILLIONS OF FOOT POUNDS)								
EVENT		10	20	30	40	50	60	70	80	90
RTO MAX MAN		10	20	30	40	50	60	70	80	90
LANDING	MAX MAN	7.6	15.8	24.7	34.1	44.0	54.3	65.0	75.9	87.1
	MAX AUTO	7.1	14.6	22.7	31.3	40.6	50.7	61.5	73.2	85.7
	AUTOBRAKE 3	6.6	13.5	20.7	28.3	36.6	45.5	55.3	65.9	77.6
	AUTOBRAKE 2	6.0	12.0	18.3	24.9	32.0	39.7	48.2	57.6	68.0
	AUTOBRAKE 1	5.6	10.9	16.3	21.9	27.9	34.4	41.8	50.2	59.8

Two Engine Detent Reverse Thrust

		REFERENCE BRAKE ENERGY PER BRAKE (MILLIONS OF FOOT POUNDS)								
EVENT		10	20	30	40	50	60	70	80	90
RTO MAX MAN		10	20	30	40	50	60	70	80	90
LANDING	MAX MAN	6.7	14.2	22.3	31.0	40.2	49.7	59.5	69.3	79.3
	MAX AUTO	5.4	11.8	19.0	26.9	35.4	44.4	53.8	63.5	73.5
	AUTOBRAKE 3	3.9	8.6	14.1	20.3	27.1	34.5	42.3	50.5	59.1
	AUTOBRAKE 2	2.1	5.0	8.5	12.8	17.7	23.2	29.4	36.0	43.2
	AUTOBRAKE 1	1.5	3.4	5.7	8.5	11.8	15.7	20.2	25.4	31.2

Cooling Time (Minutes) - Category G Steel Brakes

	EVENT ADJUSTED BRAKE ENERGY (MILLIONS OF FOOT POUNDS)								
	16 & BELOW	17	20	23	26	29	32	33 TO 48	49 & ABOVE
	BRAKE TEMPERATURE MONITOR SYSTEM INDICATION ON CDS								
	UP TO 2.4	2.6	3.1	3.5	4.0	4.4	4.9	5.0 TO 7.8	7.8 & ABOVE
INFLIGHT GEAR DOWN	NO SPECIAL PROCEDURE REQUIRED	1	2	3	4	5	6	CAUTION	FUSE PLUG MELT ZONE
GROUND		10	20	30	40	50	60		

Observe maximum quick turnaround limit.
Table shows energy per brake added by a single stop with all brakes operating. Energy is assumed to be equally distributed among the operating brakes. Total energy is the sum of residual energy plus energy added.
Add 1.0 million foot pounds per brake for each taxi mile.

When in caution zone, wheel fuse plugs may melt. Delay takeoff and inspect after one hour. If overheat occurs after takeoff, extend gear soon for at least 7 minutes.

When in fuse plug melt zone, clear runway immediately. Unless required, do not set parking brake. Do not approach gear or attempt to taxi for one hour. Tire, wheel and brake replacement may be required. If overheat occurs after takeoff, extend gear soon for at least 12 minutes.
Brake temperature monitor system (BTMS) indication on CDS systems page may be used 10 to 15 minutes after airplane has come to a complete stop or inflight with gear retracted to determine recommended cooling schedule.

Performance Inflight — Chapter PI
Engine Inoperative — Section 63

ENGINE INOP

Initial Max Continuous %N1
Based on .79M, A/C high and anti-ice off

TAT (°C)	PRESSURE ALTITUDE (1000 FT)								
	25	27	29	31	33	35	37	39	41
20	96.8	96.6	96.3	96.1	95.9	95.4	95.0	94.7	93.9
15	97.4	97.2	96.9	96.8	96.6	96.2	95.7	95.5	94.8
10	98.0	97.8	97.5	97.4	97.4	96.9	96.5	96.3	95.7
5	98.3	98.6	98.3	98.1	98.1	97.7	97.3	97.1	96.6
0	97.5	98.7	99.2	99.0	98.9	98.5	98.2	98.0	97.5
-5	96.7	98.0	99.1	99.8	99.7	99.3	98.9	98.7	98.4
-10	96.0	97.2	98.4	99.6	100.5	100.2	99.8	99.6	99.4
-15	95.2	96.4	97.6	98.8	100.1	101.0	100.8	100.6	100.3
-20	94.4	95.6	96.8	98.0	99.3	100.5	101.1	100.8	100.6
-25	93.6	94.9	96.0	97.2	98.5	99.7	100.2	100.0	99.8
-30	92.8	94.1	95.2	96.4	97.7	98.8	99.4	99.2	99.0
-35	92.0	93.2	94.4	95.6	96.8	98.0	98.5	98.3	98.1
-40	91.2	92.4	93.5	94.7	96.0	97.1	97.6	97.4	97.2

%N1 Adjustments for Engine Bleeds

BLEED CONFIGURATION	PRESSURE ALTITUDE (1000 FT)								
	25	27	29	31	33	35	37	39	41
ENGINE ANTI-ICE	-1.2	-1.1	-1.0	-0.9	-0.8	-0.8	-0.8	-0.8	-0.8
ENGINE & WING ANTI-ICE	-4.2	-4.4	-4.5	-4.7	-5.0	-4.8	-4.8	-4.8	-4.8

ENGINE INOP

Max Continuous %N1
37000 FT to 29000 FT Pressure Altitudes

37000 FT PRESS ALT		TAT (°C)											
KIAS	M	-55	-50	-45	-40	-35	-30	-25	-20	-15	-10	-5	0
160	.51	96.6	97.6	98.5	99.4	100.2	99.6	98.8	97.6	96.3	94.7	93.2	91.8
200	.63	96.0	96.9	97.8	98.7	99.6	100.4	100.1	99.3	98.4	97.5	96.3	95.2
240	.74	95.1	96.0	96.8	97.7	98.6	99.4	100.3	100.7	100.0	99.2	98.4	97.5
280	.86	94.3	95.2	96.1	97.0	97.8	98.7	99.5	100.4	101.2	100.9	100.0	99.1
35000 FT PRESS ALT		TAT (°C)											
KIAS	M	-55	-50	-45	-40	-35	-30	-25	-20	-15	-10	-5	0
160	.49	96.5	97.4	98.3	99.2	100.1	99.8	99.0	98.0	96.8	95.4	94.0	92.7
200	.60	96.1	97.0	97.9	98.8	99.7	100.6	100.5	99.6	98.6	97.6	96.5	95.4
240	.71	95.0	95.9	96.8	97.7	98.6	99.4	100.3	100.8	100.2	99.5	98.6	97.7
280	.82	93.8	94.6	95.5	96.4	97.3	98.1	98.9	99.8	100.6	100.3	99.5	98.8
33000 FT PRESS ALT		TAT (°C)											
KIAS	M	-50	-45	-40	-35	-30	-25	-20	-15	-10	-5	0	5
160	.47	97.4	98.3	99.2	100.0	100.8	100.0	99.1	97.9	96.7	95.3	93.9	92.6
200	.58	97.0	97.9	98.8	99.7	100.6	101.4	100.6	99.6	98.6	97.5	96.3	95.1
240	.68	95.9	96.8	97.7	98.5	99.4	100.2	101.1	100.9	100.2	99.4	98.4	97.4
280	.79	94.3	95.1	96.0	96.8	97.7	98.5	99.3	100.2	100.5	99.7	98.9	98.1
320	.89	93.6	94.5	95.4	96.2	97.1	97.9	98.7	99.5	100.3	101.1	100.7	99.8
31000 FT PRESS ALT		TAT (°C)											
KIAS	M	-50	-45	-40	-35	-30	-25	-20	-15	-10	-5	0	5
160	.45	97.3	98.2	99.1	100.0	100.9	101.1	100.2	99.2	98.0	96.6	95.2	93.9
200	.55	97.1	98.0	98.9	99.7	100.6	101.5	101.6	100.7	99.7	98.6	97.4	96.2
240	.66	95.6	96.5	97.4	98.3	99.1	100.0	100.8	101.3	100.5	99.8	98.8	97.8
280	.76	93.8	94.7	95.5	96.4	97.2	98.0	98.8	99.7	100.5	99.8	98.9	98.0
320	.85	92.4	93.2	94.1	94.9	95.7	96.5	97.4	98.2	98.9	99.7	99.9	99.1
29000 FT PRESS ALT		TAT (°C)											
KIAS	M	-45	-40	-35	-30	-25	-20	-15	-10	-5	0	5	10
160	.43	98.1	99.0	99.9	100.8	101.6	101.2	100.2	99.1	97.9	96.4	95.1	93.8
200	.53	97.5	98.4	99.3	100.2	101.0	101.9	101.3	100.4	99.3	98.2	96.9	95.8
240	.63	96.3	97.1	98.0	98.9	99.7	100.5	101.4	101.1	100.2	99.2	98.3	97.2
280	.73	94.2	95.0	95.9	96.7	97.5	98.3	99.1	99.9	100.1	99.1	98.2	97.5
320	.82	92.1	92.9	93.7	94.5	95.3	96.1	96.9	97.7	98.5	99.2	98.5	97.6
360	.91	92.1	92.9	93.7	94.5	95.3	96.1	96.9	97.7	98.5	99.2	100.0	100.1

%N1 Adjustments for Engine Bleeds

BLEED CONFIGURATION	PRESSURE ALTITUDE (1000 FT)				
	29	31	33	35	37
ENGINE ANTI-ICE ON	-0.9	-0.9	-0.8	-0.8	-0.8
ENGINE & WING ANTI-ICE ON	-4.1	-4.3	-4.5	-4.7	-4.7

ENGINE INOP

Max Continuous %N1
27000 FT to 20000 FT Pressure Altitudes

27000 FT PRESS ALT		TAT (°C)											
KIAS	M	-45	-40	-35	-30	-25	-20	-15	-10	-5	0	5	10
160	.41	98.0	98.8	99.7	100.6	101.4	102.2	101.2	100.2	99.0	97.8	96.4	95.1
200	.51	96.9	97.8	98.7	99.6	100.4	101.2	101.8	100.8	99.9	98.8	97.6	96.4
240	.60	95.6	96.5	97.4	98.2	99.1	99.9	100.7	101.3	100.4	99.4	98.5	97.5
280	.70	93.6	94.4	95.3	96.1	96.9	97.7	98.5	99.3	100.1	99.4	98.4	97.6
320	.79	91.6	92.4	93.2	94.0	94.8	95.6	96.4	97.2	98.0	98.7	98.6	97.8
360	.88	91.0	91.8	92.6	93.4	94.2	95.0	95.8	96.6	97.3	98.1	98.8	99.4
25000 FT PRESS ALT		TAT (°C)											
KIAS	M	-40	-35	-30	-25	-20	-15	-10	-5	0	5	10	15
160	.39	98.8	99.7	100.5	101.4	102.2	102.4	101.4	100.3	99.1	97.7	96.5	95.2
200	.49	97.5	98.3	99.2	100.0	100.9	101.7	101.5	100.6	99.5	98.4	97.3	96.2
240	.58	95.7	96.5	97.4	98.2	99.0	99.9	100.7	100.5	99.5	98.6	97.6	96.7
280	.67	93.9	94.7	95.5	96.3	97.1	97.9	98.7	99.5	99.5	98.6	97.6	96.9
320	.76	91.7	92.6	93.4	94.2	95.0	95.8	96.5	97.3	98.0	98.6	97.8	97.2
360	.85	90.4	91.2	92.1	92.9	93.7	94.5	95.3	96.1	96.9	97.6	98.4	98.2
24000 FT PRESS ALT		TAT (°C)											
KIAS	M	-40	-35	-30	-25	-20	-15	-10	-5	0	5	10	15
160	.38	98.6	99.5	100.4	101.2	102.1	102.9	101.9	100.8	99.6	98.4	97.1	95.8
200	.48	97.5	98.4	99.2	100.1	100.9	101.8	102.2	101.1	100.1	99.0	97.8	96.7
240	.57	95.9	96.8	97.6	98.5	99.3	100.1	100.9	101.2	100.2	99.2	98.2	97.3
280	.66	94.2	95.1	95.9	96.7	97.5	98.3	99.1	99.9	100.4	99.4	98.3	97.5
320	.75	92.1	93.0	93.8	94.6	95.4	96.2	96.9	97.7	98.5	99.2	98.6	97.8
360	.83	90.6	91.4	92.2	93.1	93.9	94.7	95.5	96.2	97.0	97.8	98.5	98.6
22000 FT PRESS ALT		TAT (°C)											
KIAS	M	-35	-30	-25	-20	-15	-10	-5	0	5	10	15	20
160	.37	99.1	100.0	100.9	101.7	102.5	102.8	101.8	100.7	99.5	98.2	97.0	95.8
200	.46	98.4	99.3	100.1	101.0	101.8	102.6	102.3	101.2	100.0	98.9	97.8	96.8
240	.55	97.2	98.1	98.9	99.7	100.5	101.3	102.1	101.6	100.5	99.4	98.5	97.5
280	.63	95.7	96.5	97.4	98.2	99.0	99.8	100.6	101.3	101.0	99.8	98.9	98.1
320	.72	93.9	94.7	95.5	96.3	97.1	97.9	98.6	99.4	100.1	100.2	99.3	98.6
360	.80	92.2	93.0	93.8	94.6	95.4	96.1	96.9	97.7	98.4	99.2	99.7	99.1
20000 FT PRESS ALT		TAT (°C)											
KIAS	M	-35	-30	-25	-20	-15	-10	-5	0	5	10	15	20
160	.35	98.7	99.5	100.4	101.2	102.0	102.8	102.5	101.5	100.4	99.2	98.0	96.8
200	.44	98.3	99.2	100.0	100.9	101.7	102.5	103.3	102.3	101.1	100.0	98.9	97.8
240	.53	97.5	98.4	99.2	100.0	100.8	101.7	102.5	103.1	101.8	100.5	99.5	98.6
280	.61	96.2	97.0	97.8	98.7	99.5	100.3	101.1	101.8	102.5	101.3	100.1	99.3
320	.69	94.7	95.5	96.3	97.1	97.9	98.7	99.5	100.2	101.0	101.7	100.9	99.9
360	.77	93.0	93.8	94.6	95.4	96.2	97.0	97.7	98.5	99.2	100.0	100.7	100.4

%N1 Adjustments for Engine Bleeds

BLEED CONFIGURATION	PRESSURE ALTITUDE (1000 FT)				
	20	22	24	25	27
ENGINE ANTI-ICE ON	-0.9	-0.9	-1.0	-1.0	-1.0
ENGINE & WING ANTI-ICE ON	-3.6	-3.8	-3.8	-3.9	-4.0

ENGINE INOP

Max Continuous %N1
18000 FT to 12000 FT Pressure Altitudes

18000 FT PRESS ALT		TAT (°C)											
KIAS	M	-30	-25	-20	-15	-10	-5	0	5	10	15	20	25
160	.34	98.5	99.3	100.2	101.0	101.8	102.6	101.6	100.3	99.2	98.1	97.0	95.9
200	.42	98.7	99.6	100.4	101.2	102.0	102.8	103.1	101.7	100.4	99.3	98.3	97.3
240	.51	97.8	98.7	99.5	100.3	101.1	101.9	102.7	102.5	101.1	99.9	99.0	98.1
280	.59	96.3	97.1	97.9	98.7	99.5	100.3	101.0	101.8	101.6	100.5	99.6	98.8
320	.67	94.8	95.6	96.4	97.2	97.9	98.7	99.5	100.2	101.0	100.9	100.0	99.2
360	.75	93.0	93.8	94.6	95.3	96.1	96.9	97.6	98.4	99.1	99.9	100.2	99.6
16000 FT PRESS ALT		TAT (°C)											
KIAS	M	-30	-25	-20	-15	-10	-5	0	5	10	15	20	25
160	.33	97.1	98.0	98.8	99.6	100.4	101.2	101.6	100.3	99.1	98.1	97.1	96.1
200	.41	98.0	98.8	99.6	100.4	101.2	102.0	102.8	102.5	101.3	100.2	99.3	98.3
240	.49	97.1	97.9	98.7	99.5	100.3	101.1	101.9	102.7	101.8	100.5	99.6	98.7
280	.57	95.6	96.4	97.2	98.0	98.8	99.6	100.3	101.1	101.8	100.9	99.8	99.0
320	.64	94.0	94.8	95.6	96.4	97.2	97.9	98.7	99.4	100.2	100.9	100.2	99.4
360	.72	92.1	92.9	93.7	94.5	95.3	96.1	96.9	97.7	98.4	99.2	99.9	99.6
14000 FT PRESS ALT		TAT (°C)											
KIAS	M	-25	-20	-15	-10	-5	0	5	10	15	20	25	30
160	.31	96.6	97.4	98.2	99.0	99.8	100.6	100.4	99.1	98.0	97.1	96.2	95.3
200	.39	97.1	97.9	98.7	99.5	100.3	101.1	101.8	101.5	101.0	100.1	99.3	98.4
240	.47	96.6	97.4	98.2	99.0	99.8	100.6	101.3	101.8	101.1	100.3	99.5	98.7
280	.54	95.5	96.3	97.1	97.8	98.6	99.4	100.1	100.9	101.0	100.1	99.2	98.5
320	.62	94.1	94.9	95.7	96.5	97.2	98.0	98.7	99.5	100.2	100.3	99.5	98.8
360	.69	92.2	93.1	93.9	94.7	95.5	96.3	97.0	97.8	98.6	99.3	99.6	99.0
12000 FT PRESS ALT		TAT (°C)											
KIAS	M	-20	-15	-10	-5	0	5	10	15	20	25	30	35
160	.30	96.3	97.0	97.8	98.6	99.4	100.1	99.3	98.1	97.1	96.3	95.4	94.5
200	.38	97.1	97.9	98.7	99.5	100.3	101.0	101.5	100.8	99.8	99.0	98.2	97.3
240	.45	96.5	97.3	98.0	98.8	99.6	100.3	101.1	101.0	100.1	99.4	98.6	97.9
280	.52	95.5	96.3	97.0	97.8	98.6	99.3	100.0	100.8	100.3	99.4	98.6	98.0
320	.60	94.0	94.8	95.6	96.4	97.2	97.9	98.7	99.4	100.2	99.7	98.9	98.2
360	.67	92.3	93.2	94.0	94.8	95.6	96.4	97.1	97.9	98.7	99.4	99.1	98.5

%N1 Adjustments for Engine Bleeds

BLEED CONFIGURATION	PRESSURE ALTITUDE (1000 FT)			
	12	14	16	18
ENGINE ANTI-ICE ON	-0.9	-0.9	-0.9	-0.9
ENGINE & WING ANTI-ICE ON	-3.2	-3.4	-3.4	-3.5

ENGINE INOP

Max Continuous %N1

10000 FT to 1000 FT Pressure Altitudes

10000 FT PRESS ALT		TAT (°C)											
KIAS	M	-20	-15	-10	-5	0	5	10	15	20	25	30	35
160	.29	95.2	96.0	96.8	97.6	98.3	99.1	99.8	98.6	97.4	96.6	95.8	94.9
200	.36	96.0	96.7	97.5	98.3	99.0	99.8	100.5	100.5	99.4	98.5	97.8	97.0
240	.43	95.6	96.4	97.2	97.9	98.7	99.4	100.2	100.9	100.1	99.2	98.4	97.7
280	.51	94.5	95.3	96.1	96.9	97.6	98.4	99.1	99.9	100.4	99.5	98.7	98.0
320	.58	93.0	93.9	94.7	95.5	96.2	97.0	97.8	98.6	99.3	99.7	99.0	98.2
360	.65	91.6	92.4	93.2	94.0	94.8	95.6	96.4	97.2	98.0	98.7	99.1	98.5
5000 FT PRESS ALT		TAT (°C)											
KIAS	M	-10	-5	0	5	10	15	20	25	30	35	40	45
160	.26	94.9	95.7	96.4	97.2	98.0	98.8	99.2	98.3	97.4	96.6	95.9	95.1
200	.33	94.7	95.5	96.3	97.1	97.8	98.6	99.4	98.9	98.0	97.3	96.6	95.8
240	.40	94.0	94.8	95.6	96.4	97.2	97.9	98.7	99.5	98.7	97.9	97.2	96.5
280	.46	93.3	94.1	94.9	95.7	96.5	97.3	98.1	98.8	98.9	98.2	97.5	96.8
320	.53	92.5	93.3	94.1	94.9	95.7	96.5	97.2	98.0	98.7	98.4	97.7	97.1
360	.59	91.5	92.3	93.1	93.9	94.7	95.5	96.2	97.0	97.8	98.5	98.0	97.3
3000 FT PRESS ALT		TAT (°C)											
KIAS	M	-5	0	5	10	15	20	25	30	35	40	45	50
160	.26	94.8	95.6	96.4	97.2	98.0	98.7	98.8	97.9	97.1	96.4	95.6	94.8
200	.32	94.5	95.3	96.1	96.9	97.6	98.4	99.2	98.3	97.5	96.8	96.1	95.3
240	.38	94.1	94.9	95.6	96.4	97.2	98.0	98.7	98.8	98.0	97.2	96.6	95.9
280	.45	93.2	94.0	94.8	95.6	96.4	97.2	97.9	98.7	98.3	97.5	96.9	96.2
320	.51	92.5	93.3	94.1	94.9	95.7	96.4	97.2	98.0	98.5	97.8	97.1	96.5
360	.57	91.6	92.4	93.2	94.0	94.7	95.5	96.3	97.1	97.8	98.1	97.4	96.8
1000 FT PRESS ALT		TAT (°C)											
KIAS	M	-5	0	5	10	15	20	25	30	35	40	45	50
160	.25	93.9	94.7	95.4	96.2	97.0	97.8	98.5	98.2	97.4	96.7	96.0	95.2
200	.31	93.5	94.3	95.1	95.9	96.7	97.4	98.2	98.5	97.8	97.0	96.3	95.6
240	.37	93.0	93.8	94.6	95.4	96.1	96.9	97.7	98.4	98.1	97.3	96.6	95.9
280	.43	92.3	93.2	93.9	94.7	95.5	96.3	97.1	97.8	98.3	97.6	96.9	96.2
320	.49	91.6	92.4	93.2	94.0	94.8	95.6	96.3	97.1	97.9	97.9	97.2	96.5
360	.55	90.7	91.5	92.3	93.1	93.9	94.7	95.4	96.2	96.9	97.7	97.3	96.6

%N1 Adjustments for Engine Bleeds

BLEED CONFIGURATION	PRESSURE ALTITUDE (1000 FT)			
	1	3	5	10
ENGINE ANTI-ICE ON	-0.6	-0.8	-0.8	-0.8
ENGINE & WING ANTI-ICE ON	-2.9	-3.0	-3.1	-3.2

ENGINE INOP

MAX CONTINUOUS THRUST

Driftdown Speed/Level Off Altitude

100 ft/min residual rate of climb

WEIGHT (1000 LB)		OPTIMUM DRIFTDOWN SPEED (KIAS)	LEVEL OFF ALTITUDE (FT)		
START DRIFTDOWN	LEVEL OFF		ISA + 10°C & BELOW	ISA + 15°C	ISA + 20°C
180	173	258	18300	17100	15900
170	164	251	19900	18700	17500
160	154	244	21200	20300	19100
150	145	236	22700	21700	20700
140	135	229	24200	23300	22400
130	125	220	26000	25000	24100
120	115	212	28000	27100	26100
110	106	203	30000	29200	28200
100	96	194	32000	31300	30400
90	87	184	34200	33500	32600

Includes APU fuel burn.

ENGINE INOP

MAX CONTINUOUS THRUST

Driftdown/LRC Cruise Range Capability

Ground to Air Miles Conversion

AIR DISTANCE (NM)					GROUND DISTANCE (NM)	AIR DISTANCE (NM)				
HEADWIND COMPONENT (KTS)						TAILWIND COMPONENT (KTS)				
100	80	60	40	20		20	40	60	80	100
140	130	121	113	106	100	95	90	85	81	78
280	259	241	226	212	200	189	179	171	163	155
420	389	362	339	318	300	284	269	256	244	233
560	519	483	452	424	400	378	359	341	326	311
700	648	604	565	530	500	473	449	427	407	389
840	778	724	677	636	600	568	538	512	488	467
980	907	845	790	742	700	662	628	598	570	544
1120	1037	965	903	848	800	757	718	683	651	622
1260	1167	1086	1016	955	900	851	808	768	733	700
1400	1296	1207	1129	1061	1000	946	897	854	814	778
1540	1426	1327	1242	1167	1100	1041	987	939	895	856
1680	1555	1448	1355	1273	1200	1135	1077	1024	977	933
1820	1685	1569	1468	1379	1300	1230	1167	1110	1058	1011
1960	1815	1690	1581	1485	1400	1324	1256	1195	1139	1089
2101	1945	1811	1694	1591	1500	1419	1346	1280	1221	1166
2241	2075	1932	1807	1697	1600	1513	1436	1366	1302	1244
2382	2205	2053	1920	1803	1700	1608	1525	1451	1383	1322
2523	2335	2174	2033	1909	1800	1702	1615	1536	1464	1399

Driftdown/Cruise Fuel and Time

AIR DIST (NM)	FUEL REQUIRED (1000 LB)										TIME (HR:MIN)
	WEIGHT AT START OF DRIFTDOWN (1000 LB)										
	90	100	110	120	130	140	150	160	170	180	
100	0.8	0.8	0.9	0.9	1.0	1.0	1.1	1.2	1.2	1.2	0:17
200	1.8	1.9	2.0	2.2	2.3	2.4	2.6	2.7	2.8	3.0	0:34
300	2.9	3.1	3.3	3.5	3.7	3.9	4.2	4.4	4.6	4.9	0:52
400	3.9	4.2	4.5	4.8	5.1	5.4	5.8	6.1	6.4	6.8	1:09
500	4.8	5.2	5.6	6.1	6.4	6.8	7.3	7.7	8.1	8.6	1:26
600	5.8	6.3	6.8	7.3	7.7	8.2	8.8	9.3	9.8	10.3	1:43
700	6.7	7.3	7.9	8.5	9.0	9.6	10.2	10.8	11.4	12.1	2:00
800	7.6	8.3	9.0	9.7	10.3	11.0	11.7	12.4	13.0	13.8	2:17
900	8.6	9.3	10.1	10.9	11.6	12.3	13.1	13.9	14.6	15.5	2:34
1000	9.5	10.3	11.1	12.0	12.8	13.7	14.5	15.4	16.2	17.1	2:51
1100	10.4	11.3	12.2	13.2	14.1	15.0	15.9	16.9	17.8	18.8	3:09
1200	11.3	12.3	13.3	14.3	15.3	16.3	17.3	18.4	19.4	20.5	3:26
1300	12.1	13.2	14.3	15.5	16.5	17.6	18.7	19.8	20.9	22.1	3:43
1400	13.0	14.2	15.4	16.6	17.7	18.9	20.1	21.3	22.4	23.7	4:00
1500	13.9	15.1	16.4	17.7	18.9	20.2	21.5	22.7	24.0	25.3	4:17
1600	14.7	16.1	17.4	18.8	20.1	21.4	22.8	24.2	25.5	27.0	4:35
1700	15.6	17.0	18.4	19.9	21.3	22.7	24.2	25.6	27.0	28.5	4:52
1800	16.4	17.9	19.4	21.0	22.4	24.0	25.5	27.0	28.5	30.1	5:09

Includes APU fuel burn.
Driftdown at optimum driftdown speed and cruise at long range cruise speed.

ENGINE INOP

MAX CONTINUOUS THRUST

Long Range Cruise Altitude Capability

100 ft/min residual rate of climb

WEIGHT (1000 LB)	PRESSURE ALTITUDE (FT)		
	ISA + 10°C & BELOW	ISA + 15°C	ISA + 20°C
190	13600	11200	8300
180	15600	13600	10800
170	17400	15700	13300
160	19300	17600	15700
150	20900	19600	17700
140	22300	21200	19800
130	23900	22800	21500
120	25800	24500	23300
110	28300	26900	25200
100	30600	29600	28100
90	32700	31900	30800

With engine anti-ice on, decrease altitude capability by 1100 ft.
With engine and wing anti-ice on, decrease altitude capability by 5100 ft.

ENGINE INOP

Long Range Cruise Control

WEIGHT (1000 LB)		PRESSURE ALTITUDE (1000 FT)										
		10	15	17	19	21	23	25	27	29	31	33
180	%N1	91.5	95.3	97.7								
	MACH	.542	.578	.593								
	KIAS	301	292	288								
	FF/ENG	6644	6551	6590								
170	%N1	90.1	93.7	95.7	98.5							
	MACH	.531	.569	.582	.597							
	KIAS	294	287	283	280							
	FF/ENG	6299	6201	6169	6249							
160	%N1	88.6	92.2	93.9	96.1							
	MACH	.519	.557	.572	.586							
	KIAS	287	281	278	274							
	FF/ENG	5951	5852	5803	5796							
150	%N1	87.1	90.6	92.1	94.0	96.5						
	MACH	.505	.545	.561	.575	.590						
	KIAS	280	275	272	269	265						
	FF/ENG	5602	5508	5455	5411	5446						
140	%N1	85.4	89.0	90.5	92.0	94.1	96.9					
	MACH	.492	.531	.547	.563	.577	.593					
	KIAS	272	268	266	263	259	256					
	FF/ENG	5256	5166	5114	5062	5034	5109					
130	%N1	83.6	87.2	88.7	90.2	91.9	94.1	97.1				
	MACH	.477	.517	.533	.549	.565	.579	.595				
	KIAS	264	260	258	256	253	250	246				
	FF/ENG	4911	4821	4774	4721	4681	4669	4772				
120	%N1	81.7	85.3	86.8	88.3	89.8	91.6	94.0	97.1			
	MACH	.461	.500	.517	.533	.550	.566	.580	.597			
	KIAS	255	252	250	249	246	244	240	237			
	FF/ENG	4565	4474	4430	4382	4337	4307	4313	4423			
110	%N1	79.7	83.2	84.7	86.2	87.8	89.3	91.2	93.7	96.9		
	MACH	.445	.483	.499	.516	.533	.549	.566	.580	.597		
	KIAS	246	243	242	240	238	236	234	230	227		
	FF/ENG	4223	4130	4085	4040	4000	3959	3945	3960	4067		
100	%N1	77.4	81.0	82.5	84.0	85.5	87.1	88.6	90.5	93.2	96.3	
	MACH	.428	.464	.480	.497	.514	.531	.548	.564	.579	.596	
	KIAS	237	233	232	231	230	228	226	223	220	217	
	FF/ENG	3890	3786	3743	3698	3660	3623	3595	3592	3604	3705	
90	%N1	75.2	78.6	80.0	81.5	83.0	84.6	86.1	87.6	89.5	92.3	95.4
	MACH	.410	.445	.460	.476	.492	.509	.527	.544	.561	.577	.594
	KIAS	227	223	222	221	220	218	217	215	213	209	206
	FF/ENG	3566	3446	3402	3358	3320	3286	3259	3244	3239	3246	3334

ENGINE INOP

MAX CONTINUOUS THRUST

Long Range Cruise Diversion Fuel and Time

Ground to Air Miles Conversion

AIR DISTANCE (NM) HEADWIND COMPONENT (KTS)					GROUND DISTANCE (NM)	AIR DISTANCE (NM) TAILWIND COMPONENT (KTS)				
100	80	60	40	20		20	40	60	80	100
296	270	248	230	214	200	190	180	172	164	157
596	544	498	461	429	400	379	360	343	327	314
898	819	750	692	644	600	569	540	514	491	470
1201	1095	1002	924	858	800	758	720	685	654	626
1506	1372	1255	1157	1074	1000	948	899	856	816	781
1813	1650	1508	1390	1289	1200	1137	1079	1026	979	937
2122	1930	1762	1623	1505	1400	1326	1259	1197	1141	1092
2433	2211	2017	1856	1720	1600	1516	1438	1368	1304	1247
2745	2493	2272	2090	1936	1800	1704	1617	1537	1466	1402

Reference Fuel and Time Required at Check Point

AIR DIST (NM)	PRESSURE ALTITUDE (1000 FT)									
	10		14		18		22		26	
	FUEL (1000 LB)	TIME (HR:MIN)	FUEL (1000 LB)	TIME (HR:MIN)	FUEL (1000 LB)	TIME (HR:MIN)	FUEL (1000 LB)	TIME (HR:MIN)	FUEL (1000 LB)	TIME (HR:MIN)
200	3.1	0:42	2.8	0:41	2.5	0:39	2.2	0:38	2.1	0:37
400	6.4	1:22	5.9	1:19	5.4	1:16	4.9	1:13	4.8	1:11
600	9.7	2:03	8.9	1:57	8.2	1:52	7.6	1:48	7.4	1:44
800	12.9	2:44	11.9	2:36	11.0	2:29	10.3	2:23	10.0	2:18
1000	16.1	3:25	14.9	3:15	13.8	3:06	12.9	2:58	12.5	2:52
1200	19.3	4:07	17.9	3:55	16.6	3:43	15.5	3:34	15.0	3:27
1400	22.4	4:49	20.8	4:35	19.3	4:21	18.0	4:10	17.5	4:01
1600	25.5	5:32	23.7	5:15	22.0	5:00	20.6	4:46	19.9	4:36
1800	28.5	6:15	26.5	5:56	24.7	5:38	23.0	5:23	22.2	5:11

Fuel Required Adjustments (1000 LB)

REFERENCE FUEL REQUIRED (1000 LB)	WEIGHT AT CHECK POINT (1000 LB)				
	90	110	130	150	170
2	-0.2	-0.1	0.0	0.2	0.5
4	-0.5	-0.3	0.0	0.6	1.2
6	-0.8	-0.4	0.0	0.9	1.9
8	-1.1	-0.5	0.0	1.2	2.6
10	-1.3	-0.7	0.0	1.6	3.3
12	-1.6	-0.8	0.0	1.9	4.0
14	-1.9	-1.0	0.0	2.2	4.6
16	-2.2	-1.1	0.0	2.5	5.3
18	-2.5	-1.2	0.0	2.7	5.9
20	-2.7	-1.4	0.0	3.0	6.5
22	-3.0	-1.5	0.0	3.3	7.1
24	-3.3	-1.7	0.0	3.5	7.7
26	-3.6	-1.8	0.0	3.8	8.2
28	-3.9	-1.9	0.0	4.0	8.8
30	-4.1	-2.1	0.0	4.2	9.3

Includes APU fuel burn.

ENGINE INOP

MAX CONTINUOUS THRUST

Holding

Flaps Up

WEIGHT (1000 LB)		PRESSURE ALTITUDE (FT)						
		1500	5000	10000	15000	20000	25000	30000
190	%N1	82.6	85.4	89.7	94.9			
	KIAS	254	254	255	257			
	FF/ENG	6340	6340	6390	6580			
180	%N1	81.0	83.9	88.1	92.8			
	KIAS	247	247	249	250			
	FF/ENG	6000	5990	6020	6140			
170	%N1	79.4	82.3	86.5	91.0	98.7		
	KIAS	240	241	242	243	244		
	FF/ENG	5670	5640	5650	5740	6100		
160	%N1	77.8	80.6	84.8	89.2	95.5		
	KIAS	232	233	234	235	237		
	FF/ENG	5340	5310	5300	5360	5540		
150	%N1	76.2	78.8	83.0	87.3	92.6		
	KIAS	225	226	227	228	229		
	FF/ENG	5020	4980	4950	4990	5080		
140	%N1	74.3	77.0	81.1	85.4	90.1		
	KIAS	218	218	219	220	221		
	FF/ENG	4690	4650	4610	4620	4660		
130	%N1	72.2	75.1	79.0	83.3	87.9	95.0	
	KIAS	209	210	211	212	213	214	
	FF/ENG	4370	4320	4280	4270	4280	4500	
120	%N1	70.1	73.0	76.9	81.1	85.6	91.1	
	KIAS	201	202	202	203	204	205	
	FF/ENG	4060	4000	3960	3930	3920	4020	
110	%N1	67.8	70.5	74.7	78.8	83.2	88.0	96.9
	KIAS	193	193	194	194	195	196	198
	FF/ENG	3750	3680	3640	3600	3570	3610	3950
100	%N1	65.5	68.1	72.2	76.2	80.6	85.2	92.0
	KIAS	187	187	187	187	187	187	188
	FF/ENG	3450	3380	3320	3280	3230	3240	3400
90	%N1	62.9	65.6	69.5	73.6	77.9	82.3	87.3
	KIAS	181	181	181	181	181	181	181
	FF/ENG	3160	3100	3030	2980	2920	2910	2980

This table includes 5% additional fuel for holding in a racetrack pattern.

ENGINE INOP

ADVISORY INFORMATION

Gear Down Landing Rate of Climb Available

Flaps 15

TAT (°C)	RATE OF CLIMB (FT/MIN)					
	PRESSURE ALTITUDE (FT)					
	-2000	0	2000	4000	6000	8000
52	180	110				
50	210	140	30			
48	250	170	60			
46	280	200	90	-30		
44	310	240	120	0		
42	350	270	150	30	-90	
40	380	310	180	70	-60	
38	410	340	220	100	-30	-190
36	430	380	250	130	-10	-160
34	430	410	290	150	20	-130
32	440	430	310	180	40	-110
30	440	440	340	200	60	-80
20	460	450	360	240	110	-20
10	480	470	370	240	120	0
0	490	480	380	250	130	0
-20	520	500	400	270	140	10
-40	540	530	420	280	140	10

Rate of climb capability shown is valid for 110000 lb, gear down at VREF15+5.
Decrease rate of climb 140 ft/min per 10000 lb greater than 110000 lb.
Increase rate of climb 180 ft/min per 10000 lb less than 110000 lb.

Flaps 30

TAT (°C)	RATE OF CLIMB (FT/MIN)					
	PRESSURE ALTITUDE (FT)					
	-2000	0	2000	4000	6000	8000
52	0	-70				
50	30	-40	-160			
48	60	-10	-130			
46	90	20	-100	-210		
44	120	50	-70	-180		
42	150	80	-40	-160	-280	
40	180	110	-10	-130	-250	
38	210	140	20	-100	-230	-380
36	230	170	50	-70	-200	-350
34	240	210	80	-40	-180	-330
32	240	230	110	-20	-150	-300
30	240	230	130	0	-140	-280
20	260	250	150	30	-90	-220
10	270	260	160	40	-80	-210
0	280	270	170	40	-80	-210
-20	300	280	180	50	-80	-210
-40	310	300	190	60	-80	-220

Rate of climb capability shown is valid for 110000 lb, gear down at VREF30+5.
Decrease rate of climb 140 ft/min per 10000 lb greater than 110000 lb.
Increase rate of climb 180 ft/min per 10000 lb less than 110000 lb.

ALTERNATE MODE EEC

Alternate Mode EEC Limit Weight

PERFORMANCE LIMIT	NORMAL MODE PERFORMANCE LIMIT WEIGHT (1000 LB)									
	100	110	120	130	140	150	160	170	180	190
FIELD	95.6	105.0	114.5	123.2	132.6	142.1	151.5	160.9	170.4	180.2
CLIMB	93.2	102.5	111.8	121.1	130.7	140.1	149.2	158.7	168.1	177.3
OBSTACLE	93.4	102.6	111.8	121.2	130.8	140.3	149.6	159.2	168.6	177.9

Alternate Mode EEC Takeoff Speed Adjustment

TAKEOFF SPEEDS	TAKEOFF SPEED ADJUSTMENT (KTS)
DRY V1	+1
WET V1	+2
VR	+1
V2	0

Alternate Mode EEC Max Takeoff %N1

Based on engine bleeds for packs on, engine and wing anti-ice on or off

OAT		AIRPORT PRESSURE ALTITUDE (FT)												
°C	°F	-2000	-1000	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
60	140	92.6	93.2	93.6	93.7	93.8	93.9	94.0	94.1	94.0	93.7	93.6	93.5	93.5
55	131	93.2	93.8	94.3	94.4	94.5	94.6	94.7	94.9	94.7	94.4	94.1	93.5	92.8
50	122	93.8	94.4	94.9	95.1	95.2	95.4	95.5	95.6	95.5	95.2	94.9	94.4	93.9
45	113	94.6	95.2	95.6	95.8	95.9	96.1	96.2	96.3	96.2	95.9	95.6	95.3	94.9
40	104	95.2	95.9	96.4	96.5	96.6	96.7	96.8	97.0	96.9	96.6	96.3	96.2	95.9
35	95	95.8	96.5	97.2	97.3	97.4	97.5	97.6	97.7	97.6	97.3	97.0	96.9	96.8
30	86	95.4	96.6	98.1	98.1	98.2	98.2	98.3	98.3	98.2	98.1	97.8	97.7	97.7
25	77	94.6	95.9	97.3	97.9	98.5	98.6	98.5	98.5	98.5	98.5	98.4	98.4	98.5
20	68	93.8	95.1	96.6	97.1	97.7	98.0	98.3	98.6	98.6	98.7	98.6	98.6	98.6
15	59	93.0	94.3	95.8	96.4	97.0	97.3	97.6	97.9	98.3	98.7	98.9	98.9	98.9
10	50	92.3	93.6	95.0	95.6	96.2	96.5	96.8	97.2	97.5	97.9	98.3	98.8	99.3
5	41	91.5	92.8	94.2	94.8	95.4	95.8	96.1	96.4	96.8	97.2	97.6	98.1	98.5
0	32	90.7	92.0	93.4	94.1	94.7	95.0	95.3	95.7	96.0	96.4	96.8	97.3	97.8
-5	23	89.8	91.2	92.6	93.3	93.9	94.2	94.5	94.9	95.3	95.7	96.1	96.5	97.0
-10	14	89.0	90.4	91.8	92.5	93.1	93.4	93.8	94.1	94.5	94.9	95.3	95.8	96.2
-15	5	88.2	89.5	91.0	91.7	92.3	92.6	93.0	93.4	93.7	94.1	94.5	95.0	95.4
-20	-4	87.4	88.7	90.2	90.8	91.5	91.8	92.2	92.6	93.0	93.4	93.7	94.2	94.6
-25	-13	86.5	87.9	89.4	90.0	90.7	91.0	91.4	91.8	92.2	92.6	93.0	93.4	93.8
-30	-22	85.7	87.0	88.5	89.2	89.8	90.2	90.6	91.0	91.4	91.8	92.1	92.6	93.0
-35	-31	84.8	86.2	87.7	88.3	89.0	89.4	89.7	90.2	90.6	90.9	91.3	91.8	92.2
-40	-40	83.9	85.3	86.8	87.5	88.1	88.5	88.9	89.3	89.7	90.1	90.5	90.9	91.4
-45	-49	83.1	84.4	86.0	86.6	87.3	87.7	88.1	88.5	88.9	89.3	89.7	90.1	90.5
-50	-58	82.2	83.5	85.1	85.7	86.4	86.8	87.2	87.7	88.1	88.4	88.8	89.3	89.7

%N1 Adjustments for Engine Bleed

BLEED CONFIGURATION	AIRPORT PRESSURE ALTITUDE (FT)												
	-2000	-1000	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
PACKS OFF	0.7	0.7	0.8	0.9	0.9	0.9	1.0	1.0	1.0	1.0	1.0	1.0	1.0

Intentionally
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Performance Inflight — Chapter PI
Gear Down — Section 65

GEAR DOWN

Long Range Cruise Altitude Capability
Max Cruise Thrust, 100 ft/min residual rate of climb

WEIGHT (1000 LB)	PRESSURE ALTITUDE (FT)		
	ISA + 10°C & BELOW	ISA + 15°C	ISA + 20°C
180	16100	13300	10100
170	18700	16000	13200
160	21200	18700	16000
150	23600	21300	18600
140	25900	24200	21600
130	28100	26600	24800
120	30200	29100	27400
110	32200	31200	29900
100	34200	33200	32100
90	36400	35400	34300

GEAR DOWN

Long Range Cruise Control

WEIGHT (1000 LB)		PRESSURE ALTITUDE (1000 FT)									
		10	21	23	25	27	29	31	33	35	37
180	%N1	85.5									
	MACH	.473									
	KIAS	262									
	FF/ENG	5250									
170	%N1	84.0									
	MACH	.460									
	KIAS	254									
	FF/ENG	4943									
160	%N1	82.3	91.7								
	MACH	.447	.548								
	KIAS	247	245								
	FF/ENG	4639	4619								
150	%N1	80.5	89.9	91.9							
	MACH	.434	.535	.552							
	KIAS	240	239	237							
	FF/ENG	4341	4320	4308							
140	%N1	78.7	88.0	89.8	92.0	95.0					
	MACH	.420	.518	.538	.555	.573					
	KIAS	232	232	231	229	227					
	FF/ENG	4052	4008	4006	4011	4089					
130	%N1	76.7	85.9	87.7	89.6	91.9	95.2				
	MACH	.406	.500	.521	.541	.558	.576				
	KIAS	224	223	224	223	221	218				
	FF/ENG	3766	3695	3698	3705	3721	3810				
120	%N1	74.8	83.7	85.5	87.3	89.2	91.7	95.2			
	MACH	.391	.482	.501	.523	.543	.560	.579			
	KIAS	216	215	215	215	214	212	210			
	FF/ENG	3485	3390	3387	3397	3414	3432	3528			
110	%N1	72.5	81.4	83.1	84.9	86.7	88.7	91.3	94.9		
	MACH	.375	.462	.481	.501	.523	.543	.561	.580		
	KIAS	207	206	206	206	206	205	203	201		
	FF/ENG	3209	3092	3085	3090	3109	3124	3142	3241		
100	%N1	70.0	78.9	80.6	82.3	84.1	85.9	87.9	90.7	94.2	
	MACH	.359	.442	.460	.479	.499	.521	.542	.560	.580	
	KIAS	198	197	197	197	196	197	196	194	192	
	FF/ENG	2942	2803	2790	2793	2806	2821	2834	2850	2945	
90	%N1	67.4	76.1	77.8	79.5	81.3	83.0	84.9	87.0	89.7	93.7
	MACH	.343	.421	.438	.456	.475	.496	.518	.540	.558	.578
	KIAS	189	187	187	187	187	187	187	186	184	182
	FF/ENG	2685	2525	2502	2501	2515	2522	2532	2543	2557	2656

GEAR DOWN

Long Range Cruise Enroute Fuel and Time
Ground to Air Miles Conversion

AIR DISTANCE (NM)					GROUND DISTANCE (NM)	AIR DISTANCE (NM)				
HEADWIND COMPONENT (KTS)						TAILWIND COMPONENT (KTS)				
100	80	60	40	20		20	40	60	80	100
325	290	260	236	217	200	188	178	168	160	153
657	585	524	475	435	400	377	357	338	321	307
995	884	789	714	653	600	566	535	507	482	460
1337	1186	1056	955	872	800	755	713	676	642	613
1685	1491	1326	1196	1091	1000	943	891	844	802	765
2038	1801	1598	1440	1311	1200	1131	1068	1011	961	917
2398	2114	1872	1683	1532	1400	1319	1245	1179	1120	1068
2765	2432	2149	1929	1753	1600	1507	1422	1346	1278	1218
3139	2754	2428	2176	1974	1800	1694	1598	1512	1435	1368

Reference Fuel and Time Required at Check Point

AIR DIST (NM)	PRESSURE ALTITUDE (1000 FT)									
	10		14		20		24		28	
	FUEL (1000 LB)	TIME (HR:MIN)	FUEL (1000 LB)	TIME (HR:MIN)	FUEL (1000 LB)	TIME HR:MIN)	FUEL (1000 LB)	TIME (HR:MIN)	FUEL (1000 LB)	TIME (HR:MIN)
200	5.4	0:49	4.9	0:47	4.2	0:44	3.9	0:42	3.6	0:41
400	11.0	1:37	10.2	1:32	9.0	1:25	8.4	1:21	7.9	1:18
600	16.5	2:26	15.3	2:18	13.7	2:07	12.7	2:00	12.1	1:54
800	21.9	3:16	20.4	3:05	18.2	2:49	17.0	2:39	16.2	2:31
1000	27.2	4:07	25.3	3:53	22.7	3:32	21.2	3:20	20.2	3:09
1200	32.3	4:59	30.1	4:41	27.0	4:16	25.3	4:01	24.1	3:47
1400	37.3	5:53	34.8	5:31	31.3	5:01	29.3	4:42	27.9	4:26
1600	42.2	6:47	39.4	6:23	35.4	5:47	33.2	5:25	31.6	5:06
1800	47.1	7:43	43.9	7:15	39.5	6:34	37.1	6:08	35.3	5:46

Fuel Required Adjustments (1000 LB)

REFERENCE FUEL REQUIRED (1000 LB)	WEIGHT AT CHECK POINT (1000 LB)				
	90	110	130	150	170
5	-0.7	-0.4	0.0	0.7	1.6
10	-1.5	-0.8	0.0	1.4	3.2
15	-2.3	-1.2	0.0	2.1	4.7
20	-3.1	-1.5	0.0	2.7	6.1
25	-3.8	-1.9	0.0	3.3	7.4
30	-4.6	-2.3	0.0	3.8	8.5
35	-5.4	-2.7	0.0	4.2	9.5
40	-6.1	-3.1	0.0	4.6	10.4
45	-6.9	-3.5	0.0	5.0	11.1
50	-7.7	-3.8	0.0	5.3	11.8

GEAR DOWN

Descent

VREF40 + 70 KIAS

PRESSURE ALTITUDE (FT)	TIME (MIN)	FUEL (LB)	DISTANCE (NM)
41000	20	600	87
39000	20	590	83
37000	19	580	79
35000	18	570	74
33000	18	560	70
31000	17	540	66
29000	16	530	62
27000	15	520	58
25000	15	510	54
23000	14	490	50
21000	13	480	46
19000	12	460	42
17000	11	440	39
15000	11	420	35
10000	8	360	25
5000	6	300	16
1500	4	240	9

Allowances for a straight-in approach are included.

GEAR DOWN

Holding
Flaps Up

WEIGHT (1000 LB)		PRESSURE ALTITUDE (FT)							
		1500	5000	10000	15000	20000	25000	30000	35000
190	%N1	77.0	79.8	84.1	88.5				
	KIAS	230	230	230	230				
	FF/ENG	5180	5150	5150	5210				
180	%N1	75.6	78.3	82.6	86.9	92.0			
	KIAS	225	225	225	225	225			
	FF/ENG	4910	4880	4870	4900	4970			
170	%N1	74.0	76.8	81.0	85.3	90.0			
	KIAS	221	221	221	221	221			
	FF/ENG	4650	4610	4590	4610	4640			
160	%N1	72.4	75.3	79.3	83.6	88.3			
	KIAS	216	216	216	216	216			
	FF/ENG	4390	4350	4320	4330	4340			
150	%N1	70.6	73.6	77.6	81.9	86.4	92.1		
	KIAS	211	211	211	211	211	211		
	FF/ENG	4140	4090	4060	4050	4050	4150		
140	%N1	69.2	72.0	76.1	80.3	84.7	89.6		
	KIAS	209	209	209	209	209	209		
	FF/ENG	3930	3880	3840	3820	3800	3850		
130	%N1	67.4	70.1	74.3	78.4	82.8	87.5	95.3	
	KIAS	204	204	204	204	204	204	204	
	FF/ENG	3690	3630	3590	3560	3540	3560	3800	
120	%N1	65.6	68.2	72.4	76.4	80.8	85.4	91.5	
	KIAS	199	199	199	199	199	199	199	
	FF/ENG	3460	3400	3340	3310	3270	3280	3400	
110	%N1	63.6	66.3	70.3	74.4	78.7	83.1	88.1	
	KIAS	193	193	193	193	193	193	193	
	FF/ENG	3230	3170	3110	3070	3020	3020	3080	
100	%N1	61.4	64.3	68.1	72.3	76.4	80.9	85.5	93.4
	KIAS	187	187	187	187	187	187	187	187
	FF/ENG	3000	2950	2890	2840	2780	2760	2810	2990
90	%N1	59.2	62.0	65.9	70.0	74.2	78.6	83.1	89.0
	KIAS	181	181	181	181	181	181	181	181
	FF/ENG	2780	2730	2680	2620	2560	2520	2560	2620

This table includes 5% additional fuel for holding in a racetrack pattern.

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GEAR DOWN

ENGINE INOP

MAX CONTINUOUS THRUST

Driftdown Speed/Level Off Altitude

100 ft/min residual rate of climb

WEIGHT (1000 LB)		OPTIMUM DRIFTDOWN SPEED (KIAS)	LEVEL OFF ALTITUDE (FT)		
START DRIFTDOWN	LEVEL OFF		ISA + 10°C & BELOW	ISA + 15°C	ISA + 20°C
180	170	223	2000		
170	161	218	4300	2600	
160	152	214	6500	5100	3000
150	142	210	8600	7200	5300
140	133	207	10700	9500	7700
130	124	202	12900	11900	10400
120	114	197	15100	14300	13300
110	105	191	17400	16600	15800
100	95	186	19700	18800	18000
90	86	180	21900	21000	20200

Includes APU fuel burn.

Long Range Cruise Altitude Capability

100 ft/min residual rate of climb

WEIGHT (1000 LB)	PRESSURE ALTITUDE (FT)		
	ISA + 10°C & BELOW	ISA + 15°C	ISA + 20°C
160	1800		
150	4700	2600	
140	7500	5800	3200
130	10300	8900	6500
120	12800	11800	9900
110	15500	14700	13500
100	18300	17400	16600
90	21000	20200	19300

GEAR DOWN
ENGINE INOP

MAX CONTINUOUS THRUST

Long Range Cruise Control

WEIGHT (1000 LB)		PRESSURE ALTITUDE (1000 FT) 5	7	9	11	13	15	17	19	21
150	%N1	94.7								
	MACH	.384								
	KIAS	232								
	FF/ENG	8277								
140	%N1	92.6	94.4	97.0						
	MACH	.372	.385	.398						
	KIAS	225	225	224						
	FF/ENG	7681	7688	7778						
130	%N1	90.5	92.1	94.0	96.7					
	MACH	.361	.373	.385	.399					
	KIAS	218	217	217	216					
	FF/ENG	7104	7094	7101	7204					
120	%N1	88.2	89.8	91.5	93.3	96.1				
	MACH	.349	.360	.372	.385	.399				
	KIAS	211	210	209	208	208				
	FF/ENG	6559	6523	6509	6521	6625				
110	%N1	86.0	87.4	89.0	90.7	92.5	95.3			
	MACH	.337	.348	.359	.371	.383	.397			
	KIAS	204	203	201	200	200	199			
	FF/ENG	6045	5985	5946	5934	5947	6029			
100	%N1	83.6	85.0	86.4	87.9	89.6	91.4	94.2	98.5	
	MACH	.325	.335	.345	.356	.368	.381	.395	.409	
	KIAS	197	195	194	193	192	191	190	189	
	FF/ENG	5552	5479	5419	5380	5368	5369	5413	5600	
90	%N1	81.1	82.4	83.8	85.2	86.7	88.3	90.1	92.8	96.9
	MACH	.313	.322	.331	.341	.352	.364	.377	.392	.408
	KIAS	189	188	186	184	183	182	181	181	181
	FF/ENG	5082	4994	4922	4863	4824	4803	4785	4815	5003

GEAR DOWN
ENGINE INOP
MAX CONTINUOUS THRUST

Long Range Cruise Diversion Fuel and Time
Ground to Air Miles Conversion

AIR DISTANCE (NM)					GROUND DISTANCE (NM)	AIR DISTANCE (NM)				
HEADWIND COMPONENT (KTS)						TAILWIND COMPONENT (KTS)				
100	80	60	40	20		20	40	60	80	100
173	152	134	120	109	100	93	88	83	78	75
354	309	271	242	220	200	187	174	164	155	147
536	467	409	365	330	300	280	262	246	232	220
720	627	548	488	441	400	373	349	328	308	292
906	787	687	611	551	500	466	435	408	385	365
1093	948	826	734	662	600	559	522	489	461	437
1282	1111	967	858	773	700	652	609	570	537	508
1472	1274	1107	982	884	800	744	695	651	612	580
1664	1438	1248	1106	995	900	838	782	732	688	651
1858	1603	1390	1230	1106	1000	930	868	812	764	723

Reference Fuel and Time Required at Check Point

AIR DIST (NM)	PRESSURE ALTITUDE (1000 FT)					
	6		10		14	
	FUEL (1000 LB)	TIME (HR:MIN)	FUEL (1000 LB)	TIME (HR:MIN)	FUEL (1000 LB)	TIME (HR:MIN)
100	2.8	0:27	2.5	0:26	2.3	0:26
200	5.8	0:53	5.4	0:51	5.2	0:49
300	8.8	1:19	8.2	1:15	8.0	1:12
400	11.7	1:45	11.0	1:40	10.7	1:35
500	14.6	2:11	13.7	2:05	13.4	1:59
600	17.5	2:38	16.4	2:30	16.0	2:23
700	20.3	3:05	19.1	2:56	18.6	2:47
800	23.1	3:32	21.7	3:22	21.1	3:12
900	25.9	4:00	24.3	3:48	23.5	3:36
1000	28.6	4:27	26.9	4:14	26.0	4:01

GEAR DOWN
ENGINE INOP
MAX CONTINUOUS THRUST

Long Range Cruise Diversion Fuel and Time
Fuel Required Adjustments (1000 LB)

REFERENCE FUEL REQUIRED (1000 LB)	WEIGHT AT CHECK POINT (1000 LB)				
	90	110	130	150	170
2	-0.3	-0.2	0.0	0.3	0.5
4	-0.6	-0.3	0.0	0.6	1.2
6	-0.9	-0.5	0.0	0.9	1.8
8	-1.2	-0.6	0.0	1.3	2.5
10	-1.5	-0.8	0.0	1.6	3.1
12	-1.8	-0.9	0.0	1.9	3.8
14	-2.1	-1.1	0.0	2.3	4.4
16	-2.4	-1.2	0.0	2.6	5.1
18	-2.7	-1.4	0.0	2.9	5.7
20	-3.0	-1.5	0.0	3.2	6.4
22	-3.3	-1.7	0.0	3.6	7.0
24	-3.6	-1.8	0.0	3.9	7.7
26	-3.9	-2.0	0.0	4.2	8.4
28	-4.2	-2.1	0.0	4.6	9.0
30	-4.5	-2.2	0.0	4.9	9.7
32	-4.8	-2.4	0.0	5.2	10.4

Includes APU fuel burn.

GEAR DOWN
ENGINE INOP
MAX CONTINUOUS THRUST

Holding
Flaps Up

WEIGHT (1000 LB)		PRESSURE ALTITUDE (FT)			
		1500	5000	10000	15000
170	%N1	93.2			
	KIAS	221			
	FF/ENG	9060			
160	%N1	91.3	94.6		
	KIAS	216	216		
	FF/ENG	8480	8580		
150	%N1	89.4	92.6		
	KIAS	211	211		
	FF/ENG	7920	7990		
140	%N1	87.7	90.7	96.3	
	KIAS	209	209	209	
	FF/ENG	7460	7500	7690	
130	%N1	85.6	88.6	93.3	
	KIAS	204	204	204	
	FF/ENG	6940	6950	7050	
120	%N1	83.5	86.4	90.9	98.2
	KIAS	199	199	199	199
	FF/ENG	6430	6430	6480	6820
110	%N1	81.2	84.2	88.5	93.9
	KIAS	193	193	193	193
	FF/ENG	5960	5930	5950	6070
100	%N1	78.9	81.9	86.1	90.8
	KIAS	187	187	187	187
	FF/ENG	5510	5460	5450	5510
90	%N1	76.6	79.4	83.6	88.1
	KIAS	181	181	181	181
	FF/ENG	5070	5020	4980	5000

This table includes 5% additional fuel for holding in a racetrack pattern.

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Performance Inflight — Chapter PI
Text — Section 67

Introduction

This chapter contains information to supplement performance data from the Flight Management Computer (FMC). In addition, sufficient inflight data is provided to complete a flight with the FMC inoperative. In the event of conflict between data presented in this chapter and that contained in the approved Airplane Flight Manual, the Flight Manual shall always take precedence.

General

Takeoff Speeds

The speeds presented in the Takeoff Speeds table as well as FMC computed takeoff speeds can be used for all performance conditions except where adjustments must be made for anti-skid inoperative, thrust reversers inoperative, improved climb, contaminated runway situations, or brake energy limits.

V1 adjustments are not necessary for equal amounts of clearway and stopway. V1 for takeoff limit weights based on unequal clearway and stopway should be obtained from computerized takeoff speeds calculations for the specific takeoff conditions.

These speeds may be used for weights less than or equal to the performance limited weight subject to the restrictions noted above.

The FMC will protect for minimum control speeds by increasing V1, VR and V2 as required. However, the FMC will not compute takeoff speeds for weights where the required speed increase exceeds the maximum certified speed increase. This typically occurs at full rated thrust and light weights. In this case, the message "V SPEEDS UNAVAILABLE" will appear on the FMC scratchpad and the takeoff speed entries will be blank. In this situation, manually verify takeoff speeds using an approved source of takeoff performance information. Upon verifying the takeoff speeds, takeoff is permitted. When selected takeoff speeds cannot be verified, the options are to select a lower number flap setting, select derate thrust and/or increase airplane gross weight (e.g. add fuel). Selecting derate thrust is the preferred method as this will reduce the minimum control speeds. Note that the assumed temperature method will not help this condition as the minimum control speeds are determined at the actual temperature and therefore are not reduced by an assumed temperature selection.

Normal takeoff speeds, V1, VR, and V2 are read from either the dry or wet table by entering with takeoff flap setting and brake release weight. Use the tables provided to adjust takeoff speeds for altitude and actual temperature or assumed temperature for reduced thrust takeoffs. Slope and wind adjustments to V1 are obtained by entering the Slope and Wind V1 Adjustment table.

V1(MCG)

Regulations prohibit scheduling takeoff with a V1 less than minimum V1 for control on the ground, V1(MCG). It is therefore necessary to compare the adjusted V1 to V1(MCG). The V1(MCG) presented in this manual is conservative for all weight and bleed configurations.

To find V1(MCG) enter the V1(MCG) table with the airport pressure altitude and actual OAT. If the adjusted V1 is less than V1(MCG), set V1 equal to V1(MCG). If the adjusted VR is less than V1(MCG), set VR equal to V1(MCG), and determine a new V2 by adding the difference between the normal VR and V1(MCG) to the normal V2. No takeoff weight adjustment is necessary provided that the actual field length exceeds the minimum field length shown in the Field and Climb Limit Weight table in chapter Performance Dispatch.

Stab Trim

To find takeoff stabilizer trim setting, enter Stab Trim Setting table with anticipated brake release weight and center of gravity (C.G. % MAC) and read required stabilizer trim units.

VREF

This table contains flaps 40, 30 and 15 reference speeds for a given weight.

Flap Maneuver Speeds

This table provides flap maneuver speeds for various flap settings. During flap retraction, selection of the next flap position is initiated when reaching the maneuver speed for the existing flap position. During flap retraction, at least adequate maneuver capability or 30° of bank (15° of bank and 15° overshoot) to stick shaker is provided at the flap retraction speed. Full maneuver capability or at least 40° of bank (25° of bank and 15° overshoot) is provided when the airplane has accelerated to the recommended maneuver speed for the selected flap position.

During flap extension, selection of the flaps to the next flap position should be made when approaching, and before decelerating below, the maneuver speed for the existing flap position. The flap extension speed schedule varies with airplane weight and provides full maneuver capability or at least 40° of bank (25° of bank and 15° overshoot) to stick shaker at all weights.

Slush/Standing Water Takeoff

Experience has shown that aircraft performance may deteriorate significantly on runways covered with snow, slush, standing water or ice. Therefore, reductions in field/obstacle limited takeoff weight and revised takeoff speeds are necessary. The tables are intended for guidance in accordance with advisory material and assume an engine failure at the critical point during the takeoff.

The entire runway is assumed to be completely covered by a contaminant of uniform thickness and density. Therefore this information is conservative when operating under typical cold weather conditions where patches of slush exist and some degree of sanding is common. Takeoffs in slush or standing water depths greater than 0.5 inches (13 mm) are not recommended because of possible airplane damage as a result of spray impingement on the airplane structure. The use of assumed temperature for reduced thrust is not allowed on contaminated runways. Interpolation for slush/standing water depths between the values shown is permitted.

Takeoff weight determination:

1. Enter the Weight Adjustment table with the dry field/obstacle limit weight to obtain the weight reduction for the slush/standing water depth and airport pressure altitude.
2. Adjust field length available for temperature by amount shown beneath V1(MCG) limit weight table.
3. Enter the V1(MCG) Limit Weight table with the adjusted field length and pressure altitude to obtain the slush/standing water limit weight with respect to minimum field length required for V1(MCG) speed.
4. The maximum allowable takeoff weight in slush/standing water is the lesser of the limit weights found in steps 1 and 3.

Takeoff speed determination:

1. Determine takeoff speeds V1, VR and V2 for actual brake release weight using the Dry Runway Takeoff Speeds table for the appropriate flap setting and thrust rating.
2. If V1(MCG) limited, set V1=V1(MCG). If not limited by V1(MCG) considerations, enter the V1 Adjustment table with actual brake release weight to determine the V1 reduction to apply to V1 speed. If the adjusted V1 is less than V1(MCG), set V1=V1(MCG).

Slippery Runway Takeoff

Airplane braking action is reported as good, medium or poor, depending on existing runway conditions. If braking action is reported as good, conditions should not be expected to be as good as on clean, dry runways. The value "good" is comparative and is intended to mean that airplanes should not experience braking or directional control difficulties when stopping. The performance level used to calculate the "good" data is consistent with wet runway testing done on early Boeing jets. The performance level used to calculate the "poor" data reflects a runway covered with wet ice. Performance is based on a 15 ft screen height at the end of the runway. The tables provided are used in the same manner as the Slush/Standing Water tables.

Anti-Skid Inoperative

When operating with anti-skid inoperative, the field limit weight and V1 must be reduced to account for the effect on accelerate-stop performance. Anti-skid inoperative is only allowed on a dry runway. A simplified method which conservatively accounts for the effects of anti-skid inoperative is to reduce the normal dry field/obstacle limited weight by 18100 lb and the V1 associated with the reduced weight by the amount shown in the table below.

ANTI-SKID INOPERATIVE V1 ADJUSTMENTS	
FIELD LENGTH (FT)	V1 ADJUSTMENT (KIAS)
6000	-22
8000	-18
10000	-15
12000	-13
14000	-11

If the resulting V1 is less than V1(MCG), takeoff is permitted with V1 set equal to V1(MCG) provided the dry accelerate-stop distance adjusted for wind and slope exceeds approximately 5800 ft.

Detailed analysis for the specific case from the Airplane Flight Manual may yield a less restrictive penalty.

Thrust Reverser Inoperative

When dispatching on a wet runway with both thrust reversers operative, an operative anti-skid system, and all brakes operating, regulations allow deceleration credit for one thrust reverser in the engine failure case and two thrust reversers in the all engine stop case.

When dispatching on a wet runway with one thrust reverser inoperative, the field/obstacle limited weight and V1 must be reduced to account for the effect on accelerate-stop performance. A simplified method, which conservatively accounts for this, is to reduce the normal wet runway/field/obstacle limited weight by 2300 lb and the V1 associated with the reduced weight by 2 knots.

If the resulting V1 is less than minimum V1, takeoff is permitted with V1 set equal to V1(MCG) provided the accelerate-stop distance available adjusted for wind and slope exceeds approximately 4000 ft.

Detailed analysis for the specific case from the Airplane Flight Manual may yield a less restrictive penalty.

Takeoff %N1

To find Max Takeoff %N1 based on normal engine bleed for air conditioning packs on, enter Takeoff %N1 Table with airport pressure altitude and airport OAT and read %N1. Apply %N1 adjustments as provided when applicable.

Assumed Temperature Reduced Thrust

Regulations permit the use of up to 25% takeoff thrust reduction for operation with assumed temperature reduced thrust. Use of assumed temperature reduced thrust is not allowed with anti-skid inoperative or on runways contaminated with standing water, ice, slush, or snow. Use of assumed temperature reduced thrust is not recommended if potential windshear conditions exist.

To find the maximum allowable assumed temperature enter the Maximum Assumed Temperature table with airport pressure altitude and OAT. Compare this temperature to that at which the airplane is performance limited as determined from available takeoff performance data. Next, enter the Maximum Takeoff %N1 table with airport pressure altitude and the lower of the two temperatures previously determined, to obtain a maximum takeoff %N1. Do not use an assumed temperature less than the minimum assumed temperature shown. Enter the %N1 Adjustment table with OAT and the difference between the assumed and actual OAT to obtain a %N1 adjustment. Subtract the %N1 adjustment from the maximum takeoff %N1 found previously to determine the assumed temperature reduced thrust %N1.

Apply %N1 adjustments as provided when applicable.

Max Climb %N1

This table shows Max Climb %N1 for a 280/.78 climb speed schedule, normal engine bleed for packs on or off and anti-ice off. Enter the table with airport pressure altitude and TAT and read %N1. %N1 adjustments are shown for anti-ice operation.

Go-around %N1

To find Max Go-around %N1 based on normal engine bleed for packs on (AUTO) and anti-ice on or off, enter the Go-around %N1 table with airport pressure altitude and reported OAT or TAT and read %N1. For packs OFF or HIGH operation, apply the %N1 adjustment shown below the table.

Flight with Unreliable Airspeed / Turbulent Air Penetration

Pitch attitude and average %N1 information is provided for use in all phases of flight in the event of unreliable airspeed/Mach indications resulting from blocking or freezing of the pitot system. Loss of radome or turbulent air may also cause unreliable airspeed/Mach indications. The cruise table in this section may also be used for turbulent air penetration. The Flight with Unreliable Airspeed - FINAL APPROACH table includes a 10 knot margin for landing.

Pitch attitude is shown in bold type for emphasis since altitude and/or vertical speed indications may also be unreliable.

All Engines

Long Range Cruise Maximum Operating Altitude

These tables provide the maximum operating altitude in the same manner as the FMC. Maximum altitudes are shown for a given cruise weight and maneuver capability. This table considers both thrust and buffet limits, providing the more limiting of the two. Any data that is thrust limited is denoted by an asterisk and represents only a thrust limited condition in level flight with 100 ft/min residual rate of climb. Flying above these altitudes with sustained banks in excess of approximately 15° may cause the airplane to lose speed and/or altitude. The altitudes shown in the table are limited to the maximum certified altitude of 41000 ft.

Long Range Cruise Control

These tables provide target %N1, Long Range Cruise Mach number, IAS and standard day fuel flow per engine for the airplane weight and pressure altitude. As indicated by the shaded area, at optimum altitude .79M approximates the Long Range Cruise Mach schedule.

Long Range Cruise Enroute Fuel and Time

Long Range Cruise Enroute Fuel and Time tables are provided to determine remaining time and fuel required to destination. The data is based on Long Range Cruise and .78/280/250 descent. Tables are presented for low altitudes and high altitudes.

To determine remaining fuel and time required, first enter the Ground to Air Miles Conversion table to convert ground distance and enroute wind to an equivalent still air distance for use with the Reference Fuel and Time tables. Next, enter the Reference Fuel and Time table with air distance from the Ground to Air Miles Conversion table and the desired altitude and read Reference Fuel and Time Required. Lastly, enter the Fuel Required Adjustment table with the Reference Fuel and the actual weight at checkpoint to obtain fuel required to destination.

APU Operation During Flight

For APU operation during flight, increase fuel flow according to the table in the Engine Inoperative text section.

Long Range Cruise Wind-Altitude Trade

Wind is a factor which may justify operations considerably below optimum altitude. For example, a favorable wind component may have an effect on ground speed which more than compensates for the loss in air range.

Using this table, it is possible to determine the break-even wind (advantage necessary or disadvantage that can be tolerated) to maintain the same range at another altitude and long range cruise speed. The tables make no allowance for climb or descent time, fuel or distance, and are based on comparing ground fuel mileage.

Descent

Time, fuel, and distance for descent are shown for a .78/280/250 descent speed schedule. Enter the table with top of descent pressure altitude and read distance, time and fuel. Data is based on flight idle thrust descent in zero wind. Allowances are included for a straight-in approach with gear down and landing flaps at the outer marker.

Holding

Target %N1, indicated airspeed and fuel flow per engine information is tabulated for holding with flaps up based on the FMC optimum holding speed schedule. This is the higher of the maximum endurance speed and the maneuvering speed. Small variations in airspeed will not appreciably affect the overall endurance time. Enter the table with weight and pressure altitude to read %N1, IAS and fuel flow per engine.

Advisory Information

Normal Configuration Landing Distance

The normal configuration distance tables are provided as advisory information to help determine the actual landing distance performance of the airplane for different runway surface conditions and brake configurations.

Flaps 15, 30, and 40 landing distances and adjustments are provided for dry runways as well as runways with good, medium, and poor reported braking action, which are commonly referred to as slippery runway conditions.

If the surface is affected by water, snow or ice, and the braking action is reported as "good", conditions should not be expected to be as good as on clean, dry runways. The value "good" is comparative and is intended to mean that airplanes should not experience braking or directional control difficulties when landing. The performance level used to calculate the "good" data is consistent with wet runway testing done on early Boeing jets. The performance level used to calculate "poor" data reflects runways covered with wet ice.

Dry runway landing performance is shown for max manual braking configuration and autobrake settings max, 3, 2, and 1. The autobrake performance may be used to assist in the selection of the most desirable autobrake setting for a given field length. Selection of an autobrake setting results in a constant rate of deceleration. Maximum effort manual braking should achieve shorter landing distance than the max autobrake setting. The reference landing distance is a reference distance from 50 ft above the threshold to stop based on a reference landing weight and normal approach speed for the selected landing flap at sea level, zero wind, zero slope, and two engine detent reverse thrust. Subsequent columns provide adjustments for off-reference landing weight, altitude, wind, slope, temperature, speed, and reverse thrust. Each adjustment is independently added to the reference landing distance.

Non-normal Configuration Landing Distance

Advisory information is provided to support non-normal configurations that affect the landing performance of the airplane. Landing distances and adjustments are provided for dry runways and runways with good, medium, and poor reported braking action.

Enter the table with the applicable non-normal configuration and read the normal approach speed. The reference landing distance is a reference distance from 50 ft above the threshold to stop based on a reference landing weight and speed at sea level, zero wind, and zero slope. Subsequent columns provide adjustments for off-reference landing weight, altitude, wind, slope, and speed conditions. Each adjustment is independently added to the reference landing distance. Landing distance includes the effect of reverse thrust.

Recommended Brake Cooling Schedule

Advisory information is provided to assist in avoiding the problems associated with hot brakes. For normal operation, most landings are at weights below the AFM quick turnaround limit weight.

Use of the recommended cooling schedule will help avoid brake overheat and fuse plug problems that could result from repeated landings at short time intervals or a rejected takeoff.

Enter the Recommended Brake Cooling Schedule table with the airplane weight and brakes on speed, adjusted for wind at the appropriate temperature and altitude condition. Instructions for applying wind adjustments are included below the table. Linear interpolation may be used to obtain intermediate values. The resulting number is the reference brake energy per brake in millions of foot-pounds, and represents the amount of energy absorbed by each brake during a rejected takeoff. Notes providing adjustments for wind are included below the table.

To determine the energy per brake absorbed during landing, enter the appropriate Adjusted Brake Energy Per Brake table (No Reverse Thrust or 2 Engine Reverse) with the reference brake energy per brake and the type of braking used during landing (Max Manual, Max Auto, or Autobrake). The resulting number is the adjusted brake energy per brake and represents the energy absorbed in each brake during the landing.

The recommended cooling time is found in the appropriate (steel or carbon brakes) final table by entering with the adjusted brake energy per brake. Times are provided for ground cooling and inflight gear down cooling.

Brake Temperature Monitor System (BTMS) indications are also shown. If brake cooling is determined from the BTMS, use the hottest brake indication 10 to 15 minutes after the airplane has come to a complete stop, or inflight with gear retracted to determine recommended cooling schedule.

Engine Inoperative

Initial Max Continuous %N1

The Initial Max Continuous %N1 setting for use following an engine failure is shown. The table is based on the typical all engine cruise speed of .79M to provide a target %N1 setting at the start of driftdown. Once driftdown is established, the Max Continuous %N1 table should be used to determine %N1 for the given conditions.

Max Continuous %N1

Power setting is based on one engine operating with one A/C pack operating and all anti-ice bleeds off. Enter the table with pressure altitude, TAT, and IAS or Mach to read %N1.

It is desirable to maintain engine thrust level within the limits of the Max Cruise thrust rating. However, where thrust level in excess of Max Cruise rating is required, such as for meeting terrain clearance, ATC altitude assignments, or to attain maximum range capability, it is permissible to use the thrust needed up to the Max Continuous thrust rating. The Max Continuous thrust rating is intended primarily for emergency use at the discretion of the pilot and is the maximum thrust that may be used continuously.

Driftdown Speed/Level Off Altitude

The table shows optimum driftdown speed as a function of cruise weight at start of driftdown. Also shown are the approximate weight and pressure altitude at which the airplane will level off considering 100 ft/min residual rate of climb.

The level off altitude is dependent on air temperature (ISA deviation).

Driftdown/LRC Range Capability

This table shows the range capability from the start of driftdown. Driftdown is continued to level off altitude. As weight decreases due to fuel burn, the airplane is accelerated to Long Range Cruise speed. Cruise is continued at level off altitude and Long Range Cruise speed.

To determine fuel required, enter the Ground to Air Miles Conversion table with the desired ground distance and adjust for anticipated winds to obtain air distance to destination. Then enter the Driftdown/Cruise Fuel and Time table with air distance and weight at start of driftdown to determine fuel and time required. If altitudes other than the level off altitude is used, fuel and time required may be obtained by using the Engine Inoperative Long Range Cruise Enroute Fuel and Time table.

Long Range Cruise Altitude Capability

The table shows the maximum altitude that can be maintained at a given weight and air temperature (ISA deviation), based on Long Range Cruise speed, Max Continuous thrust, and 100 ft/min residual rate of climb.

Long Range Cruise Control

The table provides target %N1, engine inoperative Long Range Cruise Mach number, IAS and fuel flow for the airplane weight and pressure altitude. The fuel flow values in this table reflect single engine fuel burn.

APU Operation During Flight

For APU operation during flight, increase fuel flow according to the following table. These increments include the APU fuel flow and the effect of increased drag from the APU door.

PRESSURE ALTITUDE (1000 FT)	APU FUEL FLOW (LB/HR)
39	100
35	100
31	110
25	130
20	150
15	160
10	180
5	200

Long Range Cruise Diversion Fuel and Time

Tables are provided for crews to determine the fuel and time required to proceed to an alternate airfield with one engine inoperative. The data is based on single engine Long Range Cruise speed and .78/280/250 descent. Enter with Air Distance as determined from the Ground to Air Miles Conversion table and read Fuel and Time required at the cruise pressure altitude. Adjust the fuel obtained for deviation from the reference weight at checkpoint as required by entering the off reference fuel adjustments table with the fuel required for the reference weight and the actual weight at checkpoint. Read fuel required and time for the actual weight.

Holding

Single engine holding data is provided in the same format as the all engine holding data and is based on the same assumptions.

Gear Down Landing Rate of Climb Available

Rate of climb data is provided as guidance information in the event an engine inoperative landing (manual or autoland) is planned. The tables show gear down rate of climb available for Flaps 15 and Flaps 30. Enter the table with TAT and pressure altitude to read rate of climb available. Apply adjustments shown to correct for weight.

Alternate Mode EEC

Introduction

This section contains performance data for airplane operation with the Electronic Engine Control (EEC) in the alternate mode (ALTN EEC switch illuminated) for applicable thrust ratings. The data includes engine bleed effects for normal air conditioning operation i.e., two packs on at normal flow all engines operating.

Operation with derate and/or assumed temperature reduced thrust is not permitted with the EEC in alternate mode.

Limit Weight

A simplified method which conservatively accounts for the effects of EEC in alternate mode is to reduce the normal mode (ON EEC switch illuminated) performance limited weights. The Limit Weight table provides takeoff field, climb, and obstacle limit weights. To determine limit weights for operations with the EEC in alternate mode, enter the table with the limit weights for normal mode EEC operation and read the associated limit weight for each performance condition. The most limiting of the takeoff weights must be used. Analysis from the Airplane Flight Manual - Digital Performance Information may yield less restrictive limit weights.

Takeoff Speed Adjustment

Takeoff speeds for the reduced weight should be increased by the amount shown in the Takeoff Speeds Adjustment table. The adjusted V1 should not exceed the adjusted VR.

Note: The FMC does not incorporate alternate mode EEC performance in its takeoff speeds calculations.

Max Takeoff %N1

The alternate mode EEC thrust schedule provides equal or greater thrust than the normal mode thrust for the same thrust lever position. Thrust limit protection is not provided in alternate mode EEC and maximum rated thrust may be reached at thrust lever position less than full forward. As a result, thrust overboost may occur if the target alternate mode EEC Max Takeoff %N1 settings are not observed.

To find alternate mode EEC Max Takeoff %N1 based on normal engine bleed for air conditioning packs on, enter the Alternate Mode EEC Max Takeoff %N1 table with airport pressure altitude and airport OAT and read %N1. For packs off apply the %N1 adjustment provided below the table. No %N1 adjustment is required for engine or wing anti-ice.

Gear Down

This section contains performance for airplane operation with the landing gear extended. The data is based on engine bleeds for normal air conditioning.

Note: The Flight Management Computer System (FMCS) does not contain special provisions for operation with landing gear extended. As a result, the FMCS may generate inappropriate enroute speed schedules, display non-conservative predictions of fuel burn, estimated time of arrival (ETA), maximum altitude, and compute overly shallow descent path. An accurate estimated time of arrival (ETA) is available if current speed or Mach is entered into the VNAV cruise page.

Tables for gear down performance in this section are identical in format and used in the same manner as tables for the gear up configuration previously described.

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Performance Inflight — Chapter PI
Table of Contents — Section 70

737-900ERW CFM56-7B26 C KG M FAA CATH/P

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General

The table below shows the airplanes that have been identified with the following performance package. Note, some airplanes may be identified with more than one performance package. This configuration table information reflects the Boeing delivered configuration updated for service bulletin incorporations in conformance with the policy stated in the introduction section of the FCOM. The performance data is prepared for the owner/operator named on the title page. The intent of this information is to assist flight crews and airlines in knowing which performance package is applicable to a given airplane. The performance package model identification information is based on Boeing's knowledge of the airline's fleet at a point in time approximately three months prior to the page date. Notice of Errata (NOE) will not be provided to airlines to identify airplanes that are moved between performance packages within this manual or airplanes added to the airline's fleet whose performance packages are already represented in this manual. These types of changes will be updated in the next block revision. Owners/operators are responsible for ensuring the operational documentation they are using is complete and matches the current configuration of their airplanes, and the accuracy and validity of all information furnished by the owner/operator or any other party. Owners/operators receiving active revision service are responsible to ensure that any modifications to the listed airplanes are properly reflected in this manual.

Serial and tabulation number are supplied by Boeing.

Registry Number	Serial Number	Tabulation Number
YX910	YX910	YX910

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Performance Inflight
General

Takeoff Speeds - Dry Runway
V1, VR, V2 for Max Takeoff Thrust

WEIGHT (1000 KG)	FLAPS 1			FLAPS 5			FLAPS 10			FLAPS 15			FLAPS 25		
	V1	VR	V2	V1	VR	V2	V1	VR	V2	V1	VR	V2	V1	VR	V2
90	174	175	181	165	168	173									
85	168	170	177	160	163	169									
80	163	165	172	155	157	165	147	149	156	145	147	154	142	142	149
75	157	159	167	150	152	160	142	143	151	140	141	149	137	137	145
70	151	153	162	144	146	155	136	138	147	134	136	145	131	132	141
65	145	147	157	138	140	150	131	132	142	129	130	140	126	127	136
60	139	140	152	132	133	145	124	126	137	123	124	135	120	121	132
55	131	132	146	125	126	139	118	119	132	116	118	130	114	114	127
50	124	125	139	118	119	133	111	112	126	110	111	125	107	108	121
45	116	117	133	111	111	127	105	105	120	103	103	119	100	101	116
40	108	108	126	103	103	121	97	97	114	96	96	113	92	93	110

Check V1(MCG).

V1, VR, V2 Adjustments*

TEMP		V1							VR							V2						
		PRESS ALT (1000 FT)							PRESS ALT (1000 FT)							PRESS ALT (1000 FT)						
°C	°F	-2	0	2	4	6	8	10	-2	0	2	4	6	8	10	-2	0	2	4	6	8	10
70	158	5	5						4	5						-2	-2					
60	140	4	4	5	6				3	4	5	6				-2	-2	-2	-3			
50	122	2	3	4	5	6	7	8	2	3	4	5	6	7	8	-1	-1	-2	-2	-2	-3	-4
40	104	1	1	2	3	4	5	7	1	1	2	3	4	6	7	0	-1	-1	-1	-2	-2	-3
30	86	0	0	1	2	3	5	6	0	0	1	2	4	5	6	0	0	-1	-1	-1	-2	-2
20	68	0	0	1	2	3	4	5	0	0	1	2	3	4	5	0	0	0	-1	-1	-2	-2
-60	-76	0	0	1	2	3	4	5	0	0	1	2	3	4	5	0	0	0	-1	-1	-1	-2

Slope and Wind V1 Adjustments*

WEIGHT (1000 KG)	SLOPE (%)					WIND (KTS)							
	-2	-1	0	1	2	-15	-10	-5	0	10	20	30	40
90	-4	-2	0	2	2	-2	-1	-1	0	0	0	1	1
80	-3	-2	0	1	2	-2	-1	-1	0	0	1	1	1
70	-2	-1	0	1	1	-2	-1	0	0	0	1	1	1
60	-1	0	0	1	1	-2	-1	0	0	0	1	1	1
50	-1	0	0	0	0	-1	-1	0	0	0	0	0	0
40	0	0	0	0	0	-1	-1	0	0	0	0	0	0

***V1 not to exceed VR.**

V1(MCG)
Max Takeoff Thrust

TEMP		PRESSURE ALTITUDE (FT)						
°C	°F	-2000	0	2000	4000	6000	8000	10000
70	158	93	91					
60	140	93	91	89	88			
50	122	95	93	90	88	86	83	81
40	104	99	97	94	90	87	83	81
30	86	102	101	98	94	90	86	83
20	68	102	102	99	95	92	88	85
-60	-76	104	103	100	96	93	90	87

Takeoff Speeds - Wet Runway
V1, VR, V2 for Max Takeoff Thrust

WEIGHT	FLAPS1			FLAPS5			FLAPS10			FLAPS15			FLAPS25		
(1000 KG)	V1	VR	V2	V1	VR	V2	V1	VR	V2	V1	VR	V2	V1	VR	V2
90	169	175	181	160	168	173									
85	163	170	177	155	163	169									
80	157	165	172	149	157	165	140	149	156	138	147	154	134	142	149
75	150	159	167	143	152	160	135	143	151	133	141	149	129	137	145
70	144	153	162	136	146	155	129	138	147	127	136	145	123	132	141
65	137	147	157	130	140	150	123	132	142	121	130	140	118	127	136
60	130	140	152	123	133	145	117	126	137	115	124	135	112	121	132
55	122	132	146	116	126	139	110	119	132	108	118	130	105	114	127
50	115	125	139	109	119	133	103	112	126	101	111	125	98	108	121
45	107	117	133	101	111	127	95	105	120	94	103	119	91	101	116
40	98	108	126	93	103	121	88	97	114	86	96	113	83	93	110

Check V1(MCG).

V1, VR, V2 Adjustment*

TEMP		V1							VR							V2						
		PRESS ALT (1000 FT)							PRESS ALT (1000 FT)							PRESS ALT (1000 FT)						
°C	°F	-2	0	2	4	6	8	10	-2	0	2	4	6	8	10	-2	0	2	4	6	8	10
70	158	7	8						4	5						-2	-2					
60	140	5	6	7	9				3	4	5	6				-2	-2	-2	-3			
50	122	3	4	5	6	7	9	12	2	3	4	5	6	7	8	-1	-1	-2	-2	-2	-3	-4
40	104	1	2	3	4	5	7	9	1	1	2	3	5	6	7	0	-1	-1	-1	-2	-2	-3
30	86	0	0	1	3	4	5	7	0	0	1	2	4	5	6	0	0	-1	-1	-1	-2	-2
20	68	0	0	1	2	4	5	6	0	0	1	2	3	4	5	0	0	0	-1	-1	-2	-2
-60	-76	0	0	1	2	4	5	6	0	0	1	2	3	4	5	0	0	0	-1	-1	-1	-2

Slope and Wind V1 Adjustment*

WEIGHT	SLOPE(%)					WIND(KTS)							
(1000 KG)	-2	-1	0	1	2	-15	-10	-5	0	10	20	30	40
90	-5	-3	0	3	6	-4	-2	-1	0	1	1	2	3
80	-4	-2	0	3	5	-4	-2	-1	0	1	1	2	3
70	-4	-2	0	2	4	-4	-2	-1	0	1	2	2	3
60	-3	-1	0	2	3	-4	-3	-1	0	1	2	2	3
50	-2	-1	0	1	2	-5	-3	-1	0	1	2	3	4
40	-2	-1	0	1	1	-5	-4	-2	0	1	2	3	4

***V1 not to exceed VR.**

V1(MCG)
Max Takeoff Thrust

TEMP		PRESSURE ALTITUDE (FT)						
°C	°F	-2000	0	2000	4000	6000	8000	10000
70	158	93	91					
60	140	93	91	89	88			
50	122	95	93	90	88	86	83	81
40	104	99	97	94	90	87	83	81
30	86	102	101	98	94	90	86	83
20	68	102	102	99	95	92	88	85
-60	-76	104	103	100	96	93	90	87

Stab Trim Setting
Max Takeoff Thrust
Flaps 1 and 5

WEIGHT (1000 KG)	C.G. (%MAC)										
	6	8	9	20	25	26	28	30	32	34	36
85	8 1/2	8 1/4	8 1/4	6 1/2	5 3/4	5 1/2	5 1/4	5	4 3/4	4 1/2	4
80	8 1/2	8	8	6 1/4	5 1/2	5 1/2	5	4 3/4	4 1/2	4 1/4	4
70	7 3/4	7 1/2	7 1/2	5 3/4	5	5	4 3/4	4 1/4	4	3 3/4	3 1/2
60	7 1/4	7	6 3/4	5 1/4	4 1/2	4 1/2	4 1/4	4	3 1/2	3 1/4	3
50	6 1/2	6 1/4	6	4 3/4	4	4	3 3/4	3 1/4	3	3	2 3/4
40	6	5 3/4	5 3/4	4 1/4	3 3/4	3 1/2	3 1/4	3	2 3/4	2 3/4	2 3/4

Flaps 10, 15 and 25

WEIGHT (1000 KG)	C.G. (%MAC)										
	6	8	9	20	25	26	28	30	32	34	36
85	8 1/2	8 1/4	8	5 3/4	4 3/4	4 1/2	4 1/4	3 3/4	3 1/2	3	2 3/4
80	8 1/2	8 1/4	8	5 1/2	4 1/2	4 1/2	4	3 3/4	3 1/4	3	2 3/4
70	8	7 1/2	7 1/4	5	4	4	3 1/2	3 1/4	3	2 3/4	2 3/4
60	7 1/4	6 3/4	6 3/4	4 1/2	3 3/4	3 1/2	3 1/4	2 3/4	2 3/4	2 3/4	2 3/4
50	6 1/2	6 1/4	6	4	3	3	2 3/4	2 3/4	2 3/4	2 3/4	2 3/4
40	6 1/4	5 3/4	5 1/2	3 3/4	3	2 3/4	2 3/4	2 3/4	2 3/4	2 3/4	2 3/4

VREF

WEIGHT (1000 KG)	FLAPS		
	40	30	15
85	158	161	171
80	153	157	166
75	148	152	160
70	143	147	155
65	137	142	149
60	131	136	143
55	125	130	137
50	119	124	130
45	112	118	123
40	105	111	116

Flap Maneuver Speeds

FLAP POSITION	MANEUVER SPEED
UP	VREF40 + 70
1	VREF40 + 50
5	VREF40 + 30
10	VREF40 + 30
15	VREF40 + 20
25	VREF40 + 10
30	VREF30
40	VREF40

ADVISORY INFORMATION

Slush/Standing Water Takeoff
Maximum Reverse Thrust
Weight Adjustments (1000 KG)

DRY FIELD/OBSTACLE LIMIT WEIGHT (1000 KG)	SLUSH/STANDING WATER DEPTH								
	3 mm (0.12 INCHES)			6 mm (0.25 INCHES)			13 mm (0.50 INCHES)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
90	-10.3	-12.3	-14.3	-12.8	-14.8	-16.8	-18.3	-21.3	-24.3
85	-9.7	-11.7	-13.7	-11.9	-13.9	-15.9	-16.4	-19.4	-22.4
80	-9.1	-11.1	-13.1	-10.8	-12.8	-14.8	-14.6	-17.6	-20.6
75	-8.3	-10.3	-12.3	-9.7	-11.7	-13.7	-12.8	-15.8	-18.8
70	-7.4	-9.4	-11.4	-8.6	-10.6	-12.6	-11.0	-14.0	-17.0
65	-6.5	-8.5	-10.5	-7.4	-9.4	-11.4	-9.3	-12.3	-15.3
60	-5.5	-7.5	-9.5	-6.2	-8.2	-10.2	-7.7	-10.7	-13.7
55	-4.5	-6.5	-8.5	-5.0	-7.0	-9.0	-6.2	-9.2	-12.2
50	-3.6	-5.6	-7.6	-4.0	-6.0	-8.0	-4.8	-7.8	-10.8
45	-2.7	-4.7	-6.7	-3.0	-5.0	-7.0	-3.5	-6.5	-9.5
40	-1.9	-3.9	-5.9	-2.1	-4.1	-6.1	-2.4	-5.4	-8.4

V1(MCG) Limit Weight (1000 KG)

ADJUSTED FIELD LENGTH (M)	SLUSH/STANDING WATER DEPTH								
	3 mm (0.12 INCHES)			6 mm (0.25 INCHES)			13 mm (0.50 INCHES)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
1200				30.7			36.4		
1400	46.0	30.6		49.1	33.7		54.4	39.2	
1600	65.9	49.1	33.6	69.1	52.2	36.6	73.8	57.5	42.0
1800	88.1	69.4	52.2	90.9	72.5	55.3	91.2	76.8	60.7
2000		91.8	72.9		94.5	76.0		93.9	79.8
2200			95.5			98.2			96.6

1. **Enter Weight Adjustment table with slush/standing water depth and dry field/obstacle limit weight to obtain slush/standing water weight adjustment.**
2. **Adjust field length available by -25 m/+25 m for every 5°C above/below 4°C.**
3. **Find V1(MCG) limit weight for adjusted field length and pressure altitude.**
4. **Max allowable slush/standing water limited weight is lesser of weights from 1 and 3.**

V1 Adjustment (KIAS)

WEIGHT (1000 KG)	SLUSH/STANDING WATER DEPTH								
	3 mm (0.12 INCHES)			6 mm (0.25 INCHES)			13 mm (0.50 INCHES)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
90	-15	-10	-5	-6	-1	0	0	0	0
85	-16	-11	-6	-9	-4	0	0	0	0
80	-18	-13	-8	-11	-6	-1	0	0	0
75	-19	-14	-9	-14	-9	-4	-1	0	0
70	-21	-16	-11	-16	-11	-6	-5	0	0
65	-22	-17	-12	-18	-13	-8	-8	-3	0
60	-23	-18	-13	-20	-15	-10	-12	-7	-2
55	-24	-19	-14	-22	-17	-12	-15	-10	-5
50	-25	-20	-15	-23	-18	-13	-18	-13	-8
45	-26	-21	-16	-25	-20	-15	-21	-16	-11
40	-27	-22	-17	-26	-21	-16	-23	-18	-13

1. **Obtain V1, VR and V2 for the actual weight using the Dry Runway Takeoff Speeds table.**
2. **If V1(MCG) limited, set V1 = V1(MCG). If not V1(MCG) limited, enter V1 Adjustment table with the actual weight to obtain V1 speed adjustment. If adjusted V1 is less than V1(MCG), set V1 = V1(MCG). V1 not to exceed VR.**

ADVISORY INFORMATION

Slush/Standing Water Takeoff

No Reverse Thrust

Weight Adjustments (1000 KG)

DRY FIELD/OBSTACLE LIMIT WEIGHT (1000 KG)	SLUSH/STANDING WATER DEPTH								
	3 mm (0.12 INCHES)			6 mm (0.25 INCHES)			13 mm (0.50 INCHES)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
90	-13.7	-16.2	-18.7	-16.3	-18.8	-21.3	-21.9	-25.9	-29.9
85	-13.0	-15.5	-18.0	-15.2	-17.7	-20.2	-19.7	-23.7	-27.7
80	-12.1	-14.6	-17.1	-13.9	-16.4	-18.9	-17.6	-21.6	-25.6
75	-11.2	-13.7	-16.2	-12.6	-15.1	-17.6	-15.6	-19.6	-23.6
70	-10.2	-12.7	-15.2	-11.3	-13.8	-16.3	-13.7	-17.7	-21.7
65	-9.1	-11.6	-14.1	-10.0	-12.5	-15.0	-11.9	-15.9	-19.9
60	-7.9	-10.4	-12.9	-8.6	-11.1	-13.6	-10.2	-14.2	-18.2
55	-6.8	-9.3	-11.8	-7.4	-9.9	-12.4	-8.5	-12.5	-16.5
50	-5.8	-8.3	-10.8	-6.2	-8.7	-11.2	-7.0	-11.0	-15.0
45	-4.8	-7.3	-9.8	-5.0	-7.5	-10.0	-5.5	-9.5	-13.5
40	-3.9	-6.4	-8.9	-4.1	-6.6	-9.1	-4.0	-8.0	-12.0

V1(MCG) Limit Weight (1000 KG)

ADJUSTED FIELD LENGTH (M)	SLUSH/STANDING WATER DEPTH								
	3 mm (0.12 INCHES)			6 mm (0.25 INCHES)			13 mm (0.50 INCHES)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
1800				30.5			52.0	32.9	
2000	44.1			58.7	34.9		76.7	56.0	36.4
2200	78.0	49.0		88.2	63.7	39.3	97.8	80.4	60.1
2400		83.9	54.2		92.7	68.7			83.9
2600			89.7			97.1			

1. **Enter Weight Adjustment table with slush/standing water depth and dry field/obstacle limit weight to obtain slush/standing water weight adjustment.**
2. **Adjust field length available by -45 m/+45 m for every 5°C above/below 4°C.**
3. **Find V1(MCG) limit weight for adjusted field length and pressure altitude.**
4. **Max allowable slush/standing water limited weight is lesser of weights from 1 and 3.**

V1 Adjustment (KIAS)

WEIGHT (1000 KG)	SLUSH/STANDING WATER DEPTH								
	3 mm (0.12 INCHES)			6 mm (0.25 INCHES)			13 mm (0.50 INCHES)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
90	-23	-13	-3	-11	-1	0	0	0	0
85	-25	-15	-5	-15	-5	0	0	0	0
80	-27	-17	-7	-18	-8	0	0	0	0
75	-29	-19	-9	-22	-12	-2	-3	0	0
70	-31	-21	-11	-25	-15	-5	-8	0	0
65	-34	-24	-14	-28	-18	-8	-14	-4	0
60	-36	-26	-16	-31	-21	-11	-19	-9	0
55	-38	-28	-18	-34	-24	-14	-24	-14	-4
50	-39	-29	-19	-37	-27	-17	-29	-19	-9
45	-41	-31	-21	-39	-29	-19	-34	-24	-14
40	-43	-33	-23	-42	-32	-22	-38	-28	-18

1. **Obtain V1, VR and V2 for the actual weight using the Dry Runway Takeoff Speeds table.**
2. **If V1(MCG) limited, set V1 = V1(MCG). If not V1(MCG) limited, enter V1 Adjustment table with the actual weight to obtain V1 speed adjustment. If adjusted V1 is less than V1(MCG), set V1 = V1(MCG). V1 not to exceed VR.**

ADVISORY INFORMATION

Slippery Runway Takeoff
Maximum Reverse Thrust
Weight Adjustment (1000 KG)

DRY FIELD/OBSTACLE LIMIT WEIGHT (1000 KG)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
90	-0.2	-0.9	-1.6	-5.4	-6.1	-6.8	-10.4	-11.1	-11.8
85	-0.6	-1.3	-2.0	-5.5	-6.2	-6.9	-10.1	-10.8	-11.5
80	-0.9	-1.6	-2.3	-5.6	-6.3	-7.0	-9.7	-10.4	-11.1
75	-1.1	-1.8	-2.5	-5.5	-6.2	-6.9	-9.3	-10.0	-10.7
70	-1.2	-1.9	-2.6	-5.3	-6.0	-6.7	-8.7	-9.4	-10.1
65	-1.2	-1.9	-2.6	-5.0	-5.7	-6.4	-8.0	-8.7	-9.4
60	-1.1	-1.8	-2.5	-4.5	-5.2	-5.9	-7.2	-7.9	-8.6
55	-0.8	-1.5	-2.2	-3.9	-4.6	-5.3	-6.4	-7.1	-7.8
50	-0.4	-1.1	-1.8	-3.3	-4.0	-4.7	-5.4	-6.1	-6.8
45	0.0	-0.6	-1.3	-2.4	-3.1	-3.8	-4.3	-5.0	-5.7
40	0.0	0.0	-0.7	-1.5	-2.2	-2.9	-3.0	-3.7	-4.4

V1(MCG) Limit Weight (1000 KG)

ADJUSTED FIELD LENGTH (M)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
1000	41.6								
1200	73.5	49.4							
1400		80.7	57.0	49.4					
1600			87.8	72.4	51.2	31.6	32.2		
1800				97.9	74.5	53.1	45.2		
2000						76.6	59.1	41.3	
2200							74.9	54.9	37.5
2400							92.9	70.0	50.7
2600								87.4	65.3
2800									82.0

1. **Enter Weight Adjustment table with reported braking action and dry field/obstacle limit weight to obtain slippery runway weight adjustment.**
2. **Adjust "Good" field length available by -20 m/+20 m for every 5°C above/below 4°C.**
   Adjust "Medium" field length available by -20 m/+20 m for every 5°C above/below 4°C.
   Adjust "Poor" field length available by -40 m/+40 m for every 5°C above/below 4°C.
3. **Find V1(MCG) limit weight for adjusted field length and pressure altitude.**
4. **Max allowable slippery runway limited weight is lesser of weights from 1 and 3.**

ADVISORY INFORMATION

Slippery Runway Takeoff
Maximum Reverse Thrust
V1 Adjustment (KIAS)

WEIGHT (1000 KG)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
90	-5	0	0	-14	-9	-4	-25	-20	-15
85	-6	-1	0	-16	-11	-6	-27	-22	-17
80	-7	-2	0	-17	-12	-7	-29	-24	-19
75	-8	-3	0	-19	-14	-9	-32	-27	-22
70	-9	-4	0	-20	-15	-10	-34	-29	-24
65	-10	-5	0	-22	-17	-12	-36	-31	-26
60	-11	-6	-1	-23	-18	-13	-38	-33	-28
55	-12	-7	-2	-25	-20	-15	-39	-34	-29
50	-13	-8	-3	-26	-21	-16	-41	-36	-31
45	-15	-10	-5	-28	-23	-18	-43	-38	-33
40	-16	-11	-6	-30	-25	-20	-45	-40	-35

1. **Obtain V1, VR and V2 for the actual weight using the Dry Runway Takeoff Speeds table.**
2. **If V1(MCG) limited, set V1 = V1(MCG). If not V1(MCG) limited, enter V1 Adjustment table with the actual weight to obtain V1 speed adjustment. If adjusted V1 is less than V1(MCG), set V1 = V1(MCG).V1 not to exceed VR.**

ADVISORY INFORMATION

Slippery Runway Takeoff

No Reverse Thrust

Weight Adjustments (1000 KG)

DRY FIELD/OBSTACLE LIMIT WEIGHT (1000 KG)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
90	-1.5	-2.3	-3.1	-8.2	-8.9	-9.7	-13.9	-14.7	-15.4
85	-2.0	-2.7	-3.5	-8.3	-9.0	-9.8	-13.6	-14.4	-15.2
80	-2.3	-3.1	-3.9	-8.3	-9.1	-9.8	-13.3	-14.1	-14.8
75	-2.6	-3.4	-4.1	-8.2	-8.9	-9.7	-12.8	-13.5	-14.3
70	-2.7	-3.5	-4.3	-7.9	-8.7	-9.5	-12.0	-12.8	-13.6
65	-2.7	-3.5	-4.3	-7.5	-8.3	-9.1	-11.2	-11.9	-12.7
60	-2.6	-3.4	-4.2	-7.0	-7.8	-8.5	-10.1	-10.9	-11.6
55	-2.4	-3.1	-3.9	-6.3	-7.1	-7.9	-8.8	-9.6	-10.4
50	-2.0	-2.8	-3.5	-5.5	-6.3	-7.1	-7.4	-8.2	-9.0
45	-1.5	-2.3	-3.0	-4.6	-5.4	-6.1	-5.8	-6.6	-7.4
40	-0.9	-1.7	-2.4	-3.5	-4.3	-5.1	-4.1	-4.8	-5.6

V1(MCG) Limit Weight (1000 KG)

ADJUSTED FIELD LENGTH (M)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
1200	45.9								
1400	87.2	58.2							
1600		94.9	68.4						
1800				38.7					
2000				82.2	42.8				
2200					85.5	46.9			
2400						88.7			
2800							31.2		
3000							62.6		
3200							95.5	50.7	
3400								83.2	39.1
3600									70.8

1. **Enter Weight Adjustment table with reported braking action and dry field/obstacle limit weight to obtain slippery runway weight adjustment.**
2. **Adjust "Good" field length available by -25 m/+25 m for every 5°C above/below 4°C.
   Adjust "Medium" field length available by -25 m/+25 m for every 5°C above/below 4°C.
   Adjust "Poor" field length available by -50 m/+50 m for every 5°C above/below 4°C.**
3. **Find V1(MCG) limit weight for adjusted field length and pressure altitude.**
4. **Max allowable slippery runway limited weight is lesser of weights from 1 and 3.**

ADVISORY INFORMATION

Slippery Runway Takeoff
No Reverse Thrust
V1 Adjustment (KIAS)

WEIGHT (1000 KG)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
90	-7	-2	0	-20	-15	-10	-39	-34	-29
85	-8	-3	0	-22	-17	-12	-42	-37	-32
80	-10	-5	0	-24	-19	-14	-45	-40	-35
75	-11	-6	-1	-26	-21	-16	-49	-44	-39
70	-12	-7	-2	-29	-24	-19	-52	-47	-42
65	-14	-9	-4	-32	-27	-22	-56	-51	-46
60	-16	-11	-6	-35	-30	-25	-60	-55	-50
55	-18	-13	-8	-38	-33	-28	-64	-59	-54
50	-20	-15	-10	-41	-36	-31	-68	-63	-58
45	-22	-17	-12	-44	-39	-34	-73	-68	-63
40	-24	-19	-14	-48	-43	-38	-77	-72	-67

1. **Obtain V1, VR and V2 for the actual weight using the Dry Runway Takeoff Speeds table.**
2. **If V1(MCG) limited, set V1 = V1(MCG). If not V1(MCG) limited, enter V1 Adjustment table with the actual weight to obtain V1 speed adjustment. If adjusted V1 is less than V1(MCG), set V1 = V1(MCG). V1 not to exceed VR.**

Takeoff %N1

Based on engine bleeds for packs on, engine and wing anti-ice on or off

OAT (°C)	AIRPORT PRESSURE ALTITUDE (FT)												
	-2000	-1000	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
60	94.8	95.4	95.8	95.9	96.0	96.1	96.2	96.3	96.2	95.9	95.8	95.7	95.7
55	95.4	96.0	96.5	96.6	96.7	96.8	96.9	97.1	96.9	96.6	96.3	95.7	95.0
50	96.0	96.6	97.1	97.3	97.4	97.6	97.7	97.8	97.7	97.4	97.1	96.6	96.1
45	96.8	97.4	97.8	98.0	98.1	98.3	98.4	98.5	98.4	98.1	97.8	97.5	97.1
40	97.4	98.1	98.6	98.7	98.8	98.9	99.0	99.2	99.1	98.8	98.5	98.4	98.1
35	98.0	98.7	99.4	99.5	99.6	99.7	99.8	99.9	99.8	99.5	99.2	99.1	99.0
30	97.6	98.8	100.3	100.3	100.4	100.4	100.5	100.5	100.4	100.3	100.0	99.9	99.9
25	96.8	98.1	99.5	100.1	100.7	100.8	100.7	100.7	100.7	100.7	100.6	100.6	100.7
20	96.0	97.3	98.8	99.3	99.9	100.2	100.5	100.8	100.8	100.9	100.8	100.8	100.8
15	95.2	96.5	98.0	98.6	99.2	99.5	99.8	100.1	100.5	100.9	101.1	101.1	101.1
10	94.5	95.8	97.2	97.8	98.4	98.7	99.0	99.4	99.7	100.1	100.5	101.0	101.5
5	93.7	95.0	96.4	97.0	97.6	98.0	98.3	98.6	99.0	99.4	99.8	100.3	100.7
0	92.9	94.2	95.6	96.3	96.9	97.2	97.5	97.9	98.2	98.6	99.0	99.5	100.0
-5	92.0	93.4	94.8	95.5	96.1	96.4	96.7	97.1	97.5	97.9	98.3	98.7	99.2
-10	91.2	92.6	94.0	94.7	95.3	95.6	96.0	96.3	96.7	97.1	97.5	98.0	98.4
-15	90.4	91.7	93.2	93.9	94.5	94.8	95.2	95.6	95.9	96.3	96.7	97.2	97.6
-20	89.6	90.9	92.4	93.0	93.7	94.0	94.4	94.8	95.2	95.6	95.9	96.4	96.8
-25	88.7	90.1	91.6	92.2	92.9	93.2	93.6	94.0	94.4	94.8	95.2	95.6	96.0
-30	87.9	89.2	90.7	91.4	92.0	92.4	92.8	93.2	93.6	94.0	94.3	94.8	95.2
-35	87.0	88.4	89.9	90.5	91.2	91.6	91.9	92.4	92.8	93.1	93.5	94.0	94.4
-40	86.1	87.5	89.0	89.7	90.3	90.7	91.1	91.5	91.9	92.3	92.7	93.1	93.6
-45	85.3	86.6	88.2	88.8	89.5	89.9	90.3	90.7	91.1	91.5	91.9	92.3	92.7
-50	84.4	85.7	87.3	87.9	88.6	89.0	89.4	89.9	90.3	90.6	91.0	91.5	91.9

%N1 Adjustments for Engine Bleeds

BLEED CONFIGURATION	AIRPORT PRESSURE ALTITUDE (FT)												
	-2000	-1000	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
PACKS OFF	0.7	0.7	0.7	0.7	0.7	0.7	0.8	0.8	0.8	0.8	0.8	0.9	1.0

Assumed Temperature Reduced Thrust
Maximum Assumed Temperature (Table 1 of 3)
Based on 25% Takeoff Thrust Reduction

OAT (°C)	AIRPORT PRESSURE ALTITUDE (FT)											
	-1000	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
55	73	71	69	67								
50	73	71	69	67	65	63						
45	73	71	69	67	65	63	61	59	57			
40	73	71	69	67	65	63	61	59	57	55		
35	71	71	69	67	65	63	61	59	57	55	53	
30	69	67	67	67	65	63	61	59	57	55	53	51
25	69	67	66	64	65	63	61	59	57	55	53	51
20	69	67	66	64	64	63	61	59	57	55	53	51
15	69	67	66	64	64	63	61	59	57	55	53	51
10 & BELOW	69	67	66	64	64	63	61	59	57	55	53	51

Takeoff %N1 (Table 2 of 3)
Based on engine bleed for packs on, engine and wing anti-ice on or off

ASSUMED TEMP (°C)	AIRPORT PRESSURE ALTITUDE (FT)											
	-1000	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
75	93.4	93.7	94.2	94.7	95.4	96.1	96.9	97.3	97.6	97.8	97.8	97.7
70	94.1	94.4	94.4	94.4	94.7	95.4	96.2	96.6	96.9	97.1	97.1	97.1
65	94.8	95.1	95.2	95.2	95.3	95.4	95.5	96.0	96.2	96.5	96.4	96.4
60	95.4	95.8	95.9	96.0	96.1	96.2	96.3	96.2	95.9	95.8	95.7	95.7
55	96.0	96.5	96.6	96.7	96.8	96.9	97.1	96.9	96.6	96.3	95.7	95.0
50	96.6	97.1	97.3	97.4	97.6	97.7	97.8	97.7	97.4	97.1	96.6	96.1
45	97.4	97.8	98.0	98.1	98.3	98.4	98.5	98.4	98.1	97.8	97.5	97.1
40	98.1	98.6	98.7	98.8	98.9	99.0	99.2	99.1	98.8	98.5	98.4	98.1
35	98.7	99.4	99.5	99.6	99.7	99.8	99.9	99.8	99.5	99.2	99.1	99.0
30	98.8	100.3	100.3	100.4	100.4	100.5	100.5	100.4	100.3	100.0	99.9	99.9
25	98.1	99.5	100.1	100.7	100.8	100.7	100.7	100.7	100.7	100.6	100.6	100.7
20	97.3	98.8	99.3	99.9	100.2	100.5	100.8	100.8	100.9	100.8	100.8	100.8
15	96.5	98.0	98.6	99.2	99.5	99.8	100.1	100.5	100.9	101.1	101.1	101.1
10	95.8	97.2	97.8	98.4	98.7	99.0	99.4	99.7	100.1	100.5	101.0	101.5
MINIMUM ASSUMED TEMP (°C)	32	30	28	26	24	22	20	18	16	15	12	10

With engine bleed for packs off, increase %N1 by 1.0.

Assumed Temperature Reduced Thrust

%N1 Adjustment for Temperature Difference (Table 3 of 3)

ASSUMED TEMP MINUS OAT (°C)	OUTSIDE AIR TEMPERATURE (°C)													
	-40	-20	0	5	10	15	20	25	30	35	40	45	50	55
110	14.9													
100	14.9	10.9												
90	14.0	11.7												
80	12.9	11.6	7.8											
70	11.2	10.7	8.6	7.8	6.3									
60	9.2	9.5	8.5	8.4	7.1	6.3	4.9							
50	7.8	7.8	7.5	7.1	6.9	7.0	5.6	4.9	3.4					
40		6.0	6.2	6.1	5.9	5.8	5.7	5.6	4.7	4.4	5.3			
30		4.6	4.6	4.6	4.6	4.5	4.4	4.3	4.3	4.2	4.1	4.0	3.9	
20			2.9	3.0	3.0	3.0	3.0	3.0	2.9	2.9	2.8	2.8	2.7	2.6
10			1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.4	1.4	1.4	1.4
0			0	0	0	0	0	0	0	0	0	0	0	0

1. **Determine Maximum Assumed Temperature allowed from Table 1.**
2. **Find Maximum %N1 from Table 2 using the desired assumed temperature (no greater than temperature from Table 1).**
3. **Use the difference between assumed temperature and OAT to determine the %N1 adjustment from Table 3.**
4. **Subtract %N1 adjustment from Maximum %N1 in Table 2.**

Takeoff Speeds - Dry Runway (24K Derate)

V1, VR, V2

WEIGHT	FLAPS 1			FLAPS 5			FLAPS 10			FLAPS 15			FLAPS 25		
(1000 KG)	V1	VR	V2	V1	VR	V2	V1	VR	V2	V1	VR	V2	V1	VR	V2
85	171	172	176												
80	165	166	171	157	158	164	149	150	155	147	147	153			
75	159	160	167	152	153	159	144	145	151	142	142	149	138	138	144
70	153	154	162	146	147	155	138	139	146	136	137	144	133	133	140
65	147	148	157	140	141	150	132	133	142	131	132	140	128	128	136
60	140	141	151	133	134	144	126	127	137	124	125	135	122	122	131
55	133	134	145	126	127	139	120	121	131	118	119	129	115	116	126
50	126	126	139	120	120	133	113	114	126	111	112	124	109	109	120
45	118	118	132	112	112	127	106	106	120	104	105	118	102	102	115
40	110	110	125	104	104	120	98	99	113	97	97	112	94	95	109

Check V1(MCG).

V1, VR, V2 Adjustments*

TEMP		V1							VR							V2						
		PRESS ALT (1000 FT)							PRESS ALT (1000 FT)							PRESS ALT (1000 FT)						
°C	°F	-2	0	2	4	6	8	10	-2	0	2	4	6	8	10	-2	0	2	4	6	8	10
70	158	4	5						4	5						-2	-2					
60	140	3	4	5	6				3	4	5	6				-2	-2	-2	-3			
50	122	2	3	4	5	6	6	8	2	3	4	5	6	7	8	-1	-1	-2	-2	-2	-3	-3
40	104	1	1	2	3	4	5	6	1	1	3	4	5	6	7	0	-1	-1	-2	-2	-2	-3
30	86	0	0	1	2	3	4	5	0	0	1	2	3	5	6	0	0	-1	-1	-1	-2	-2
20	68	0	0	0	1	2	3	4	0	0	1	1	2	3	4	0	0	0	0	-1	-1	-2
-60	-76	0	0	0	1	2	2	3	0	0	1	1	2	3	3	0	0	0	0	-1	-1	-1

Slope and Wind V1 Adjustments*

WEIGHT	SLOPE (%)					WIND (KTS)							
(1000 KG)	-2	-1	0	1	2	-15	-10	-5	0	10	20	30	40
85	-4	-2	0	1	1	-1	-1	-1	0	0	0	0	1
80	-3	-2	0	1	1	-1	-1	-1	0	0	0	1	1
70	-2	-1	0	1	1	-1	-1	0	0	0	1	1	1
60	-1	0	0	1	1	-1	-1	0	0	0	1	1	1
50	0	0	0	0	0	-1	-1	0	0	0	0	0	0
40	0	0	0	0	0	-1	0	0	0	0	0	0	0

***V1 not to exceed VR.**

V1(MCG)

TEMP		PRESSURE ALTITUDE (FT)						
°C	°F	-2000	0	2000	4000	6000	8000	10000
70	158	88	86					
60	140	88	86	84	83			
50	122	90	88	84	83	81	79	77
40	104	94	92	89	85	82	79	77
30	86	97	97	93	89	86	82	79
20	68	98	97	95	93	90	86	82
-60	-76	99	99	96	94	91	89	86

Takeoff Speeds - Wet Runway (24K Derate)

V1, VR, V2

WEIGHT (1000 KG)	FLAPS1			FLAPS5			FLAPS 10			FLAPS 15			FLAPS 25		
	V1	VR	V2	V1	VR	V2	V1	VR	V2	V1	VR	V2	V1	VR	V2
85	166	172	176												
80	160	166	171	152	158	164	144	150	155	143	147	153			
75	153	160	167	146	153	159	137	145	151	136	142	149	131	138	144
70	147	154	162	139	147	155	131	139	146	130	137	144	126	133	140
65	140	148	157	133	141	150	125	133	142	124	132	140	120	128	136
60	133	141	151	126	134	144	119	127	137	117	125	135	114	122	131
55	125	134	145	119	127	139	112	121	131	111	119	129	108	116	126
50	117	126	139	111	120	133	105	114	126	104	112	124	101	109	120
45	109	118	132	104	112	127	98	106	120	97	105	118	94	102	115
40	101	110	125	96	104	120	90	99	113	89	97	112	86	95	109

Check V1(MCG).

V1, VR, V2 Adjustment*

TEMP		V1							VR							V2						
		PRESS ALT (1000 FT)							PRESS ALT (1000 FT)							PRESS ALT (1000 FT)						
°C	°F	-2	0	2	4	6	8	10	-2	0	2	4	6	8	10	-2	0	2	4	6	8	10
70	158	7	8						4	5						-2	-2					
60	140	5	6	7	9				3	4	5	6				-2	-2	-2	-3			
50	122	3	4	5	6	8	9	12	2	3	4	5	6	7	8	-1	-1	-2	-2	-2	-3	-3
40	104	1	2	3	4	6	7	9	1	1	3	4	5	6	7	0	-1	-1	-2	-2	-2	-3
30	86	0	0	1	3	4	5	7	0	0	1	2	3	5	6	0	0	-1	-1	-1	-2	-2
20	68	0	0	1	1	2	4	5	0	0	1	1	2	3	4	0	0	0	0	-1	-1	-2
-60	-76	0	0	1	1	2	3	4	0	0	1	1	2	3	3	0	0	0	0	-1	-1	-1

Slope and Wind V1 Adjustment*

WEIGHT (1000 KG)	SLOPE (%)					WIND (KTS)							
	-2	-1	0	1	2	-15	-10	-5	0	10	20	30	40
85	-5	-3	0	3	6	-3	-2	-1	0	1	1	2	2
80	-5	-2	0	3	6	-3	-2	-1	0	1	1	2	2
70	-4	-2	0	2	4	-3	-2	-1	0	1	1	2	3
60	-3	-2	0	2	3	-4	-2	-1	0	1	2	2	3
50	-2	-1	0	1	3	-4	-3	-1	0	1	2	3	3
40	-2	-1	0	1	2	-5	-3	-1	0	1	2	3	4

***V1 not to exceed VR.**

V1(MCG)

TEMP		PRESSURE ALTITUDE (FT)						
°C	°F	-2000	0	2000	4000	6000	8000	10000
70	158	88	86					
60	140	88	86	84	83			
50	122	90	88	84	83	81	79	77
40	104	94	92	89	85	82	79	77
30	86	97	97	93	89	86	82	79
20	68	98	97	95	93	90	86	82
-60	-76	99	99	96	94	91	89	86

Stab Trim Setting (24K Derate)

Flaps 1 and 5

WEIGHT (1000 KG)	C.G. (%MAC)										
	6	8	9	20	25	26	28	30	32	34	36
85	8 1/2	8 1/2	8 1/4	6 1/2	5 3/4	5 1/2	5 1/4	5	4 3/4	4 1/4	4
80	8 1/2	8 1/4	8 1/4	6 1/2	5 1/2	5 1/2	5 1/4	4 3/4	4 1/2	4 1/4	3 3/4
70	8	7 3/4	7 1/2	6	5 1/4	5	4 3/4	4 1/2	4 1/4	4	3 1/2
60	7 1/2	7 1/4	7	5 1/2	4 3/4	4 3/4	4 1/2	4	3 3/4	3 1/2	3 1/4
50	6 3/4	6 1/2	6 1/4	5	4 1/4	4 1/4	4	3 3/4	3 1/4	3	3
40	6 1/2	6 1/4	6	4 3/4	4	3 3/4	3 1/2	3 1/4	3	2 3/4	2 3/4

Flaps 10, 15 and 25

WEIGHT (1000 KG)	C.G. (%MAC)										
	6	8	9	20	25	26	28	30	32	34	36
85	8 1/2	8 1/4	8	6	5	4 3/4	4 1/2	4 1/4	3 3/4	3 1/2	3
80	8 1/2	8	8	5 3/4	4 3/4	4 3/4	4 1/4	4	3 1/2	3 1/4	3
70	8	7 1/2	7 1/4	5 1/4	4 1/2	4 1/4	4	3 1/2	3 1/4	3	2 3/4
60	7 1/4	7	6 3/4	4 3/4	4	3 3/4	3 1/2	3	2 3/4	2 3/4	2 3/4
50	6 1/2	6 1/4	6	4 1/4	3 1/2	3 1/4	3	2 3/4	2 3/4	2 3/4	2 3/4
40	6 1/4	6	5 3/4	4	3 1/4	3	2 3/4	2 3/4	2 3/4	2 3/4	2 3/4

ADVISORY INFORMATION

Slush/Standing Water Takeoff (24K Derate)

Maximum Reverse Thrust

Weight Adjustments (1000 KG)

24K DERATE DRY FIELD/OBSTACLE LIMIT WEIGHT (1000 KG)	SLUSH/STANDING WATER DEPTH								
	3 mm (0.12 INCHES)			6 mm (0.25 INCHES)			13 mm (0.50 INCHES)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
90	-11.3	-12.8	-14.3	-14.5	-16.0	-17.5	-18.0	-20.3	-22.5
85	-10.3	-11.8	-13.3	-12.9	-14.4	-15.9	-16.5	-18.8	-21.0
80	-9.4	-10.9	-12.4	-11.5	-13.0	-14.5	-14.9	-17.2	-19.4
75	-8.5	-10.0	-11.5	-10.1	-11.6	-13.1	-13.3	-15.6	-17.8
70	-7.6	-9.1	-10.6	-8.9	-10.4	-11.9	-11.7	-13.9	-16.2
65	-6.7	-8.2	-9.7	-7.7	-9.2	-10.7	-10.0	-12.2	-14.5
60	-5.8	-7.3	-8.8	-6.6	-8.1	-9.6	-8.3	-10.6	-12.8
55	-4.9	-6.4	-7.9	-5.5	-7.0	-8.5	-6.7	-9.0	-11.2
50	-3.9	-5.4	-6.9	-4.3	-5.8	-7.3	-5.2	-7.5	-9.7
45	-2.8	-4.3	-5.8	-3.1	-4.6	-6.1	-3.8	-6.0	-8.3
40	-1.7	-3.2	-4.7	-1.8	-3.3	-4.8	-2.5	-4.7	-7.0

V1(MCG) Limit Weight (1000 KG)

ADJUSTED FIELD LENGTH (M)	SLUSH/STANDING WATER DEPTH								
	3 mm (0.12 INCHES)			6 mm (0.25 INCHES)			13 mm (0.50 INCHES)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
1200	34.3			37.1			41.9		
1400	54.3	34.5		57.1	37.2		61.5	42.1	
1600	76.6	54.5	34.7	79.1	57.3	37.4	81.5	61.7	42.3
1800		76.8	54.7		79.4	57.5		81.7	61.9
2000			77.1			79.6			81.9

1. **Enter Weight Adjustment table with slush/standing water depth and 24K Derate dry field/obstacle limit weight to obtain slush/standing water weight adjustment.**
2. **Adjust field length available by -25 m/+25 m for every 5°C above/below 4°C.**
3. **Find V1(MCG) limit weight for adjusted field length and pressure altitude.**
4. **Max allowable slush/standing water limited weight is lesser of weights from 1 and 3.**

V1 Adjustment (KIAS)

WEIGHT (1000 KG)	SLUSH/STANDING WATER DEPTH								
	3 mm (0.12 INCHES)			6 mm (0.25 INCHES)			13 mm (0.50 INCHES)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
90	-11	-6	-1	-3	0	0	0	0	0
85	-13	-8	-3	-5	0	0	0	0	0
80	-15	-10	-5	-8	-3	0	0	0	0
75	-17	-12	-7	-11	-6	-1	0	0	0
70	-18	-13	-8	-13	-8	-3	-3	0	0
65	-20	-15	-10	-15	-10	-5	-6	-1	0
60	-21	-16	-11	-17	-12	-7	-9	-4	0
55	-22	-17	-12	-19	-14	-9	-12	-7	-2
50	-23	-18	-13	-21	-16	-11	-15	-10	-5
45	-24	-19	-14	-23	-18	-13	-18	-13	-8
40	-25	-20	-15	-24	-19	-14	-21	-16	-11

1. **Obtain V1, VR and V2 for the actual weight using the 24K Derate Dry Runway Takeoff Speeds table.**
2. **If V1(MCG) limited, set V1 = V1(MCG). If not V1(MCG) limited, enter V1 Adjustment table with the actual weight to obtain V1 speed adjustment. If adjusted V1 is less than V1(MCG), set V1 = V1(MCG). V1 not to exceed VR.**

ADVISORY INFORMATION

Slush/Standing Water Takeoff (24K Derate)

No Reverse Thrust

Weight Adjustments (1000 KG)

24K DERATE DRY FIELD/OBSTACLE LIMIT WEIGHT (1000 KG)	SLUSH/STANDING WATER DEPTH								
	3 mm (0.12 INCHES)			6 mm (0.25 INCHES)			13 mm (0.50 INCHES)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
90	-15.0	-17.2	-19.5	-18.3	-20.6	-22.8	-23.6	-26.6	-29.6
85	-13.7	-15.9	-18.2	-16.3	-18.6	-20.8	-20.9	-23.9	-26.9
80	-12.4	-14.7	-16.9	-14.6	-16.8	-19.1	-18.5	-21.5	-24.5
75	-11.3	-13.6	-15.8	-13.0	-15.2	-17.5	-16.3	-19.3	-22.3
70	-10.3	-12.5	-14.8	-11.6	-13.8	-16.1	-14.3	-17.3	-20.3
65	-9.3	-11.5	-13.8	-10.3	-12.5	-14.8	-12.5	-15.5	-18.5
60	-8.2	-10.5	-12.7	-9.0	-11.3	-13.5	-10.8	-13.8	-16.8
55	-7.1	-9.4	-11.6	-7.8	-10.0	-12.3	-9.1	-12.1	-15.1
50	-6.0	-8.2	-10.5	-6.4	-8.7	-10.9	-7.4	-10.4	-13.4
45	-4.7	-6.9	-9.2	-5.0	-7.3	-9.5	-5.6	-8.6	-11.6
40	-3.2	-5.5	-7.7	-3.4	-5.7	-7.9	-3.8	-6.8	-9.8

V1(MCG) Limit Weight (1000 KG)

ADJUSTED FIELD LENGTH (M)	SLUSH/STANDING WATER DEPTH								
	3 mm (.12 INCHES)			6 mm (.25 INCHES)			13 mm (.50 INCHES)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
1600							41.5		
1800	35.6			50.3			67.3	38.0	
2000	72.3	30.4		82.4	45.8		88.8	63.6	34.6
2200		67.1			77.6	41.2		86.1	59.9
2400			61.9			72.9			83.3
2600			97.1						

1. **Enter Weight Adjustment table with slush/standing water depth and 24K Derate dry field/obstacle limit weight to obtain slush/standing water weight adjustment.**
2. **Adjust field length available by -40 m/+40 m for every 5°C above/below 4°C.**
3. **Find V1(MCG) limit weight for adjusted field length and pressure altitude.**
4. **Max allowable slush/standing water limited weight is lesser of weights from 1 and 3.**

V1 Adjustment (KIAS)

WEIGHT (1000 KG)	SLUSH/STANDING WATER DEPTH								
	3 mm (0.12 INCHES)			6 mm (0.25 INCHES)			13 mm (0.50 INCHES)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
90	-18	-8	0	-5	0	0	0	0	0
85	-20	-10	0	-9	0	0	0	0	0
80	-23	-13	-3	-13	-3	0	0	0	0
75	-25	-15	-5	-16	-6	0	0	0	0
70	-28	-18	-8	-20	-10	0	-4	0	0
65	-30	-20	-10	-24	-14	-4	-9	0	0
60	-32	-22	-12	-27	-17	-7	-14	-4	0
55	-34	-24	-14	-30	-20	-10	-19	-9	0
50	-36	-26	-16	-33	-23	-13	-25	-15	-5
45	-38	-28	-18	-36	-26	-16	-29	-19	-9
40	-40	-30	-20	-38	-28	-18	-34	-24	-14

1. **Obtain V1, VR and V2 for the actual weight using the 24K Derate Dry Runway Takeoff Speeds table.**
2. **If V1(MCG) limited, set V1 = V1(MCG). If not V1(MCG) limited, enter V1 Adjustment table with the actual weight to obtain V1 speed adjustment. If adjusted V1 is less than V1(MCG), set V1 = V1(MCG). V1 not to exceed VR.**

ADVISORY INFORMATION

Slippery Runway Takeoff (24K Derate)
Maximum Reverse Thrust
Weight Adjustment (1000 KG)

24K DERATE DRY FIELD/OBSTACLE LIMIT WEIGHT (1000 KG)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
90	-0.2	-0.9	-1.7	-5.1	-5.9	-6.6	-9.8	-10.5	-11.3
85	-0.5	-1.3	-2.0	-5.2	-6.0	-6.7	-9.6	-10.4	-11.1
80	-0.9	-1.6	-2.4	-5.3	-6.1	-6.8	-9.4	-10.2	-10.9
75	-1.1	-1.9	-2.6	-5.4	-6.1	-6.9	-9.1	-9.9	-10.6
70	-1.2	-2.0	-2.7	-5.2	-6.0	-6.7	-8.6	-9.4	-10.1
65	-1.2	-2.0	-2.7	-5.0	-5.7	-6.5	-8.1	-8.8	-9.6
60	-1.1	-1.9	-2.6	-4.6	-5.3	-6.1	-7.3	-8.1	-8.8
55	-0.9	-1.6	-2.4	-4.0	-4.8	-5.5	-6.5	-7.3	-8.0
50	-0.6	-1.3	-2.1	-3.4	-4.1	-4.9	-5.5	-6.3	-7.0
45	-0.1	-0.9	-1.6	-2.6	-3.4	-4.1	-4.5	-5.2	-6.0
40	0.0	-0.3	-1.1	-1.7	-2.5	-3.2	-3.2	-4.0	-4.7

V1(MCG) Limit Weight (1000 KG)

ADJUSTED FIELD LENGTH (M)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
1000	49.1								
1200	80.9	51.9		34.2					
1400		83.5	54.7	56.7	31.0				
1600			86.1	81.3	53.4		36.8		
1800					77.6	50.1	50.7		
2000						74.0	66.1	43.3	
2200							83.5	57.8	36.1
2400								74.0	50.0
2600								92.6	65.3
2800									82.6

1. **Enter Weight Adjustment table with reported braking action and 24K Derate dry field/obstacle limit weight to obtain slippery runway weight adjustment.**
2. **Adjust "Good" field length available by -20 m/+20 m for every 5°C above/below 4°C.**
   Adjust "Medium" field length available by -20 m/+20 m for every 5°C above/below 4°C.
   Adjust "Poor" field length available by -35 m/+35 m for every 5°C above/below 4°C.
3. **Find V1(MCG) limit weight for adjusted field length and pressure altitude.**
4. **Max allowable slippery runway limited weight is lesser of weights from 1 and 3.**

ADVISORY INFORMATION

Slippery Runway Takeoff (24K Derate)
Maximum Reverse Thrust
V1 Adjustment (KIAS)

WEIGHT (1000 KG)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
90	-4	0	0	-11	-6	-1	-21	-16	-11
85	-5	0	0	-13	-8	-3	-23	-18	-13
80	-6	-1	0	-15	-10	-5	-26	-21	-16
75	-7	-2	0	-16	-11	-6	-28	-23	-18
70	-8	-3	0	-18	-13	-8	-30	-25	-20
65	-9	-4	0	-20	-15	-10	-33	-28	-23
60	-10	-5	0	-21	-16	-11	-35	-30	-25
55	-11	-6	-1	-23	-18	-13	-37	-32	-27
50	-12	-7	-2	-25	-20	-15	-39	-34	-29
45	-13	-8	-3	-26	-21	-16	-40	-35	-30
40	-14	-9	-4	-28	-23	-18	-42	-37	-32

1. **Obtain V1, VR and V2 for the actual weight using the 24K Derate Dry Runway Takeoff Speeds table.**
2. **If V1(MCG) limited, set V1 = V1(MCG). If not V1(MCG) limited, enter V1 Adjustment table with the actual weight to obtain V1 speed adjustment. If adjusted V1 is less than V1(MCG), set V1 = V1(MCG). V1 not to exceed VR.**

ADVISORY INFORMATION

Slippery Runway Takeoff (24K Derate)

No Reverse Thrust

Weight Adjustments (1000 KG)

24K DERATE DRY FIELD/OBSTACLE LIMIT WEIGHT (1000 KG)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
90	-1.2	-1.9	-2.6	-7.6	-8.3	-9.0	-13.8	-14.5	-15.2
85	-1.7	-2.4	-3.1	-7.8	-8.5	-9.2	-13.5	-14.2	-14.9
80	-2.1	-2.8	-3.5	-7.9	-8.6	-9.3	-13.1	-13.8	-14.5
75	-2.4	-3.1	-3.8	-7.9	-8.6	-9.3	-12.6	-13.3	-14.0
70	-2.6	-3.3	-4.0	-7.8	-8.5	-9.2	-12.0	-12.7	-13.4
65	-2.6	-3.3	-4.0	-7.4	-8.1	-8.8	-11.2	-11.9	-12.6
60	-2.6	-3.3	-4.0	-7.0	-7.7	-8.4	-10.3	-11.0	-11.7
55	-2.4	-3.1	-3.8	-6.4	-7.1	-7.8	-9.2	-9.9	-10.6
50	-2.0	-2.7	-3.4	-5.6	-6.3	-7.0	-8.0	-8.7	-9.4
45	-1.6	-2.3	-3.0	-4.7	-5.4	-6.1	-6.7	-7.4	-8.1
40	-1.0	-1.7	-2.4	-3.6	-4.3	-5.0	-5.2	-5.9	-6.6

V1(MCG) Limit Weight (1000 KG)

ADJUSTED FIELD LENGTH (M)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
1200	61.8								
1400	97.3	68.6							
1600			74.8						
1800				63.1					
2000					56.8				
2200					96.3	50.2			
2400						91.0			
2800							59.0		
3000							91.0	33.8	
3200								67.1	
3400								98.8	42.2
3600									75.0

1. **Enter Weight Adjustment table with reported braking action and 24K Derate dry field/obstacle limit weight to obtain slippery runway weight adjustment.**
2. **Adjust "Good" field length available by -25 m/+25 m for every 5°C above/below 4°C.**
   Adjust "Medium" field length available by -25 m/+25 m for every 5°C above/below 4°C.
   Adjust "Poor" field length available by -45 m/+45 m for every 5°C above/below 4°C.
3. **Find V1(MCG) limit weight for adjusted field length and pressure altitude.**
4. **Max allowable slippery runway limited weight is lesser of weights from 1 and 3.**

ADVISORY INFORMATION

Slippery Runway Takeoff (24K Derate)
No Reverse Thrust
V1 Adjustment (KIAS)

WEIGHT (1000 KG)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
90	-6	-1	0	-16	-11	-6	-32	-27	-22
85	-7	-2	0	-18	-13	-8	-36	-31	-26
80	-8	-3	0	-20	-15	-10	-39	-34	-29
75	-9	-4	0	-23	-18	-13	-43	-38	-33
70	-11	-6	-1	-26	-21	-16	-47	-42	-37
65	-13	-8	-3	-28	-23	-18	-51	-46	-41
60	-14	-9	-4	-31	-26	-21	-55	-50	-45
55	-16	-11	-6	-34	-29	-24	-59	-54	-49
50	-18	-13	-8	-37	-32	-27	-63	-58	-53
45	-20	-15	-10	-41	-36	-31	-67	-62	-57
40	-22	-17	-12	-44	-39	-34	-71	-66	-61

1. **Obtain V1, VR and V2 for the actual weight using the 24K Derate Dry Runway Takeoff Speeds table.**
2. **If V1(MCG) limited, set V1 = V1(MCG). If not V1(MCG) limited, enter V1 Adjustment table with the actual weight to obtain V1 speed adjustment. If adjusted V1 is less than V1(MCG), set V1 = V1(MCG). V1 not to exceed VR.**

Takeoff %N1 - (24K Derate)

Based on engine bleeds for packs on, engine and wing anti-ice on or off

OAT (°C)	AIRPORT PRESSURE ALTITUDE (FT)												
	-2000	-1000	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
60	90.3	90.8	91.2	91.2	91.1	91.1	91.0	91.1	91.2	91.0	91.2	91.3	91.4
55	91.0	91.6	92.0	92.0	92.0	91.9	91.9	91.9	92.0	91.9	91.7	91.3	90.8
50	91.8	92.4	92.8	92.8	92.8	92.7	92.7	92.7	92.7	92.6	92.6	92.2	91.8
45	92.6	93.2	93.6	93.6	93.6	93.6	93.5	93.5	93.5	93.4	93.3	93.1	92.8
40	93.4	94.0	94.4	94.4	94.4	94.3	94.3	94.2	94.2	94.1	94.1	94.0	93.8
35	94.2	94.8	95.2	95.2	95.2	95.1	95.1	95.0	95.0	94.9	94.8	94.8	94.7
30	93.8	95.0	96.1	96.0	96.0	96.0	95.9	95.8	95.8	95.7	95.7	95.6	95.6
25	93.1	94.3	95.4	95.9	96.4	96.7	96.7	96.6	96.6	96.5	96.4	96.4	96.3
20	92.3	93.5	94.6	95.1	95.7	96.3	96.9	97.6	97.5	97.5	97.4	97.3	97.2
15	91.6	92.7	93.8	94.3	94.9	95.5	96.1	96.8	97.5	98.2	98.6	98.6	98.5
10	90.8	92.0	93.0	93.6	94.1	94.7	95.3	96.0	96.7	97.5	98.2	99.1	100.0
5	90.0	91.2	92.2	92.8	93.3	93.9	94.5	95.2	95.9	96.7	97.4	98.4	99.3
0	89.2	90.4	91.4	92.0	92.5	93.1	93.7	94.4	95.1	95.9	96.7	97.6	98.5
-5	88.4	89.6	90.6	91.2	91.7	92.3	92.9	93.6	94.3	95.1	95.9	96.8	97.7
-10	87.6	88.8	89.8	90.4	90.9	91.5	92.1	92.8	93.5	94.3	95.1	96.1	97.0
-15	86.8	88.0	89.0	89.5	90.0	90.6	91.3	92.0	92.7	93.5	94.3	95.3	96.2
-20	86.0	87.1	88.2	88.7	89.2	89.8	90.5	91.2	91.9	92.6	93.5	94.5	95.4
-25	85.2	86.3	87.3	87.9	88.4	89.0	89.6	90.3	91.0	91.8	92.6	93.7	94.6
-30	84.4	85.5	86.5	87.0	87.5	88.1	88.8	89.5	90.2	91.0	91.8	92.9	93.8
-35	83.5	84.6	85.6	86.2	86.6	87.3	87.9	88.6	89.3	90.1	91.0	92.1	93.0
-40	82.7	83.8	84.8	85.3	85.8	86.4	87.0	87.8	88.5	89.3	90.1	91.2	92.2
-45	81.8	82.9	83.9	84.4	84.9	85.5	86.2	86.9	87.6	88.4	89.3	90.4	91.4
-50	81.0	82.0	83.0	83.5	84.0	84.6	85.3	86.0	86.7	87.5	88.4	89.5	90.5

%N1 Adjustments for Engine Bleeds

BLEED CONFIGURATION	AIRPORT PRESSURE ALTITUDE (FT)												
	-2000	-1000	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
PACKS OFF	0.7	0.7	0.7	0.7	0.7	0.7	0.8	0.8	0.8	0.8	0.8	0.9	1.0

Assumed Temperature Reduced Thrust (24K Derate)

Maximum Assumed Temperature (Table 1 of 3)

Based on 25% Takeoff Thrust Reduction

OAT (°C)	AIRPORT PRESSURE ALTITUDE (FT)											
	-1000	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
55	73	71	69	67								
50	73	71	69	67	65	63						
45	73	71	69	67	65	63	61	59	57			
40	73	71	69	67	65	63	61	59	57	55		
35	67	67	67	67	65	63	61	59	57	55	53	
30	64	61	62	61	61	61	61	59	57	55	53	51
25	64	61	59	57	56	56	57	57	57	55	53	51
20	64	61	59	57	56	54	53	53	53	53	52	51
15	64	61	59	57	56	54	53	52	50	49	48	47
10 & BELOW	64	61	59	57	56	54	53	52	50	48	45	43

Takeoff %N1 (Table 2 of 3)

Based on engine bleed for packs on, engine and wing anti-ice on or off

ASSUMED TEMP (°C)	AIRPORT PRESSURE ALTITUDE (FT)											
	-1000	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
75	88.3	88.6	89.1	89.6	90.2	90.8	91.5	92.2	92.7	93.1	93.3	93.4
70	89.1	89.5	89.4	89.3	89.6	90.1	90.8	91.6	92.0	92.5	92.6	92.7
65	90.0	90.4	90.3	90.2	90.2	90.1	90.2	90.9	91.4	91.8	91.9	92.1
60	90.8	91.2	91.2	91.1	91.1	91.0	91.1	91.2	91.0	91.2	91.3	91.4
55	91.6	92.0	92.0	92.0	91.9	91.9	91.9	92.0	91.9	91.7	91.3	90.8
50	92.4	92.8	92.8	92.8	92.7	92.7	92.7	92.7	92.6	92.6	92.2	91.8
45	93.2	93.6	93.6	93.6	93.6	93.5	93.5	93.5	93.4	93.3	93.1	92.8
40	94.0	94.4	94.4	94.4	94.3	94.3	94.2	94.2	94.1	94.1	94.0	93.8
35	94.8	95.2	95.2	95.2	95.1	95.1	95.0	95.0	94.9	94.8	94.8	94.7
30	95.0	96.1	96.0	96.0	96.0	95.9	95.8	95.8	95.7	95.7	95.6	95.6
25	94.3	95.4	95.9	96.4	96.7	96.7	96.6	96.6	96.5	96.4	96.4	96.3
20	93.5	94.6	95.1	95.7	96.3	96.9	97.6	97.5	97.5	97.4	97.3	97.2
15	92.7	93.8	94.3	94.9	95.5	96.1	96.8	97.5	98.2	98.6	98.6	98.5
10	92.0	93.0	93.6	94.1	94.7	95.3	96.0	96.7	97.5	98.2	99.1	100.0
MINIMUM ASSUMED TEMP (°C)	32	30	28	26	24	22	20	18	16	15	12	10

With engine bleed for packs off, increase %N1 by 1.0

Assumed Temperature Reduced Thrust (24K Derate)
%N1 Adjustment for Temperature Difference (Table 3 of 3)

ASSUMED TEMP MINUS OAT (°C)	OUTSIDE AIR TEMPERATURE (°C)													
	-40	-20	0	5	10	15	20	25	30	35	40	45	50	55
110	12.1													
100	11.3	8.5												
90	11.7	8.9												
80	12.5	8.0	5.5											
70	11.3	8.4	5.9	5.6	4.0									
60	9.7	9.2	4.8	4.7	4.4	4.2	2.6							
50	7.8	7.9	5.3	3.5	3.3	3.6	3.0	2.7	1.2					
40		6.4	6.0	5.5	3.7	3.2	3.7	3.0	2.8	3.0	3.7			
30		4.6	4.6	4.6	4.5	4.3	4.2	4.0	4.1	4.0	3.9	3.8	3.7	
20			3.1	3.1	3.1	3.0	2.9	2.9	2.8	2.7	2.7	2.6	2.6	2.5
10			1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.4	1.4	1.4	1.3	1.3
0			0	0	0	0	0	0	0	0	0	0	0	0

1. **Determine Maximum Assumed Temperature allowed from Table 1.**
2. **Find Maximum %N1 from Table 2 using the desired assumed temperature (no greater than temperature from Table 1).**
3. **Use the difference between assumed temperature and OAT to determine the %N1 adjustment from Table 3.**
4. **Subtract %N1 adjustment from Maximum %N1 in Table 2.**

Takeoff Speeds - Dry Runway (22K Derate)

V1, VR, V2

WEIGHT (1000 KG)	FLAPS1			FLAPS5			FLAPS 10			FLAPS 15			FLAPS 25		
	V1	VR	V2	V1	VR	V2	V1	VR	V2	V1	VR	V2	V1	VR	V2
80	167	167	171	159	159	163									
75	161	161	166	153	154	159	145	145	150	142	143	148			
70	155	155	161	148	148	154	139	140	146	138	138	144	134	134	140
65	149	149	156	141	142	149	134	134	141	132	132	139	129	129	136
60	142	142	150	135	135	144	127	128	136	126	126	134	123	123	131
55	134	135	144	128	128	138	121	121	131	119	120	129	116	117	125
50	127	127	138	121	121	132	114	115	125	113	113	123	110	110	120
45	119	119	132	113	113	126	107	107	119	106	106	118	103	103	114
40	111	111	125	105	105	119	99	99	113	98	98	112	95	96	108

Check V1(MCG).

V1, VR, V2 Adjustments*

TEMP		V1							VR							V2						
		PRESS ALT (1000 FT)							PRESS ALT (1000 FT)							PRESS ALT (1000 FT)						
°C	°F	-2	0	2	4	6	8	10	-2	0	2	4	6	8	10	-2	0	2	4	6	8	10
70	158	4	5						4	5						-2	-2					
60	140	3	4	4	5				3	4	5	5				-2	-2	-2	-2			
50	122	2	3	3	4	5	6	7	2	3	4	4	5	6	7	-1	-1	-2	-2	-2	-3	-3
40	104	1	1	2	3	4	5	6	1	1	2	3	4	5	6	0	-1	-1	-1	-2	-2	-2
30	86	0	0	1	2	3	4	5	0	0	1	2	3	4	5	0	0	0	-1	-1	-2	-2
20	68	0	0	0	1	2	3	4	0	0	1	1	2	3	4	0	0	0	0	-1	-1	-2
-60	-76	0	0	0	1	1	2	3	0	0	1	1	2	2	3	0	0	0	0	-1	-1	-1

Slope and Wind V1 Adjustments*

WEIGHT (1000 KG)	SLOPE (%)					WIND (KTS)							
	-2	-1	0	1	2	-15	-10	-5	0	10	20	30	40
80	-3	-2	0	0	0	-1	-1	0	0	0	0	0	0
70	-2	-1	0	0	0	-1	-1	0	0	0	0	0	0
60	-1	0	0	0	0	-1	-1	0	0	0	0	0	0
50	0	0	0	0	0	-1	0	0	0	0	0	0	0
40	0	0	0	0	0	0	0	0	0	0	0	0	0

***V1 not to exceed VR.**

V1(MCG)

TEMP		PRESSURE ALTITUDE (FT)						
°C	°F	-2000	0	2000	4000	6000	8000	10000
70	158	85	83					
60	140	85	83	82	80			
50	122	87	85	82	80	78	76	74
40	104	91	89	86	83	80	76	74
30	86	94	94	90	87	83	79	76
20	68	94	94	92	90	87	83	80
-60	-76	96	95	93	92	89	87	84

Takeoff Speeds - Wet Runway (22K Derate)

V1, VR, V2

WEIGHT	FLAPS1			FLAPS5			FLAPS 10			FLAPS 15			FLAPS 25		
(1000 KG)	V1	VR	V2	V1	VR	V2	V1	VR	V2	V1	VR	V2	V1	VR	V2
80	162	167	171	154	159	163									
75	156	161	166	148	154	159	139	145	150	139	143	148			
70	149	155	161	141	148	154	133	140	146	132	138	144	128	134	140
65	142	149	156	135	142	149	127	134	141	126	132	139	122	129	136
60	135	142	150	128	135	144	121	128	136	119	126	134	116	123	131
55	127	135	144	121	128	138	114	121	131	113	120	129	109	117	125
50	119	127	138	113	121	132	107	115	125	106	113	123	103	110	120
45	111	119	132	106	113	126	100	107	119	98	106	118	96	103	114
40	103	111	125	98	105	119	92	99	113	91	98	112	88	96	108

Check V1(MCG).

V1, VR, V2 Adjustments*

TEMP		V1							VR							V2						
		PRESS ALT (1000 FT)							PRESS ALT (1000 FT)							PRESS ALT (1000 FT)						
°C	°F	-2	0	2	4	6	8	10	-2	0	2	4	6	8	10	-2	0	2	4	6	8	10
70	158	7	8						4	5						-2	-2					
60	140	5	6	7	8				3	4	5	5				-2	-2	-2	-2			
50	122	3	4	5	6	7	9	12	2	3	4	4	5	6	7	-1	-1	-2	-2	-2	-3	-3
40	104	1	2	3	4	5	7	9	1	1	2	3	4	5	6	0	-1	-1	-1	-2	-2	-2
30	86	0	0	1	2	3	5	7	0	0	1	2	3	4	5	0	0	0	-1	-1	-2	-2
20	68	0	0	0	1	2	3	5	0	0	1	1	2	3	4	0	0	0	0	-1	-1	-2
-60	-76	0	0	0	1	2	2	3	0	0	1	1	2	2	3	0	0	0	0	-1	-1	-1

Slope and Wind V1 Adjustments*

WEIGHT	SLOPE (%)					WIND (KTS)							
(1000 KG)	-2	-1	0	1	2	-15	-10	-5	0	10	20	30	40
80	-5	-2	0	3	6	-3	-2	-1	0	1	1	2	2
70	-4	-2	0	2	5	-3	-2	-1	0	1	1	2	2
60	-3	-2	0	2	4	-3	-2	-1	0	1	1	2	3
50	-2	-1	0	1	3	-4	-3	-1	0	1	2	2	3
40	-2	-1	0	1	2	-5	-3	-1	0	1	2	3	3

***V1 not to exceed VR.**

V1(MCG)

TEMP		PRESSURE ALTITUDE (FT)						
°C	°F	-2000	0	2000	4000	6000	8000	10000
70	158	85	83					
60	140	85	83	82	80			
50	122	87	85	82	80	78	76	74
40	104	91	89	86	83	80	76	74
30	86	94	94	90	87	83	79	76
20	68	94	94	92	90	87	83	80
-60	-76	96	95	93	92	89	87	84

Stab Trim Setting (22K Derate)

Flaps 1 and 5

WEIGHT (1000 KG)	C.G. (%MAC)										
	6	8	9	20	25	26	28	30	32	34	36
85	8 1/2	8 1/2	8 1/2	6 3/4	6	5 3/4	5 1/2	5 1/4	4 3/4	4 1/2	4 1/4
80	8 1/2	8 1/2	8 1/4	6 1/2	5 3/4	5 1/2	5 1/4	5	4 3/4	4 1/4	4
70	8 1/4	8	7 3/4	6 1/4	5 1/2	5 1/4	5	4 3/4	4 1/4	4	3 3/4
60	7 3/4	7 1/2	7 1/4	5 3/4	5	5	4 1/2	4 1/4	4	3 3/4	3 1/2
50	7	6 3/4	6 3/4	5 1/4	4 1/2	4 1/2	4 1/4	4	3 1/2	3 1/4	3
40	6 3/4	6 1/2	6 1/4	5	4 1/4	4 1/4	4	3 1/2	3 1/4	3	2 3/4

Flaps 10, 15 and 25

WEIGHT (1000 KG)	C.G. (%MAC)										
	6	8	9	20	25	26	28	30	32	34	36
85	8 1/2	8 1/4	8	6	5 1/4	5	4 3/4	4 1/2	4	3 3/4	3 1/2
80	8 1/2	8	8	6	5	5	4 1/2	4 1/4	3 3/4	3 1/2	3 1/4
70	8	7 1/2	7 1/2	5 1/2	4 1/2	4 1/2	4	3 3/4	3 1/2	3	2 3/4
60	7 1/4	7	6 3/4	5	4	4	3 1/2	3 1/4	3	2 3/4	2 3/4
50	6 3/4	6 1/4	6 1/4	4 1/2	3 1/2	3 1/2	3 1/4	2 3/4	2 3/4	2 3/4	2 3/4
40	6 1/2	6	6	4 1/4	3 1/2	3 1/4	3	2 3/4	2 3/4	2 3/4	2 3/4

ADVISORY INFORMATION

Slush/Standing Water Takeoff (22K Derate)

Maximum Reverse Thrust

Weight Adjustments (1000 KG)

22K DERATE DRY FIELD/OBSTACLE LIMIT WEIGHT (1000 KG)	SLUSH/STANDING WATER DEPTH								
	3 mm (0.12 INCHES)			6 mm (0.25 INCHES)			13 mm (0.50 INCHES)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
90	-11.5	-13.0	-14.5	-15.0	-16.5	-18.0	-20.1	-22.4	-24.6
85	-10.6	-12.1	-13.6	-13.5	-15.0	-16.5	-18.1	-20.3	-22.6
80	-9.7	-11.2	-12.7	-12.1	-13.6	-15.1	-16.1	-18.3	-20.6
75	-8.8	-10.3	-11.8	-10.7	-12.2	-13.7	-14.2	-16.4	-18.7
70	-7.8	-9.3	-10.8	-9.3	-10.8	-12.3	-12.3	-14.5	-16.8
65	-6.9	-8.4	-9.9	-8.0	-9.5	-11.0	-10.5	-12.8	-15.0
60	-5.9	-7.4	-8.9	-6.8	-8.3	-9.8	-8.8	-11.0	-13.3
55	-4.9	-6.4	-7.9	-5.6	-7.1	-8.6	-7.1	-9.4	-11.6
50	-4.0	-5.5	-7.0	-4.4	-5.9	-7.4	-5.5	-7.8	-10.0
45	-3.0	-4.5	-6.0	-3.3	-4.8	-6.3	-4.0	-6.3	-8.5
40	-2.0	-3.5	-5.0	-2.2	-3.7	-5.2	-2.6	-4.8	-7.1

V1(MCG) Limit Weight (1000 KG)

ADJUSTED FIELD LENGTH (M)	SLUSH/STANDING WATER DEPTH								
	3 mm (0.12 INCHES)			6 mm (0.25 INCHES)			13 mm (0.50 INCHES)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
1200	39.6			42.3			46.7		
1400	61.3	39.8		63.7	42.5		66.9	46.9	
1600	84.8	61.6	40.0	87.0	63.9	42.7	86.8	67.1	47.1
1800		85.0	61.8		87.2	64.1		87.0	67.3
2000			85.3			87.4			87.2

1. **Enter Weight Adjustment table with slush/standing water depth and 22K Derate dry field/obstacle limit weight to obtain slush/standing water weight adjustment.**
2. **Adjust field length available by -25 m/+25 m for every 5°C above/below 4°C.**
3. **Find V1(MCG) limit weight for adjusted field length and pressure altitude.**
4. **Max allowable slush/standing water limited weight is lesser of weights from 1 and 3.**

V1 Adjustment (KIAS)

WEIGHT (1000 KG)	SLUSH/STANDING WATER DEPTH								
	3 mm (0.12 INCHES)			6 mm (0.25 INCHES)			13 mm (0.50 INCHES)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
90	-8	-3	0	0	0	0	0	0	0
85	-10	-5	0	-2	0	0	0	0	0
80	-12	-7	-2	-5	0	0	0	0	0
75	-14	-9	-4	-8	-3	0	0	0	0
70	-16	-11	-6	-11	-6	-1	0	0	0
65	-18	-13	-8	-13	-8	-3	-3	0	0
60	-19	-14	-9	-15	-10	-5	-6	-1	0
55	-21	-16	-11	-17	-12	-7	-10	-5	0
50	-22	-17	-12	-19	-14	-9	-13	-8	-3
45	-23	-18	-13	-21	-16	-11	-16	-11	-6
40	-24	-19	-14	-23	-18	-13	-19	-14	-9

1. **Obtain V1, VR and V2 for the actual weight using the 22K Derate Dry Runway Takeoff Speeds table.**
2. **If V1(MCG) limited, set V1 = V1(MCG). If not V1(MCG) limited, enter V1 Adjustment table with the actual weight to obtain V1 speed adjustment. If adjusted V1 is less than V1(MCG), set V1 = V1(MCG). V1 not to exceed VR.**

ADVISORY INFORMATION

Slush/Standing Water Takeoff (22K Derate)

No Reverse Thrust

Weight Adjustments (1000 KG)

22K DERATE DRY FIELD/OBSTACLE LIMIT WEIGHT (1000 KG)	SLUSH/STANDING WATER DEPTH								
	3 mm (0.12 INCHES)			6 mm (0.25 INCHES)			13 mm (0.50 INCHES)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
90	-15.1	-17.4	-19.6	-18.9	-21.1	-23.4	-26.2	-28.9	-31.7
85	-14.0	-16.2	-18.5	-17.0	-19.3	-21.5	-23.1	-25.9	-28.6
80	-12.8	-15.0	-17.3	-15.2	-17.5	-19.7	-20.2	-23.0	-25.7
75	-11.6	-13.9	-16.1	-13.5	-15.8	-18.0	-17.6	-20.3	-23.1
70	-10.5	-12.7	-15.0	-12.0	-14.2	-16.5	-15.1	-17.9	-20.6
65	-9.4	-11.6	-13.9	-10.5	-12.7	-15.0	-13.0	-15.7	-18.5
60	-8.3	-10.5	-12.8	-9.1	-11.4	-13.6	-11.0	-13.7	-16.5
55	-7.2	-9.4	-11.7	-7.8	-10.1	-12.3	-9.3	-12.0	-14.8
50	-6.1	-8.3	-10.6	-6.7	-8.9	-11.2	-7.8	-10.6	-13.3
45	-5.0	-7.3	-9.5	-5.6	-7.9	-10.1	-6.6	-9.3	-12.1
40	-4.0	-6.2	-8.5	-4.6	-6.9	-9.1	-5.5	-8.3	-11.0

V1(MCG) Limit Weight (1000 KG)

ADJUSTED FIELD LENGTH (M)	SLUSH/STANDING WATER DEPTH								
	3 mm (.12 INCHES)			6 mm (.25 INCHES)			13 mm (.50 INCHES)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
1600				34.3			52.6		
1800	57.1			67.5			78.6	46.6	
2000	93.8	48.7			60.1			73.0	40.5
2200		85.9	40.1		94.2	52.7		97.7	67.4
2400			77.9			86.6			92.4

1. **Enter Weight Adjustment table with slush/standing water depth and 22K Derate dry field/obstacle limit weight to obtain slush/standing water weight adjustment.**
2. **Adjust field length available by -30 m/+30 m for every 5°C above/below 4°C.**
3. **Find V1(MCG) limit weight for adjusted field length and pressure altitude.**
4. **Max allowable slush/standing water limited weight is lesser of weights from 1 and 3.**

V1 Adjustment (KIAS)

WEIGHT (1000 KG)	SLUSH/STANDING WATER DEPTH								
	3 mm (0.12 INCHES)			6 mm (0.25 INCHES)			13 mm (0.50 INCHES)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
90	-12	-2	0	0	0	0	0	0	0
85	-15	-5	0	-4	0	0	0	0	0
80	-18	-8	0	-8	0	0	0	0	0
75	-21	-11	-1	-12	-2	0	0	0	0
70	-24	-14	-4	-16	-6	0	0	0	0
65	-27	-17	-7	-20	-10	0	-4	0	0
60	-29	-19	-9	-23	-13	-3	-10	0	0
55	-32	-22	-12	-27	-17	-7	-15	-5	0
50	-34	-24	-14	-30	-20	-10	-20	-10	0
45	-36	-26	-16	-33	-23	-13	-26	-16	-6
40	-38	-28	-18	-36	-26	-16	-31	-21	-11

1. **Obtain V1, VR and V2 for the actual weight using the 22K Derate Dry Runway Takeoff Speeds table.**
2. **If V1(MCG) limited, set V1 = V1(MCG). If not V1(MCG) limited, enter V1 Adjustment table with the actual weight to obtain V1 speed adjustment. If adjusted V1 is less than V1(MCG), set V1 = V1(MCG). V1 not to exceed VR.**

ADVISORY INFORMATION

Slippery Runway Takeoff (22K Derate)

Maximum Reverse Thrust

Weight Adjustment (1000 KG)

22K DERATE DRY FIELD/OBSTACLE LIMIT WEIGHT (1000 KG)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
90	-0.1	-0.9	-1.6	-4.8	-5.5	-6.3	-9.4	-10.2	-10.9
85	-0.5	-1.3	-2.0	-5.0	-5.8	-6.5	-9.4	-10.1	-10.9
80	-0.8	-1.6	-2.3	-5.2	-5.9	-6.7	-9.2	-10.0	-10.7
75	-1.1	-1.8	-2.6	-5.2	-6.0	-6.7	-9.0	-9.7	-10.5
70	-1.2	-1.9	-2.7	-5.1	-5.9	-6.6	-8.6	-9.3	-10.1
65	-1.2	-1.9	-2.7	-4.9	-5.6	-6.4	-8.0	-8.8	-9.5
60	-1.1	-1.9	-2.6	-4.5	-5.3	-6.0	-7.4	-8.1	-8.9
55	-0.9	-1.6	-2.4	-4.1	-4.8	-5.6	-6.6	-7.3	-8.1
50	-0.6	-1.3	-2.1	-3.4	-4.2	-4.9	-5.7	-6.4	-7.2
45	-0.2	-0.9	-1.7	-2.7	-3.4	-4.2	-4.6	-5.3	-6.1
40	0.0	-0.4	-1.2	-1.8	-2.6	-3.3	-3.4	-4.2	-4.9

V1(MCG) Limit Weight (1000 KG)

ADJUSTED FIELD LENGTH (M)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
1000	54.8								
1200	86.6	57.5		39.3					
1400		89.2	60.3	62.8	36.1				
1600			91.9	88.3	59.3	32.9	40.7		
1800					84.5	55.9	55.6	33.2	
2000						80.8	72.1	47.6	
2200							91.0	63.2	40.0
2400								80.8	54.8
2600									71.2
2800									90.0

1. **Enter Weight Adjustment table with reported braking action and 22K Derate dry field/obstacle limit weight to obtain slippery runway weight adjustment.**
2. **Adjust “Good” field length available by -20 m/+20 m for every 5°C above/below 4°C.**
   Adjust “Medium” field length available by -20 m/+20 m for every 5°C above/below 4°C.
   Adjust “Poor” field length available by -35 m/+35 m for every 5°C above/below 4°C.
3. **Find V1(MCG) limit weight for adjusted field length and pressure altitude.**
4. **Max allowable slippery runway limited weight is lesser of weights from 1 and 3.**

ADVISORY INFORMATION

Slippery Runway Takeoff (22K Derate)
Maximum Reverse Thrust
V1 Adjustment (KIAS)

WEIGHT (1000 KG)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
90	-3	0	0	-9	-4	0	-17	-12	-7
85	-4	0	0	-11	-6	-1	-19	-14	-9
80	-5	0	0	-13	-8	-3	-22	-17	-12
75	-6	-1	0	-15	-10	-5	-25	-20	-15
70	-7	-2	0	-16	-11	-6	-28	-23	-18
65	-8	-3	0	-18	-13	-8	-30	-25	-20
60	-9	-4	0	-20	-15	-10	-32	-27	-22
55	-10	-5	0	-22	-17	-12	-34	-29	-24
50	-11	-6	-1	-23	-18	-13	-37	-32	-27
45	-13	-8	-3	-25	-20	-15	-38	-33	-28
40	-13	-8	-3	-26	-21	-16	-40	-35	-30

1. **Obtain V1, VR and V2 for the actual weight using the 22K Derate Dry Runway Takeoff Speeds table.**
2. **If V1(MCG) limited, set V1 = V1(MCG). If not V1(MCG) limited, enter V1 Adjustment table with the actual weight to obtain V1 speed adjustment. If adjusted V1 is less than V1(MCG), set V1 = V1(MCG). V1 not to exceed VR.**

ADVISORY INFORMATION

Slippery Runway Takeoff (22K Derate)
No Reverse Thrust
Weight Adjustments (1000 KG)

22K DERATE DRY FIELD/OBSTACLE LIMIT WEIGHT (1000 KG)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
90	-1.0	-1.8	-2.6	-7.0	-7.8	-8.6	-13.3	-14.1	-14.9
85	-1.5	-2.3	-3.1	-7.3	-8.1	-8.9	-13.1	-13.9	-14.7
80	-1.9	-2.7	-3.5	-7.6	-8.4	-9.2	-12.9	-13.7	-14.5
75	-2.2	-3.0	-3.8	-7.6	-8.4	-9.2	-12.5	-13.3	-14.1
70	-2.4	-3.2	-4.0	-7.5	-8.3	-9.1	-11.9	-12.7	-13.5
65	-2.5	-3.3	-4.1	-7.3	-8.1	-8.9	-11.1	-11.9	-12.7
60	-2.4	-3.2	-4.0	-6.9	-7.7	-8.5	-10.1	-10.9	-11.7
55	-2.3	-3.1	-3.9	-6.3	-7.1	-7.9	-9.0	-9.8	-10.6
50	-2.0	-2.8	-3.6	-5.6	-6.4	-7.2	-7.7	-8.5	-9.3
45	-1.6	-2.4	-3.2	-4.7	-5.5	-6.3	-6.2	-7.0	-7.8
40	-1.1	-1.9	-2.7	-3.7	-4.5	-5.3	-4.6	-5.4	-6.2

V1(MCG) Limit Weight (1000 KG)

ADJUSTED FIELD LENGTH (M)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
1200	71.3								
1400		74.5	31.4						
1600			77.7	34.5					
1800				79.2					
2000					73.8				
2200						68.1			
2600							48.0		
2800							80.8		
3000								53.7	
3200								86.1	
3400									59.5
3600									91.4

1. **Enter Weight Adjustment table with reported braking action and 22K Derate dry field/obstacle limit weight to obtain slippery runway weight adjustment.**
2. **Adjust “Good” field length available by -20 m/+20 m for every 5°C above/below 4°C.
Adjust “Medium” field length available by -20 m/+20 m for every 5°C above/below 4°C.
Adjust “Poor” field length available by -45 m/+45 m for every 5°C above/below 4°C.**
3. **Find V1(MCG) limit weight for adjusted field length and pressure altitude.**
4. **Max allowable slippery runway limited weight is lesser of weights from 1 and 3.**

ADVISORY INFORMATION

Slippery Runway Takeoff (22K Derate)
No Reverse Thrust
V1 Adjustment (KIAS)

WEIGHT (1000 KG)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
90	-4	0	0	-12	-7	-2	-26	-21	-16
85	-5	0	0	-15	-10	-5	-30	-25	-20
80	-7	-2	0	-17	-12	-7	-34	-29	-24
75	-8	-3	0	-20	-15	-10	-38	-33	-28
70	-10	-5	0	-23	-18	-13	-42	-37	-32
65	-11	-6	-1	-26	-21	-16	-47	-42	-37
60	-13	-8	-3	-29	-24	-19	-51	-46	-41
55	-15	-10	-5	-32	-27	-22	-55	-50	-45
50	-17	-12	-7	-35	-30	-25	-59	-54	-49
45	-18	-13	-8	-38	-33	-28	-63	-58	-53
40	-20	-15	-10	-41	-36	-31	-67	-62	-57

1. **Obtain V1, VR and V2 for the actual weight using the 22K Derate Dry Runway Takeoff Speeds table.**
2. **If V1(MCG) limited, set V1 = V1(MCG). If not V1(MCG) limited, enter V1 Adjustment table with the actual weight to obtain V1 speed adjustment. If adjusted V1 is less than V1(MCG), set V1 = V1(MCG). V1 not to exceed VR.**

Takeoff %N1 (22K Derate)

Based on engine bleeds for packs on, engine and wing anti-ice on or off

OAT (°C)	AIRPORT PRESSURE ALTITUDE (FT)												
	-2000	-1000	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
60	87.7	88.3	88.7	88.8	88.9	89.1	89.2	89.2	89.1	88.6	88.3	88.7	89.2
55	88.5	89.1	89.5	89.7	89.8	89.9	90.0	90.0	90.0	89.5	89.0	88.8	88.6
50	89.3	89.8	90.4	90.5	90.6	90.7	90.9	90.8	90.8	90.4	89.9	89.7	89.6
45	90.2	90.7	91.2	91.3	91.4	91.5	91.7	91.6	91.6	91.2	90.8	90.7	90.5
40	91.1	91.6	92.1	92.2	92.3	92.4	92.5	92.4	92.4	92.1	91.7	91.6	91.5
35	91.9	92.5	93.0	93.1	93.2	93.2	93.3	93.3	93.2	92.9	92.5	92.5	92.4
30	91.5	92.6	93.8	93.9	94.0	94.0	94.1	94.0	93.9	93.7	93.4	93.3	93.2
25	90.8	91.9	93.1	93.7	94.4	94.8	94.9	94.8	94.8	94.4	94.0	94.0	94.0
20	90.0	91.1	92.3	93.0	93.6	94.3	95.0	95.6	95.6	95.3	94.9	94.8	94.7
15	89.3	90.4	91.6	92.2	92.8	93.6	94.3	94.8	95.3	95.9	96.1	95.9	95.5
10	88.5	89.6	90.8	91.4	92.1	92.8	93.5	94.0	94.5	95.1	95.7	96.4	97.1
5	87.8	88.9	90.0	90.7	91.3	92.0	92.7	93.2	93.7	94.3	94.9	95.6	96.3
0	87.0	88.1	89.2	89.9	90.5	91.2	91.9	92.4	92.9	93.5	94.1	94.8	95.5
-5	86.2	87.3	88.4	89.1	89.7	90.4	91.1	91.6	92.1	92.7	93.3	94.0	94.7
-10	85.4	86.5	87.6	88.3	88.9	89.6	90.3	90.8	91.3	91.9	92.5	93.2	93.9
-15	84.6	85.7	86.8	87.5	88.1	88.8	89.4	90.0	90.5	91.1	91.7	92.4	93.1
-20	83.8	84.9	86.0	86.6	87.3	87.9	88.6	89.1	89.7	90.3	90.8	91.6	92.3
-25	83.0	84.1	85.2	85.8	86.4	87.1	87.8	88.3	88.8	89.4	90.0	90.7	91.5
-30	82.2	83.3	84.4	85.0	85.6	86.3	86.9	87.4	88.0	88.6	89.2	89.9	90.6
-35	81.4	82.4	83.5	84.1	84.7	85.4	86.1	86.6	87.1	87.7	88.3	89.0	89.8
-40	80.6	81.6	82.7	83.3	83.9	84.5	85.2	85.7	86.2	86.8	87.4	88.2	88.9
-45	79.7	80.7	81.8	82.4	83.0	83.7	84.3	84.8	85.3	86.0	86.6	87.3	88.0
-50	78.9	79.9	80.9	81.5	82.1	82.8	83.4	83.9	84.5	85.1	85.7	86.4	87.2

%N1 Adjustments for Engine Bleeds

BLEED CONFIGURATION	AIRPORT PRESSURE ALTITUDE (FT)												
	-2000	-1000	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
PACKS OFF	0.7	0.7	0.7	0.7	0.7	0.7	0.8	0.8	0.8	0.8	0.9	0.9	0.9

Assumed Temperature Reduced Thrust (22K Derate)
Maximum Assumed Temperature (Table 1 of 3)
Based on 25% Takeoff Thrust Reduction

OAT (°C)	AIRPORT PRESSURE ALTITUDE (FT)											
	-1000	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
55	73	71	69	67								
50	73	71	69	67	65	63						
45	73	71	69	67	65	63	61	59	57			
40	72	71	69	67	65	63	61	59	57	55		
35	66	66	66	66	65	63	61	59	57	55	53	
30	63	61	61	61	61	61	61	59	57	55	53	51
25	63	61	59	57	56	56	56	56	56	55	53	51
20	63	61	59	57	55	53	51	51	51	50	50	50
15	63	61	59	57	55	53	51	50	47	45	45	45
10 & BELOW	63	61	59	57	55	53	51	50	47	45	43	41

Takeoff %N1 (Table 2 of 3)
Based on engine bleeds for packs on, engine and wing anti-ice on or off

ASSUMED TEMP (°C)	AIRPORT PRESSURE ALTITUDE (FT)											
	-1000	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
75	85.7	86.0	86.7	87.4	88.2	88.9	89.5	90.1	90.2	90.2	90.6	91.1
70	86.6	87.0	87.1	87.1	87.5	88.3	88.9	89.4	89.5	89.6	90.0	90.4
65	87.4	87.8	88.0	88.0	88.2	88.3	88.3	88.8	88.9	88.9	89.4	89.8
60	88.3	88.7	88.8	88.9	89.1	89.2	89.2	89.1	88.6	88.3	88.7	89.2
55	89.1	89.5	89.7	89.8	89.9	90.0	90.0	90.0	89.5	89.0	88.8	88.6
50	89.8	90.4	90.5	90.6	90.7	90.9	90.8	90.8	90.4	89.9	89.7	89.6
45	90.7	91.2	91.3	91.4	91.5	91.7	91.6	91.6	91.2	90.8	90.7	90.5
40	91.6	92.1	92.2	92.3	92.4	92.5	92.4	92.4	92.1	91.7	91.6	91.5
35	92.5	93.0	93.1	93.2	93.2	93.3	93.3	93.2	92.9	92.5	92.5	92.4
30	92.6	93.8	93.9	94.0	94.0	94.1	94.0	93.9	93.7	93.4	93.3	93.2
25	91.9	93.1	93.7	94.4	94.8	94.9	94.8	94.8	94.4	94.0	94.0	94.0
20	91.1	92.3	93.0	93.6	94.3	95.0	95.6	95.6	95.3	94.9	94.8	94.7
15	90.4	91.6	92.2	92.8	93.6	94.3	94.8	95.3	95.9	96.1	95.9	95.5
10	89.6	90.8	91.4	92.1	92.8	93.5	94.0	94.5	95.1	95.7	96.4	97.1
MINIMUM ASSUMED TEMP (°C)	32	30	28	26	24	22	20	18	16	15	12	10

With engine bleed for packs off, increase %N1 by 0.9.

Assumed Temperature Reduced Thrust (22K Derate)
%N1 Adjustment for Temperature Difference (Table 3 of 3)

ASSUMED TEMP MINUS OAT (°C)	OUTSIDE AIR TEMPERATURE (°C)													
	-40	-20	0	5	10	15	20	25	30	35	40	45	50	55
110	11.6													
100	10.3	7.9												
90	10.8	8.4												
80	12.2	7.1	5.0											
70	11.0	7.6	5.4	5.2	3.5									
60	9.6	9.0	4.1	4.0	3.9	3.8	2.1							
50	8.0	7.7	4.5	2.8	2.6	2.7	2.6	2.4	0.8					
40		6.2	5.9	4.7	3.0	2.6	2.7	2.8	2.6	2.5	2.9			
30		4.7	4.6	4.5	4.4	4.2	4.1	4.0	4.0	3.9	3.8	3.7	3.6	
20			3.1	3.0	3.0	3.0	2.9	2.8	2.7	2.7	2.6	2.6	2.5	2.4
10			1.5	1.5	1.5	1.5	1.5	1.5	1.4	1.4	1.4	1.3	1.3	1.3
0			0	0	0	0	0	0	0	0	0	0	0	0

1. **Determine Maximum Assumed Temperature allowed from Table 1.**
2. **Find Maximum %N1 from Table 2 using the desired assumed temperature (no greater than temperature from Table 1).**
3. **Use the difference between assumed temperature and OAT to determine the %N1 adjustment from Table 3.**
4. **Subtract %N1 adjustment from Maximum %N1 in Table 2.**

Max Climb %N1

Based on engine bleed for packs on or off and anti-ice off

TAT (°C)	PRESSURE ALTITUDE (FT)/SPEED (KIAS/MACH)									
	0	5000	10000	15000	20000	25000	30000	35000	37000	41000
	280	280	280	280	280	280	280	.78	.78	.78
60	90.2	90.5	90.4	90.6	90.4	92.1	93.8	95.1	95.2	93.5
55	91.0	91.2	91.3	91.4	90.8	91.5	93.1	94.4	94.5	92.8
50	91.7	92.0	92.1	92.2	91.7	91.5	92.4	93.7	93.8	92.1
45	92.4	92.6	92.8	93.0	92.6	92.4	92.4	93.0	93.1	91.4
40	93.1	93.3	93.6	93.8	93.4	93.2	93.2	92.3	92.4	90.7
35	93.6	94.0	94.3	94.5	94.3	94.0	94.0	93.0	92.4	90.8
30	92.9	94.8	95.0	95.2	95.1	94.8	94.7	93.9	93.3	91.8
25	92.2	94.8	95.7	95.9	95.9	95.5	95.4	94.7	94.1	92.8
20	91.4	94.0	96.5	96.7	96.6	96.2	96.1	95.4	94.9	93.7
15	90.6	93.2	95.9	97.5	97.4	96.9	96.7	96.2	95.7	94.6
10	89.9	92.5	95.1	97.8	98.3	97.7	97.4	96.9	96.5	95.6
5	89.1	91.7	94.3	97.0	99.2	98.6	98.1	97.7	97.3	96.5
0	88.3	90.9	93.5	96.2	98.6	99.6	99.1	98.5	98.2	97.5
-5	87.6	90.1	92.7	95.4	97.8	99.6	100.0	99.2	99.0	98.4
-10	86.8	89.3	91.9	94.6	97.1	98.8	100.3	100.2	99.8	99.4
-15	86.0	88.5	91.0	93.8	96.3	98.0	99.6	101.1	100.8	100.4
-20	85.2	87.6	90.2	93.0	95.5	97.2	98.7	100.8	101.3	101.0
-25	84.3	86.8	89.4	92.2	94.7	96.4	97.9	100.0	100.5	100.1
-30	83.5	86.0	88.5	91.3	93.9	95.6	97.1	99.1	99.6	99.3
-35	82.7	85.1	87.7	90.5	93.1	94.8	96.3	98.3	98.8	98.4
-40	81.8	84.3	86.8	89.6	92.3	93.9	95.4	97.4	97.9	97.6

%N1 Adjustments for Engine Bleeds

BLEED CONFIGURATION	PRESSURE ALTITUDE (1000 FT)					
	0	10	20	30	35	41
ENGINE ANTI-ICE	-0.6	-0.8	-0.9	-0.9	-0.8	-0.8
ENGINE & WING ANTI-ICE*	-1.8	-2.1	-2.5	-2.7	-3.0	-3.0

***Dual bleed sources**

Go-around %N1

Based on engine bleed for packs on, engine and wing anti-ice on or off

AIRPORT OAT		TAT (°C)	AIRPORT PRESSURE ALTITUDE (FT)											
°C	°F		-2000	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
57	134	60	95.0	96.2	96.8									
52	125	55	95.9	96.7	96.6	96.8	97.5							
47	116	50	96.6	97.6	97.8	97.8	97.7	97.5	98.2	98.8				
42	108	45	97.4	98.4	98.5	98.6	98.7	98.8	98.7	98.5	98.5	99.0		
37	99	40	98.0	99.1	99.2	99.3	99.4	99.5	99.6	99.5	99.1	98.9	98.8	99.1
32	90	35	98.1	99.9	100.0	100.1	100.1	100.3	100.3	100.2	99.9	99.6	99.6	99.5
27	81	30	97.3	99.8	100.4	100.7	100.7	100.7	100.7	100.7	100.6	100.4	100.4	100.3
22	72	25	96.6	99.1	99.7	100.2	100.6	100.9	100.9	100.9	100.9	100.9	100.9	100.8
17	63	20	95.8	98.3	98.9	99.5	99.8	100.2	100.5	100.9	101.0	101.1	101.0	101.0
12	54	15	95.0	97.5	98.1	98.7	99.1	99.4	99.8	100.1	100.5	100.9	101.3	101.2
7	45	10	94.2	96.8	97.4	98.0	98.3	98.7	99.0	99.4	99.8	100.2	100.5	100.9
2	36	5	93.4	96.0	96.6	97.2	97.6	97.9	98.3	98.7	99.0	99.4	99.8	100.2
-3	27	0	92.6	95.2	95.8	96.4	96.8	97.2	97.5	97.9	98.3	98.7	99.0	99.4
-8	18	-5	91.8	94.4	95.0	95.6	96.0	96.4	96.8	97.2	97.5	97.9	98.3	98.6
-13	9	-10	91.0	93.6	94.2	94.8	95.2	95.6	96.0	96.4	96.8	97.1	97.5	97.9
-17	1	-15	90.2	92.8	93.4	94.0	94.4	94.8	95.2	95.6	96.0	96.4	96.7	97.1
-22	-8	-20	89.3	92.0	92.6	93.2	93.6	94.0	94.4	94.8	95.2	95.6	95.9	96.3
-27	-17	-25	88.5	91.1	91.8	92.4	92.8	93.2	93.6	94.0	94.4	94.8	95.1	95.5
-32	-26	-30	87.6	90.3	90.9	91.6	92.0	92.4	92.8	93.3	93.6	94.0	94.3	94.7
-37	-35	-35	86.8	89.4	90.1	90.7	91.1	91.6	92.0	92.4	92.8	93.2	93.5	93.9
-42	-44	-40	85.9	88.6	89.2	89.9	90.3	90.7	91.2	91.6	92.0	92.4	92.7	93.0
-47	-53	-45	85.0	87.7	88.4	89.0	89.4	89.9	90.3	90.8	91.2	91.5	91.9	92.2
-52	-62	-50	84.1	86.8	87.5	88.2	88.6	89.0	89.5	90.0	90.3	90.7	91.0	91.4

%N1 Adjustments for Engine Bleeds

BLEED CONFIGURATION	PRESSURE ALTITUDE (FT)											
	-2000	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
PACKS OFF	0.7	0.8	0.8	0.8	0.8	0.9	0.9	0.9	0.9	0.9	0.9	0.9
A/C HIGH	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1

Flight With Unreliable Airspeed/ Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

CLIMB (280/.76)

Flaps Up, Set Max Climb Thrust

PRESSURE ALTITUDE (FT)		WEIGHT (1000 KG)				
		40	50	60	70	80
40000	**PITCH ATT**	**4.0**	**4.0**	**4.0**		
	V/S (FT/MIN)	1700	1100	500		
30000	**PITCH ATT**	**4.0**	**4.0**	**4.0**	**4.0**	**4.0**
	V/S (FT/MIN)	2500	1900	1400	1100	800
20000	**PITCH ATT**	**7.0**	**6.5**	**6.0**	**6.0**	**6.0**
	V/S (FT/MIN)	4100	3200	2600	2100	1700
10000	**PITCH ATT**	**11.0**	**9.5**	**8.5**	**8.0**	**8.0**
	V/S (FT/MIN)	5600	4400	3600	3000	2500
SEA LEVEL	**PITCH ATT**	**14.5**	**12.5**	**11.0**	**10.0**	**9.5**
	V/S (FT/MIN)	6700	5300	4300	3600	3100

CRUISE (.76/280)

Flaps Up, %N1 for Level Flight

PRESSURE ALTITUDE (FT)		WEIGHT (1000 KG)				
		40	50	60	70	80
40000	**PITCH ATT**	**2.0**	**2.5**	**3.5**		
	%N1	**83.4**	**85.9**	**90.1**		
35000	**PITCH ATT**	**1.0**	**2.0**	**2.5**	**3.0**	**4.0**
	%N1	**81.5**	**83.0**	**85.0**	**87.6**	**92.0**
30000	**PITCH ATT**	**1.0**	**1.5**	**2.0**	**2.5**	**3.0**
	%N1	**80.8**	**81.9**	**83.1**	**84.7**	**86.8**
25000	**PITCH ATT**	**1.0**	**1.5**	**2.0**	**2.5**	**3.5**
	%N1	**77.3**	**78.3**	**79.4**	**80.9**	**82.9**
20000	**PITCH ATT**	**1.0**	**1.5**	**2.0**	**3.0**	**3.5**
	%N1	**73.8**	**74.6**	**75.7**	**77.1**	**78.9**
15000	**PITCH ATT**	**1.0**	**1.5**	**2.5**	**3.0**	**3.5**
	%N1	**70.2**	**70.9**	**72.0**	**73.4**	**75.0**

Flight With Unreliable Airspeed/ Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

DESCENT (.76/280)
Flaps Up, Set Idle Thrust

PRESSURE ALTITUDE (FT)		WEIGHT (1000 KG) 40	50	60	70	80
40000	**PITCH ATT**	**-1.5**	**-0.5**	**0.5**	**1.0**	**1.5**
	V/S (FT/MIN)	-2700	-2500	-2400	-2700	-3000
30000	**PITCH ATT**	**-3.0**	**-2.0**	**-1.0**	**-0.5**	**0.5**
	V/S (FT/MIN)	-3100	-2600	-2300	-2100	-2000
20000	**PITCH ATT**	**-3.5**	**-2.0**	**-1.0**	**0.0**	**0.5**
	V/S (FT/MIN)	-2800	-2400	-2100	-1900	-1800
10000	**PITCH ATT**	**-3.5**	**-2.0**	**-1.0**	**0.0**	**0.5**
	V/S (FT/MIN)	-2600	-2100	-1900	-1700	-1600
SEA LEVEL	**PITCH ATT**	**-4.0**	**-2.5**	**-1.0**	**-0.5**	**0.5**
	V/S (FT/MIN)	-2400	-1900	-1700	-1500	-1400

HOLDING (VREF40 + 70)
Flaps Up, %N1 for Level Flight

PRESSURE ALTITUDE (FT)		WEIGHT (1000 KG) 40	50	60	70	80
15000	**PITCH ATT**	**5.0**	**5.0**	**5.0**	**5.0**	**5.0**
	%N1	**56.2**	**61.8**	**66.0**	**69.8**	**73.3**
	KIAS	175	193	212	229	246
10000	**PITCH ATT**	**5.0**	**5.5**	**5.0**	**5.0**	**5.0**
	%N1	**52.6**	**57.6**	**62.2**	**66.0**	**69.1**
	KIAS	175	192	211	228	244
5000	**PITCH ATT**	**5.0**	**5.5**	**5.5**	**5.5**	**5.0**
	%N1	**49.1**	**54.0**	**58.2**	**62.0**	**65.6**
	KIAS	175	191	210	227	243

Flight With Unreliable Airspeed/ Turbulent Air Penetration
Altitude and/or vertical speed indications may also be unreliable.

TERMINAL AREA (5000 FT)
%N1 for Level Flight
Airport Altitude = -2000 FT

FLAP POSITION (VREF+INCREMENT)		WEIGHT (1000 KG)				
		40	50	60	70	80
FLAPS UP (GEAR UP) VREF40+70	**PITCH ATT**	**4.5**	**5.5**	**5.5**	**6.0**	**6.5**
	%N1	**47.3**	**52.0**	**56.1**	**59.8**	**63.4**
	KIAS	175	188	200	211	221
FLAPS 1 (GEAR UP) VREF40+50	**PITCH ATT**	**5.0**	**5.5**	**5.5**	**6.0**	**6.5**
	%N1	**49.7**	**54.5**	**58.6**	**62.6**	**66.1**
	KIAS	155	168	180	191	201
FLAPS 5 (GEAR UP) VREF40+30	**PITCH ATT**	**5.5**	**6.0**	**6.5**	**6.5**	**7.0**
	%N1	**49.5**	**54.7**	**59.3**	**63.6**	**67.2**
	KIAS	135	148	160	171	181
FLAPS 10 (GEAR UP) VREF40+30	**PITCH ATT**	**4.0**	**4.5**	**4.5**	**5.0**	**5.0**
	%N1	**52.0**	**57.1**	**61.9**	**66.0**	**69.6**
	KIAS	135	148	160	171	181
FLAPS 15 (GEAR UP) VREF40+20	**PITCH ATT**	**4.5**	**5.0**	**5.0**	**5.5**	**5.5**
	%N1	**52.1**	**57.6**	**62.5**	**66.7**	**70.4**
	KIAS	125	138	150	161	171
FLAPS 25 (GEAR UP) VREF40+10	**PITCH ATT**	**5.5**	**5.5**	**5.5**	**6.0**	**6.0**
	%N1	**53.4**	**59.2**	**64.1**	**68.4**	**72.2**
	KIAS	115	128	140	151	161
FLAPS 15 (GEAR DOWN) VREF40+20	**PITCH ATT**	**5.0**	**5.0**	**5.5**	**5.5**	**5.5**
	%N1	**56.5**	**62.2**	**67.1**	**71.3**	**75.3**
	KIAS	125	138	150	161	171

Flight With Unreliable Airspeed/ Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

TERMINAL AREA (5000 FT)

%N1 for Level Flight

Airport Altitude = -1000 FT

FLAP POSITION (VREF+INCREMENT)		WEIGHT (1000 KG)				
		40	50	60	70	80
FLAPS UP (GEAR UP) VREF40+70	**PITCH ATT**	**4.5**	**5.5**	**5.5**	**6.0**	**6.5**
	%N1	**48.0**	**52.6**	**56.8**	**60.6**	**64.2**
	KIAS	175	188	200	211	221
FLAPS 1 (GEAR UP) VREF40+50	**PITCH ATT**	**5.0**	**5.5**	**5.5**	**6.0**	**6.5**
	%N1	**50.4**	**55.2**	**59.4**	**63.5**	**66.9**
	KIAS	155	168	180	191	201
FLAPS 5 (GEAR UP) VREF40+30	**PITCH ATT**	**5.5**	**6.0**	**6.5**	**6.5**	**7.0**
	%N1	**50.2**	**55.4**	**60.1**	**64.3**	**68.0**
	KIAS	135	148	160	171	181
FLAPS 10 (GEAR UP) VREF40+30	**PITCH ATT**	**4.0**	**4.5**	**4.5**	**5.0**	**5.0**
	%N1	**52.7**	**57.9**	**62.7**	**66.9**	**70.5**
	KIAS	135	148	160	171	181
FLAPS 15 (GEAR UP) VREF40+20	**PITCH ATT**	**4.5**	**5.0**	**5.0**	**5.5**	**5.5**
	%N1	**52.8**	**58.3**	**63.2**	**67.5**	**71.2**
	KIAS	125	138	150	161	171
FLAPS 25 (GEAR UP) VREF40+10	**PITCH ATT**	**5.5**	**5.5**	**5.5**	**5.5**	**6.0**
	%N1	**54.2**	**60.0**	**65.0**	**69.2**	**73.1**
	KIAS	115	128	140	151	161
FLAPS 15 (GEAR DOWN) VREF40+20	**PITCH ATT**	**5.0**	**5.0**	**5.5**	**5.5**	**5.5**
	%N1	**57.2**	**63.0**	**67.9**	**72.3**	**76.1**
	KIAS	125	138	150	161	171

Flight With Unreliable Airspeed/ Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

TERMINAL AREA (5000 FT)

%N1 for Level Flight
Airport Altitude = SEA LEVEL

FLAP POSITION (VREF+INCREMENT)		WEIGHT (1000 KG)				
		40	50	60	70	80
FLAPS UP (GEAR UP) VREF40+70	**PITCH ATT**	**4.5**	**5.5**	**5.5**	**6.0**	**6.5**
	%N1	**48.7**	**53.3**	**57.5**	**61.4**	**65.0**
	KIAS	175	188	200	211	222
FLAPS 1 (GEAR UP) VREF40+50	**PITCH ATT**	**5.0**	**5.5**	**5.5**	**6.0**	**6.5**
	%N1	**51.1**	**55.9**	**60.2**	**64.3**	**67.6**
	KIAS	155	168	180	191	202
FLAPS 5 (GEAR UP) VREF40+30	**PITCH ATT**	**5.5**	**6.0**	**6.5**	**6.5**	**7.0**
	%N1	**50.9**	**56.1**	**60.9**	**65.1**	**68.8**
	KIAS	135	148	160	171	182
FLAPS 10 (GEAR UP) VREF40+30	**PITCH ATT**	**4.0**	**4.5**	**4.5**	**5.0**	**5.0**
	%N1	**53.4**	**58.7**	**63.5**	**67.6**	**71.3**
	KIAS	135	148	160	171	182
FLAPS 15 (GEAR UP) VREF40+20	**PITCH ATT**	**4.5**	**5.0**	**5.0**	**5.5**	**5.5**
	%N1	**53.5**	**59.1**	**64.1**	**68.2**	**72.1**
	KIAS	125	138	150	161	172
FLAPS 25 (GEAR UP) VREF40+10	**PITCH ATT**	**5.5**	**5.5**	**5.5**	**5.5**	**5.5**
	%N1	**54.9**	**60.8**	**65.8**	**70.0**	**73.9**
	KIAS	115	128	140	151	162
FLAPS 15 (GEAR DOWN) VREF40+20	**PITCH ATT**	**5.0**	**5.0**	**5.5**	**5.5**	**5.5**
	%N1	**58.0**	**63.8**	**68.7**	**73.1**	**76.9**
	KIAS	125	138	150	161	172

Flight With Unreliable Airspeed/ Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

TERMINAL AREA (5000 FT)
%N1 for Level Flight
Airport Altitude = 1000 FT

FLAP POSITION (VREF+INCREMENT)		WEIGHT (1000 KG) 40	50	60	70	80
FLAPS UP (GEAR UP) VREF40+70	**PITCH ATT**	**4.5**	**5.5**	**5.5**	**6.0**	**6.5**
	%N1	**49.5**	**54.0**	**58.3**	**62.2**	**65.8**
	KIAS	175	188	200	211	222
FLAPS 1 (GEAR UP) VREF40+50	**PITCH ATT**	**5.0**	**5.5**	**5.5**	**6.0**	**6.0**
	%N1	**51.8**	**56.7**	**61.1**	**65.0**	**68.4**
	KIAS	155	168	180	191	202
FLAPS 5 (GEAR UP) VREF40+30	**PITCH ATT**	**5.5**	**6.0**	**6.5**	**6.5**	**7.0**
	%N1	**51.6**	**56.9**	**61.7**	**65.9**	**69.6**
	KIAS	135	148	160	171	182
FLAPS 10 (GEAR UP) VREF40+30	**PITCH ATT**	**4.0**	**4.5**	**4.5**	**5.0**	**5.0**
	%N1	**54.1**	**59.5**	**64.3**	**68.4**	**72.2**
	KIAS	135	148	160	171	182
FLAPS 15 (GEAR UP) VREF40+20	**PITCH ATT**	**4.5**	**5.0**	**5.0**	**5.5**	**5.5**
	%N1	**54.3**	**59.9**	**64.9**	**69.1**	**73.0**
	KIAS	125	138	150	161	172
FLAPS 25 (GEAR UP) VREF40+10	**PITCH ATT**	**5.5**	**5.5**	**5.5**	**5.5**	**5.5**
	%N1	**55.7**	**61.6**	**66.5**	**70.8**	**74.8**
	KIAS	115	128	140	151	162
FLAPS 15 (GEAR DOWN) VREF40+20	**PITCH ATT**	**4.5**	**5.0**	**5.0**	**5.5**	**5.5**
	%N1	**58.8**	**64.7**	**69.6**	**74.0**	**77.8**
	KIAS	125	138	150	161	172

Flight With Unreliable Airspeed/ Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

TERMINAL AREA (5000 FT)
%N1 for Level Flight
Airport Altitude = 2000 FT

FLAP POSITION (VREF+INCREMENT)		WEIGHT (1000 KG)				
		40	50	60	70	80
FLAPS UP	**PITCH ATT**	**4.5**	**5.5**	**5.5**	**6.0**	**6.5**
(GEAR UP)	**%N1**	**50.2**	**54.8**	**59.0**	**63.1**	**66.5**
VREF40+70	KIAS	175	188	201	212	222
FLAPS 1	**PITCH ATT**	**5.0**	**5.5**	**5.5**	**6.0**	**6.0**
(GEAR UP)	**%N1**	**52.5**	**57.5**	**61.9**	**65.8**	**69.2**
VREF40+50	KIAS	155	168	181	192	202
FLAPS 5	**PITCH ATT**	**5.5**	**6.0**	**6.5**	**6.5**	**7.0**
(GEAR UP)	**%N1**	**52.4**	**57.6**	**62.6**	**66.8**	**70.4**
VREF40+30	KIAS	135	148	161	172	182
FLAPS 10	**PITCH ATT**	**4.0**	**4.5**	**4.5**	**5.0**	**5.0**
(GEAR UP)	**%N1**	**54.9**	**60.3**	**65.1**	**69.3**	**73.1**
VREF40+30	KIAS	135	148	161	172	182
FLAPS 15	**PITCH ATT**	**4.5**	**5.0**	**5.0**	**5.0**	**5.5**
(GEAR UP)	**%N1**	**55.0**	**60.8**	**65.7**	**69.9**	**73.9**
VREF40+20	KIAS	125	138	151	162	172
FLAPS 25	**PITCH ATT**	**5.5**	**5.5**	**5.5**	**5.5**	**5.5**
(GEAR UP)	**%N1**	**56.5**	**62.4**	**67.3**	**71.7**	**75.6**
VREF40+10	KIAS	115	128	141	152	162
FLAPS 15	**PITCH ATT**	**4.5**	**5.0**	**5.0**	**5.5**	**5.5**
(GEAR DOWN)	**%N1**	**59.6**	**65.5**	**70.4**	**74.9**	**78.6**
VREF40+20	KIAS	125	138	151	162	172

Flight With Unreliable Airspeed/ Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

TERMINAL AREA (5000 FT)
%N1 for Level Flight
Airport Altitude = 3000 FT

FLAP POSITION (VREF+INCREMENT)		WEIGHT (1000 KG) 40	50	60	70	80
FLAPS UP (GEAR UP) VREF40+70	**PITCH ATT**	**4.5**	**5.5**	**5.5**	**6.0**	**6.5**
	%N1	**50.8**	**55.6**	**59.8**	**63.9**	**67.3**
	KIAS	175	188	201	212	222
FLAPS 1 (GEAR UP) VREF40+50	**PITCH ATT**	**5.0**	**5.5**	**5.5**	**6.0**	**6.0**
	%N1	**53.3**	**58.2**	**62.8**	**66.6**	**70.1**
	KIAS	155	168	181	192	202
FLAPS 5 (GEAR UP) VREF40+30	**PITCH ATT**	**5.5**	**6.0**	**6.5**	**6.5**	**7.0**
	%N1	**53.1**	**58.4**	**63.4**	**67.5**	**71.2**
	KIAS	135	148	161	172	182
FLAPS 10 (GEAR UP) VREF40+30	**PITCH ATT**	**4.0**	**4.5**	**4.5**	**4.5**	**5.0**
	%N1	**55.6**	**61.2**	**66.0**	**70.1**	**73.9**
	KIAS	135	148	161	172	182
FLAPS 15 (GEAR UP) VREF40+20	**PITCH ATT**	**4.5**	**5.0**	**5.0**	**5.0**	**5.5**
	%N1	**55.7**	**61.6**	**66.5**	**70.8**	**74.7**
	KIAS	125	138	151	162	172
FLAPS 25 (GEAR UP) VREF40+10	**PITCH ATT**	**5.5**	**5.5**	**5.5**	**5.5**	**5.5**
	%N1	**57.2**	**63.2**	**68.1**	**72.6**	**76.4**
	KIAS	115	128	141	152	162
FLAPS 15 (GEAR DOWN) VREF40+20	**PITCH ATT**	**4.5**	**5.0**	**5.0**	**5.5**	**5.5**
	%N1	**60.4**	**66.3**	**71.3**	**75.7**	**79.5**
	KIAS	125	138	151	162	172

Flight With Unreliable Airspeed/ Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

TERMINAL AREA (5000 FT)
%N1 for Level Flight
Airport Altitude = 4000 FT

FLAP POSITION (VREF+INCREMENT)		WEIGHT (1000 KG)				
		40	50	60	70	80
FLAPS UP (GEAR UP) VREF40+70	**PITCH ATT**	**5.0**	**5.5**	**5.5**	**6.0**	**6.5**
	%N1	**51.5**	**56.3**	**60.6**	**64.7**	**68.0**
	KIAS	175	189	201	212	223
FLAPS 1 (GEAR UP) VREF40+50	**PITCH ATT**	**5.0**	**5.5**	**5.5**	**6.0**	**6.0**
	%N1	**54.0**	**59.0**	**63.6**	**67.4**	**70.9**
	KIAS	155	169	181	192	203
FLAPS 5 (GEAR UP) VREF40+30	**PITCH ATT**	**5.5**	**6.0**	**6.5**	**6.5**	**7.0**
	%N1	**53.8**	**59.3**	**64.2**	**68.3**	**72.1**
	KIAS	135	149	161	172	183
FLAPS 10 (GEAR UP) VREF40+30	**PITCH ATT**	**4.0**	**4.5**	**4.5**	**4.5**	**5.0**
	%N1	**56.4**	**62.0**	**66.8**	**71.0**	**74.7**
	KIAS	135	149	161	172	183
FLAPS 15 (GEAR UP) VREF40+20	**PITCH ATT**	**4.5**	**5.0**	**5.0**	**5.0**	**5.5**
	%N1	**56.5**	**62.4**	**67.3**	**71.7**	**75.5**
	KIAS	125	139	151	162	173
FLAPS 25 (GEAR UP) VREF40+10	**PITCH ATT**	**5.5**	**5.5**	**5.5**	**5.5**	**5.5**
	%N1	**58.0**	**64.1**	**68.9**	**73.4**	**77.2**
	KIAS	115	129	141	152	163
FLAPS 15 (GEAR DOWN) VREF40+20	**PITCH ATT**	**4.5**	**5.0**	**5.0**	**5.5**	**5.5**
	%N1	**61.2**	**67.1**	**72.2**	**76.5**	**80.4**
	KIAS	125	139	151	162	173

Flight With Unreliable Airspeed/ Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

TERMINAL AREA (5000 FT)
%N1 for Level Flight
Airport Altitude = 5000 FT

FLAP POSITION (VREF+INCREMENT)		WEIGHT (1000 KG)				
		40	50	60	70	80
FLAPS UP (GEAR UP) VREF40+70	**PITCH ATT**	**4.5**	**5.5**	**5.5**	**6.0**	**6.5**
	%N1	**52.1**	**57.0**	**61.5**	**65.4**	**68.8**
	KIAS	175	189	201	213	223
FLAPS 1 (GEAR UP) VREF40+50	**PITCH ATT**	**5.0**	**5.5**	**5.5**	**6.0**	**6.0**
	%N1	**54.8**	**59.9**	**64.4**	**68.2**	**71.8**
	KIAS	155	169	181	193	203
FLAPS 5 (GEAR UP) VREF40+30	**PITCH ATT**	**5.5**	**6.0**	**6.5**	**6.5**	**6.5**
	%N1	**54.5**	**60.1**	**65.0**	**69.1**	**73.0**
	KIAS	135	149	161	173	183
FLAPS 10 (GEAR UP) VREF40+30	**PITCH ATT**	**4.0**	**4.0**	**4.5**	**4.5**	**5.0**
	%N1	**57.1**	**62.8**	**67.6**	**71.9**	**75.5**
	KIAS	135	149	161	173	183
FLAPS 15 (GEAR UP) VREF40+20	**PITCH ATT**	**4.5**	**5.0**	**5.0**	**5.0**	**5.5**
	%N1	**57.3**	**63.2**	**68.1**	**72.6**	**76.3**
	KIAS	125	139	151	163	173
FLAPS 25 (GEAR UP) VREF40+10	**PITCH ATT**	**5.5**	**5.5**	**5.5**	**5.5**	**5.5**
	%N1	**58.8**	**64.8**	**69.8**	**74.3**	**78.1**
	KIAS	115	129	141	153	163
FLAPS 15 (GEAR DOWN) VREF40+20	**PITCH ATT**	**4.5**	**5.0**	**5.0**	**5.5**	**5.5**
	%N1	**62.0**	**67.9**	**73.1**	**77.4**	**81.3**
	KIAS	125	139	151	163	173

Flight With Unreliable Airspeed/ Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

TERMINAL AREA (5000 FT)
%N1 for Level Flight
Airport Altitude = 6000 FT

FLAP POSITION (VREF+INCREMENT)		WEIGHT (1000 KG)				
		40	50	60	70	80
FLAPS UP (GEAR UP) VREF40+70	**PITCH ATT**	**4.5**	**5.5**	**5.5**	**6.0**	**6.5**
	%N1	**52.9**	**57.8**	**62.4**	**66.2**	**69.6**
	KIAS	175	189	202	213	224
FLAPS 1 (GEAR UP) VREF40+50	**PITCH ATT**	**5.0**	**5.5**	**5.5**	**6.0**	**6.0**
	%N1	**55.5**	**60.7**	**65.1**	**69.0**	**72.7**
	KIAS	155	169	182	193	204
FLAPS 5 (GEAR UP) VREF40+30	**PITCH ATT**	**5.5**	**6.0**	**6.5**	**6.5**	**6.5**
	%N1	**55.3**	**61.0**	**65.8**	**70.0**	**73.8**
	KIAS	135	149	162	173	184
FLAPS 10 (GEAR UP) VREF40+30	**PITCH ATT**	**4.0**	**4.0**	**4.5**	**4.5**	**5.0**
	%N1	**58.0**	**63.7**	**68.5**	**72.8**	**76.3**
	KIAS	135	149	162	173	184
FLAPS 15 (GEAR UP) VREF40+20	**PITCH ATT**	**4.5**	**5.0**	**5.0**	**5.0**	**5.0**
	%N1	**58.1**	**64.0**	**69.0**	**73.4**	**77.1**
	KIAS	125	139	152	163	174
FLAPS 25 (GEAR UP) VREF40+10	**PITCH ATT**	**5.5**	**5.5**	**5.5**	**5.5**	**5.5**
	%N1	**59.7**	**65.6**	**70.7**	**75.1**	**79.0**
	KIAS	115	129	142	153	164
FLAPS 15 (GEAR DOWN) VREF40+20	**PITCH ATT**	**4.5**	**5.0**	**5.0**	**5.0**	**5.5**
	%N1	**62.9**	**68.8**	**74.0**	**78.3**	**82.2**
	KIAS	125	139	152	163	174

Flight With Unreliable Airspeed/ Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

TERMINAL AREA (5000 FT)
%N1 for Level Flight
Airport Altitude = 7000 FT

FLAP POSITION (VREF+INCREMENT)		WEIGHT (1000 KG) 40	50	60	70	80
FLAPS UP (GEAR UP) VREF40+70	**PITCH ATT**	**4.5**	**5.5**	**5.5**	**6.0**	**6.5**
	%N1	**53.6**	**58.5**	**63.2**	**66.9**	**70.4**
	KIAS	175	189	202	213	224
FLAPS 1 (GEAR UP) VREF40+50	**PITCH ATT**	**5.0**	**5.5**	**5.5**	**6.0**	**6.0**
	%N1	**56.3**	**61.6**	**65.9**	**69.9**	**73.6**
	KIAS	155	169	182	193	204
FLAPS 5 (GEAR UP) VREF40+30	**PITCH ATT**	**5.5**	**6.0**	**6.5**	**6.5**	**6.5**
	%N1	**56.0**	**61.9**	**66.6**	**70.8**	**74.6**
	KIAS	135	149	162	173	184
FLAPS 10 (GEAR UP) VREF40+30	**PITCH ATT**	**4.0**	**4.0**	**4.5**	**4.5**	**5.0**
	%N1	**58.8**	**64.5**	**69.3**	**73.6**	**77.2**
	KIAS	135	149	162	173	184
FLAPS 15 (GEAR UP) VREF40+20	**PITCH ATT**	**4.5**	**5.0**	**5.0**	**5.0**	**5.0**
	%N1	**58.9**	**64.9**	**69.9**	**74.3**	**77.9**
	KIAS	125	139	152	163	174
FLAPS 25 (GEAR UP) VREF40+10	**PITCH ATT**	**5.5**	**5.5**	**5.5**	**5.5**	**5.5**
	%N1	**60.5**	**66.4**	**71.6**	**75.9**	**79.9**
	KIAS	115	129	142	153	164
FLAPS 15 (GEAR DOWN) VREF40+20	**PITCH ATT**	**4.5**	**5.0**	**5.0**	**5.0**	**5.5**
	%N1	**63.8**	**69.7**	**74.8**	**79.2**	**83.1**
	KIAS	125	139	152	163	174

Flight With Unreliable Airspeed/ Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

TERMINAL AREA (5000 FT)
%N1 for Level Flight
Airport Altitude = 8000 FT

FLAP POSITION (VREF+INCREMENT)		WEIGHT (1000 KG) 40	50	60	70	80
FLAPS UP (GEAR UP) VREF40+70	**PITCH ATT**	**4.5**	**5.5**	**5.5**	**6.0**	**6.5**
	%N1	**54.3**	**59.4**	**64.0**	**67.7**	**71.3**
	KIAS	176	189	202	214	224
FLAPS 1 (GEAR UP) VREF40+50	**PITCH ATT**	**5.0**	**5.0**	**5.5**	**6.0**	**6.0**
	%N1	**57.1**	**62.4**	**66.7**	**70.8**	**74.4**
	KIAS	156	169	182	194	204
FLAPS 5 (GEAR UP) VREF40+30	**PITCH ATT**	**5.5**	**6.0**	**6.0**	**6.5**	**6.5**
	%N1	**56.8**	**62.7**	**67.4**	**71.7**	**75.4**
	KIAS	136	149	162	174	184
FLAPS 10 (GEAR UP) VREF40+30	**PITCH ATT**	**4.0**	**4.0**	**4.5**	**4.5**	**5.0**
	%N1	**59.7**	**65.3**	**70.2**	**74.4**	**78.0**
	KIAS	136	149	162	174	184
FLAPS 15 (GEAR UP) VREF40+20	**PITCH ATT**	**4.5**	**5.0**	**5.0**	**5.0**	**5.0**
	%N1	**59.8**	**65.7**	**70.8**	**75.0**	**78.8**
	KIAS	126	139	152	164	174
FLAPS 25 (GEAR UP) VREF40+10	**PITCH ATT**	**5.5**	**5.5**	**5.5**	**5.5**	**5.5**
	%N1	**61.3**	**67.2**	**72.5**	**76.8**	**80.8**
	KIAS	116	129	142	154	164
FLAPS 15 (GEAR DOWN) VREF40+20	**PITCH ATT**	**4.5**	**5.0**	**5.0**	**5.0**	**5.5**
	%N1	**64.5**	**70.6**	**75.7**	**80.1**	**84.0**
	KIAS	126	139	152	164	174

Flight With Unreliable Airspeed/ Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

TERMINAL AREA (5000 FT)

%N1 for Level Flight

Airport Altitude = 9000 FT

FLAP POSITION (VREF+INCREMENT)		WEIGHT (1000 KG)				
		40	50	60	70	80
FLAPS UP (GEAR UP) VREF40+70	**PITCH ATT**	**4.5**	**5.0**	**5.5**	**6.0**	**6.5**
	%N1	**55.1**	**60.2**	**64.8**	**68.5**	**72.1**
	KIAS	176	190	203	214	225
FLAPS 1 (GEAR UP) VREF40+50	**PITCH ATT**	**5.0**	**5.0**	**5.5**	**6.0**	**6.0**
	%N1	**57.8**	**63.2**	**67.6**	**71.6**	**75.2**
	KIAS	156	170	183	194	205
FLAPS 5 (GEAR UP) VREF40+30	**PITCH ATT**	**5.5**	**6.0**	**6.0**	**6.5**	**6.5**
	%N1	**57.7**	**63.5**	**68.2**	**72.6**	**76.2**
	KIAS	136	150	163	174	185
FLAPS 10 (GEAR UP) VREF40+30	**PITCH ATT**	**4.0**	**4.0**	**4.5**	**4.5**	**4.5**
	%N1	**60.6**	**66.2**	**71.1**	**75.2**	**79.0**
	KIAS	136	150	163	174	185
FLAPS 15 (GEAR UP) VREF40+20	**PITCH ATT**	**4.5**	**4.5**	**5.0**	**5.0**	**5.0**
	%N1	**60.6**	**66.5**	**71.7**	**75.9**	**79.7**
	KIAS	126	140	153	164	175
FLAPS 25 (GEAR UP) VREF40+10	**PITCH ATT**	**5.5**	**5.5**	**5.5**	**5.5**	**5.5**
	%N1	**62.2**	**68.1**	**73.3**	**77.7**	**81.6**
	KIAS	116	130	143	154	165
FLAPS 15 (GEAR DOWN) VREF40+20	**PITCH ATT**	**4.5**	**5.0**	**5.0**	**5.0**	**5.0**
	%N1	**65.3**	**71.5**	**76.6**	**81.0**	**85.0**
	KIAS	126	140	153	164	175

Flight With Unreliable Airspeed/ Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

TERMINAL AREA (5000 FT)

%N1 for Level Flight

Airport Altitude = 10000 FT

FLAP POSITION (VREF+INCREMENT)		WEIGHT (1000 KG) 40	50	60	70	80
FLAPS UP (GEAR UP) VREF40+70	**PITCH ATT**	**4.5**	**5.0**	**5.5**	**6.0**	**6.5**
	%N1	**55.9**	**61.1**	**65.5**	**69.3**	**72.9**
	KIAS	176	190	203	215	225
FLAPS 1 (GEAR UP) VREF40+50	**PITCH ATT**	**5.0**	**5.0**	**5.5**	**6.0**	**6.0**
	%N1	**58.7**	**64.0**	**68.4**	**72.5**	**76.0**
	KIAS	156	170	183	195	205
FLAPS 5 (GEAR UP) VREF40+30	**PITCH ATT**	**5.5**	**6.0**	**6.0**	**6.5**	**6.5**
	%N1	**58.5**	**64.3**	**69.1**	**73.4**	**77.1**
	KIAS	136	150	163	175	185
FLAPS 10 (GEAR UP) VREF40+30	**PITCH ATT**	**4.0**	**4.0**	**4.5**	**4.5**	**4.5**
	%N1	**61.4**	**67.0**	**72.0**	**76.1**	**79.9**
	KIAS	136	150	163	175	185
FLAPS 15 (GEAR UP) VREF40+20	**PITCH ATT**	**4.5**	**4.5**	**5.0**	**5.0**	**5.0**
	%N1	**61.4**	**67.4**	**72.5**	**76.7**	**80.6**
	KIAS	126	140	153	165	175
FLAPS 25 (GEAR UP) VREF40+10	**PITCH ATT**	**5.5**	**5.5**	**5.0**	**5.0**	**5.5**
	%N1	**63.0**	**69.0**	**74.2**	**78.6**	**82.5**
	KIAS	116	130	143	155	165
FLAPS 15 (GEAR DOWN) VREF40+20	**PITCH ATT**	**4.5**	**5.0**	**5.0**	**5.0**	**5.0**
	%N1	**66.2**	**72.4**	**77.5**	**81.9**	**85.9**
	KIAS	126	140	153	165	175

Flight With Unreliable Airspeed/ Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

TERMINAL AREA (5000 FT)

%N1 for Level Flight

Airport Altitude = 11000 FT

FLAP POSITION (VREF+INCREMENT)		WEIGHT (1000 KG)				
		40	50	60	70	80
FLAPS UP (GEAR UP) VREF40+70	**PITCH ATT**	**4.5**	**5.0**	**5.5**	**6.0**	**6.0**
	%N1	**56.6**	**62.1**	**66.2**	**70.1**	**73.7**
	KIAS	176	190	203	215	226
FLAPS 1 (GEAR UP) VREF40+50	**PITCH ATT**	**5.0**	**5.0**	**5.5**	**6.0**	**6.0**
	%N1	**59.7**	**64.9**	**69.4**	**73.4**	**76.8**
	KIAS	156	170	183	195	206
FLAPS 5 (GEAR UP) VREF40+30	**PITCH ATT**	**5.5**	**6.0**	**6.0**	**6.5**	**6.5**
	%N1	**59.7**	**65.2**	**70.1**	**74.3**	**78.0**
	KIAS	136	150	163	175	186
FLAPS 10 (GEAR UP) VREF40+30	**PITCH ATT**	**4.0**	**4.0**	**4.5**	**4.5**	**4.5**
	%N1	**62.4**	**68.1**	**72.9**	**77.0**	**80.9**
	KIAS	136	150	163	175	186
FLAPS 15 (GEAR UP) VREF40+20	**PITCH ATT**	**4.5**	**4.5**	**5.0**	**5.0**	**5.0**
	%N1	**62.5**	**68.4**	**73.5**	**77.7**	**81.6**
	KIAS	126	140	153	165	176
FLAPS 25 (GEAR UP) VREF40+10	**PITCH ATT**	**5.0**	**5.0**	**5.0**	**5.0**	**5.0**
	%N1	**64.1**	**70.2**	**75.1**	**79.6**	**83.5**
	KIAS	116	130	143	155	166
FLAPS 15 (GEAR DOWN) VREF40+20	**PITCH ATT**	**4.5**	**5.0**	**5.0**	**5.0**	**5.0**
	%N1	**67.3**	**73.4**	**78.5**	**83.0**	**87.0**
	KIAS	126	140	153	165	176

Flight With Unreliable Airspeed/ Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

TERMINAL AREA (5000 FT)

%N1 for Level Flight

Airport Altitude = 12000 FT

FLAP POSITION (VREF+INCREMENT)		WEIGHT (1000 KG) 40	50	60	70	80
FLAPS UP (GEAR UP) VREF40+70	**PITCH ATT**	**4.5**	**5.0**	**5.5**	**6.0**	**6.0**
	%N1	**57.5**	**62.9**	**67.0**	**71.0**	**74.5**
	KIAS	176	190	204	215	226
FLAPS 1 (GEAR UP) VREF40+50	**PITCH ATT**	**5.0**	**5.0**	**5.5**	**6.0**	**6.0**
	%N1	**60.7**	**65.7**	**70.3**	**74.2**	**77.7**
	KIAS	156	170	184	195	206
FLAPS 5 (GEAR UP) VREF40+30	**PITCH ATT**	**5.5**	**6.0**	**6.0**	**6.5**	**6.5**
	%N1	**60.7**	**66.2**	**71.1**	**75.1**	**79.0**
	KIAS	136	150	164	175	186
FLAPS 10 (GEAR UP) VREF40+30	**PITCH ATT**	**4.0**	**4.0**	**4.5**	**4.5**	**4.5**
	%N1	**63.4**	**69.1**	**73.8**	**78.0**	**81.8**
	KIAS	136	150	164	175	186
FLAPS 15 (GEAR UP) VREF40+20	**PITCH ATT**	**4.5**	**4.5**	**4.5**	**5.0**	**5.0**
	%N1	**63.5**	**69.5**	**74.4**	**78.7**	**82.6**
	KIAS	126	140	154	165	176
FLAPS 25 (GEAR UP) VREF40+10	**PITCH ATT**	**5.0**	**5.0**	**5.0**	**5.0**	**5.0**
	%N1	**65.2**	**71.2**	**76.2**	**80.6**	**84.5**
	KIAS	116	130	144	155	166
FLAPS 15 (GEAR DOWN) VREF40+20	**PITCH ATT**	**4.5**	**5.0**	**5.0**	**5.0**	**5.0**
	%N1	**68.5**	**74.4**	**79.6**	**84.0**	**88.1**
	KIAS	126	140	154	165	176

Flight With Unreliable Airspeed/ Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

TERMINAL AREA (5000 FT)
%N1 for Level Flight
Airport Altitude = 13000 FT

FLAP POSITION (VREF+INCREMENT)		WEIGHT (1000 KG) 40	50	60	70	80
FLAPS UP (GEAR UP) VREF40+70	**PITCH ATT**	**4.5**	**5.0**	**5.5**	**6.0**	**6.0**
	%N1	**58.3**	**63.6**	**67.8**	**71.8**	**75.3**
	KIAS	177	191	204	216	227
FLAPS 1 (GEAR UP) VREF40+50	**PITCH ATT**	**5.0**	**5.0**	**5.5**	**5.5**	**6.0**
	%N1	**61.7**	**66.6**	**71.2**	**75.0**	**78.6**
	KIAS	157	171	184	196	207
FLAPS 5 (GEAR UP) VREF40+30	**PITCH ATT**	**5.5**	**6.0**	**6.0**	**6.5**	**6.5**
	%N1	**61.7**	**67.1**	**72.0**	**76.0**	**79.9**
	KIAS	137	151	164	176	187
FLAPS 10 (GEAR UP) VREF40+30	**PITCH ATT**	**4.0**	**4.0**	**4.0**	**4.5**	**4.5**
	%N1	**64.4**	**70.1**	**74.7**	**79.0**	**82.8**
	KIAS	137	151	164	176	187
FLAPS 15 (GEAR UP) VREF40+20	**PITCH ATT**	**4.5**	**4.5**	**4.5**	**5.0**	**5.0**
	%N1	**64.5**	**70.6**	**75.3**	**79.7**	**83.5**
	KIAS	127	141	154	166	177
FLAPS 25 (GEAR UP) VREF40+10	**PITCH ATT**	**5.0**	**5.0**	**5.0**	**5.0**	**5.0**
	%N1	**66.3**	**72.3**	**77.2**	**81.6**	**85.5**
	KIAS	117	131	144	156	167
FLAPS 15 (GEAR DOWN) VREF40+20	**PITCH ATT**	**4.5**	**4.5**	**5.0**	**5.0**	**5.0**
	%N1	**69.7**	**75.4**	**80.6**	**85.0**	**89.1**
	KIAS	127	141	154	166	177

Flight With Unreliable Airspeed/ Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

TERMINAL AREA (5000 FT)
%N1 for Level Flight
Airport Altitude = 14000 FT

FLAP POSITION (VREF+INCREMENT)		WEIGHT (1000 KG) 40	50	60	70	80
FLAPS UP	**PITCH ATT**	**4.5**	**5.0**	**5.5**	**6.0**	**6.0**
(GEAR UP)	**%N1**	**59.2**	**64.3**	**68.6**	**72.6**	**76.1**
VREF40+70	KIAS	176	191	204	216	227
FLAPS 1	**PITCH ATT**	**5.0**	**5.0**	**5.5**	**6.0**	**6.0**
(GEAR UP)	**%N1**	**62.5**	**67.5**	**72.1**	**75.8**	**79.5**
VREF40+50	KIAS	156	171	184	196	207
FLAPS 5	**PITCH ATT**	**5.5**	**6.0**	**6.0**	**6.5**	**6.5**
(GEAR UP)	**%N1**	**62.6**	**68.1**	**72.8**	**76.9**	**80.8**
VREF40+30	KIAS	136	151	164	176	187
FLAPS 10	**PITCH ATT**	**4.0**	**4.0**	**4.5**	**4.5**	**4.5**
(GEAR UP)	**%N1**	**65.3**	**71.1**	**75.6**	**79.9**	**83.6**
VREF40+30	KIAS	136	151	164	176	187
FLAPS 15	**PITCH ATT**	**4.5**	**4.5**	**4.5**	**5.0**	**5.0**
(GEAR UP)	**%N1**	**65.6**	**71.5**	**76.3**	**80.6**	**84.4**
VREF40+20	KIAS	126	141	154	166	177
FLAPS 25	**PITCH ATT**	**5.0**	**5.0**	**5.0**	**5.0**	**5.0**
(GEAR UP)	**%N1**	**67.4**	**73.2**	**78.3**	**82.6**	**86.6**
VREF40+10	KIAS	116	131	144	156	167
FLAPS 15	**PITCH ATT**	**4.5**	**5.0**	**5.0**	**5.0**	**5.0**
(GEAR DOWN)	**%N1**	**70.7**	**76.4**	**81.6**	**86.0**	**90.2**
VREF40+20	KIAS	126	141	154	166	177

Flight With Unreliable Airspeed/ Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

TERMINAL AREA (5000 FT)

%N1 for Level Flight

Airport Altitude = 14500 FT

FLAP POSITION (VREF+INCREMENT)		WEIGHT (1000 KG)				
		40	50	60	70	80
FLAPS UP (GEAR UP) VREF40+70	**PITCH ATT**	**4.5**	**5.0**	**5.5**	**6.0**	**6.0**
	%N1	**59.6**	**64.7**	**69.1**	**73.0**	**76.6**
	KIAS	177	191	204	216	227
FLAPS 1 (GEAR UP) VREF40+50	**PITCH ATT**	**5.0**	**5.0**	**5.5**	**6.0**	**6.0**
	%N1	**62.9**	**68.0**	**72.5**	**76.3**	**79.9**
	KIAS	157	171	184	196	207
FLAPS 5 (GEAR UP) VREF40+30	**PITCH ATT**	**5.5**	**6.0**	**6.0**	**6.5**	**6.5**
	%N1	**63.0**	**68.6**	**73.2**	**77.4**	**81.2**
	KIAS	137	151	164	176	187
FLAPS 10 (GEAR UP) VREF40+30	**PITCH ATT**	**4.0**	**4.0**	**4.0**	**4.5**	**4.5**
	%N1	**65.8**	**71.5**	**76.1**	**80.3**	**84.1**
	KIAS	137	151	164	176	187
FLAPS 15 (GEAR UP) VREF40+20	**PITCH ATT**	**4.5**	**4.5**	**4.5**	**5.0**	**5.0**
	%N1	**66.1**	**71.9**	**76.8**	**81.1**	**84.9**
	KIAS	127	141	154	166	177
FLAPS 25 (GEAR UP) VREF40+10	**PITCH ATT**	**5.0**	**5.0**	**5.0**	**5.0**	**5.0**
	%N1	**68.0**	**73.7**	**78.8**	**83.1**	**87.1**
	KIAS	117	131	144	156	167
FLAPS 15 (GEAR DOWN) VREF40+20	**PITCH ATT**	**4.5**	**4.5**	**5.0**	**5.0**	**5.0**
	%N1	**71.2**	**77.0**	**82.1**	**86.5**	**90.9**
	KIAS	127	141	154	166	177

Flight With Unreliable Airspeed/ Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

FINAL APPROACH (1500 FT)

Gear Down, %N1 for 3° Glideslope

Airport Altitude = -2000 FT

FLAP POSITION (VREF+INCREMENT)		WEIGHT (1000 KG)				
		40	50	60	70	80
FLAPS 15 (VREF15 + 10)	**PITCH ATT**	**1.5**	**2.0**	**2.0**	**2.0**	**2.5**
	%N1	**40.5**	**44.6**	**48.5**	**51.7**	**54.8**
	KIAS	126	140	153	164	174
FLAPS 30 (VREF30 + 10)	**PITCH ATT**	**1.0**	**1.0**	**1.0**	**1.5**	**1.5**
	%N1	**46.1**	**50.8**	**55.0**	**58.5**	**61.8**
	KIAS	121	134	146	157	166
FLAPS 40 (VREF40 + 10)	**PITCH ATT**	**0.0**	**0.5**	**0.5**	**1.0**	**0.5**
	%N1	**49.5**	**54.6**	**59.0**	**63.0**	**66.9**
	KIAS	115	127	139	149	161

Airport Altitude = -1000 FT

FLAP POSITION (VREF+INCREMENT)		WEIGHT (1000 KG)				
		40	50	60	70	80
FLAPS 15 (VREF15 + 10)	**PITCH ATT**	**1.5**	**2.0**	**2.0**	**2.0**	**2.5**
	%N1	**41.0**	**45.2**	**49.1**	**52.4**	**55.5**
	KIAS	126	140	153	164	174
FLAPS 30 (VREF30 + 10)	**PITCH ATT**	**1.0**	**1.0**	**1.0**	**1.5**	**1.5**
	%N1	**46.7**	**51.5**	**55.7**	**59.3**	**62.6**
	KIAS	121	134	146	157	166
FLAPS 40 (VREF40 + 10)	**PITCH ATT**	**0.0**	**0.5**	**0.5**	**0.5**	**0.5**
	%N1	**50.2**	**55.3**	**59.8**	**63.8**	**67.6**
	KIAS	115	127	139	150	161

Airport Altitude = SEA LEVEL

FLAP POSITION (VREF+INCREMENT)		WEIGHT (1000 KG)				
		40	50	60	70	80
FLAPS 15 (VREF15 + 10)	**PITCH ATT**	**1.5**	**2.0**	**2.0**	**2.0**	**2.5**
	%N1	**41.5**	**45.8**	**49.7**	**53.1**	**56.2**
	KIAS	126	140	153	164	174
FLAPS 30 (VREF30 + 10)	**PITCH ATT**	**1.0**	**1.0**	**1.0**	**1.5**	**1.5**
	%N1	**47.3**	**52.2**	**56.4**	**60.1**	**63.4**
	KIAS	121	134	146	157	166
FLAPS 40 (VREF40 + 10)	**PITCH ATT**	**0.0**	**0.5**	**0.5**	**0.5**	**0.5**
	%N1	**50.9**	**56.1**	**60.6**	**64.7**	**68.4**
	KIAS	115	128	139	150	161

Flight With Unreliable Airspeed/ Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

FINAL APPROACH (1500 FT)

Gear Down, %N1 for 3° Glideslope

Airport Altitude = 1000 FT

FLAP POSITION (VREF+INCREMENT)		WEIGHT (1000 KG) 40	50	60	70	80
FLAPS 15 (VREF15 + 10)	**PITCH ATT**	**1.5**	**2.0**	**2.0**	**2.0**	**2.5**
	%N1	**42.1**	**46.5**	**50.3**	**53.8**	**56.9**
	KIAS	126	140	153	164	174
FLAPS 30 (VREF30 + 10)	**PITCH ATT**	**1.0**	**1.0**	**1.0**	**1.5**	**1.5**
	%N1	**48.0**	**52.9**	**57.1**	**60.8**	**64.2**
	KIAS	121	134	146	157	166
FLAPS 40 (VREF40 + 10)	**PITCH ATT**	**0.0**	**0.5**	**0.5**	**0.5**	**0.5**
	%N1	**51.6**	**56.8**	**61.5**	**65.5**	**69.2**
	KIAS	115	128	139	150	161

Airport Altitude = 2000 FT

FLAP POSITION (VREF+INCREMENT)		WEIGHT (1000 KG) 40	50	60	70	80
FLAPS 15 (VREF15 + 10)	**PITCH ATT**	**1.5**	**2.0**	**2.0**	**2.0**	**2.5**
	%N1	**42.6**	**47.2**	**51.0**	**54.5**	**57.6**
	KIAS	126	140	153	164	174
FLAPS 30 (VREF30 + 10)	**PITCH ATT**	**1.0**	**1.0**	**1.0**	**1.5**	**1.5**
	%N1	**48.6**	**53.6**	**57.8**	**61.6**	**64.9**
	KIAS	121	134	146	157	166
FLAPS 40 (VREF40 + 10)	**PITCH ATT**	**0.0**	**0.5**	**0.5**	**0.5**	**0.5**
	%N1	**52.3**	**57.5**	**62.3**	**66.3**	**70.0**
	KIAS	115	128	140	150	161

Airport Altitude = 3000 FT

FLAP POSITION (VREF+INCREMENT)		WEIGHT (1000 KG) 40	50	60	70	80
FLAPS 15 (VREF15 + 10)	**PITCH ATT**	**1.5**	**2.0**	**2.0**	**2.0**	**2.5**
	%N1	**43.2**	**47.8**	**51.7**	**55.2**	**58.3**
	KIAS	126	140	153	164	174
FLAPS 30 (VREF30 + 10)	**PITCH ATT**	**1.0**	**1.0**	**1.0**	**1.5**	**1.5**
	%N1	**49.3**	**54.3**	**58.6**	**62.5**	**65.7**
	KIAS	121	134	146	157	166
FLAPS 40 (VREF40 + 10)	**PITCH ATT**	**0.0**	**0.5**	**0.5**	**0.5**	**0.5**
	%N1	**53.0**	**58.3**	**63.1**	**67.1**	**70.8**
	KIAS	115	128	140	151	161

Flight With Unreliable Airspeed/ Turbulent Air Penetration
Altitude and/or vertical speed indications may also be unreliable.

FINAL APPROACH (1500 FT)
Gear Down, %N1 for 3° Glideslope

Airport Altitude = 4000 FT

FLAP POSITION (VREF+INCREMENT)		WEIGHT (1000 KG) 40	50	60	70	80
FLAPS 15 (VREF15 + 10)	**PITCH ATT**	**1.5**	**2.0**	**2.0**	**2.0**	**2.5**
	%N1	**43.8**	**48.4**	**52.4**	**55.9**	**59.0**
	KIAS	126	140	153	164	174
FLAPS 30 (VREF30 + 10)	**PITCH ATT**	**1.0**	**1.0**	**1.0**	**1.5**	**1.5**
	%N1	**50.0**	**55.0**	**59.4**	**63.2**	**66.5**
	KIAS	121	134	146	157	166
FLAPS 40 (VREF40 + 10)	**PITCH ATT**	**0.0**	**0.5**	**0.5**	**0.5**	**0.5**
	%N1	**53.7**	**59.1**	**63.9**	**67.9**	**71.7**
	KIAS	115	128	140	151	161

Airport Altitude = 5000 FT

FLAP POSITION (VREF+INCREMENT)		WEIGHT (1000 KG) 40	50	60	70	80
FLAPS 15 (VREF15 + 10)	**PITCH ATT**	**1.5**	**2.0**	**2.0**	**2.0**	**2.5**
	%N1	**44.4**	**49.0**	**53.1**	**56.6**	**59.8**
	KIAS	126	140	153	164	174
FLAPS 30 (VREF30 + 10)	**PITCH ATT**	**1.0**	**1.0**	**1.0**	**1.5**	**1.5**
	%N1	**50.7**	**55.7**	**60.2**	**64.0**	**67.3**
	KIAS	121	134	146	157	167
FLAPS 40 (VREF40 + 10)	**PITCH ATT**	**0.0**	**0.5**	**0.5**	**0.5**	**0.5**
	%N1	**54.5**	**59.9**	**64.8**	**68.8**	**72.6**
	KIAS	115	128	140	151	162

Airport Altitude = 6000 FT

FLAP POSITION (VREF+INCREMENT)		WEIGHT (1000 KG) 40	50	60	70	80
FLAPS 15 (VREF15 + 10)	**PITCH ATT**	**1.5**	**2.0**	**2.0**	**2.0**	**2.5**
	%N1	**45.1**	**49.7**	**53.8**	**57.3**	**60.6**
	KIAS	126	140	153	164	175
FLAPS 30 (VREF30 + 10)	**PITCH ATT**	**1.0**	**1.0**	**1.0**	**1.5**	**1.5**
	%N1	**51.4**	**56.4**	**61.0**	**64.8**	**68.0**
	KIAS	121	134	146	157	167
FLAPS 40 (VREF40 + 10)	**PITCH ATT**	**0.0**	**0.5**	**0.5**	**0.5**	**0.5**
	%N1	**55.2**	**60.8**	**65.6**	**69.6**	**73.4**
	KIAS	115	128	140	151	162

Flight With Unreliable Airspeed/ Turbulent Air Penetration
Altitude and/or vertical speed indications may also be unreliable.

FINAL APPROACH (1500 FT)
Gear Down, %N1 for 3° Glideslope

Airport Altitude = 7000 FT

FLAP POSITION (VREF+INCREMENT)		WEIGHT (1000 KG) 40	50	60	70	80
FLAPS 15 (VREF15 + 10)	**PITCH ATT**	**1.5**	**2.0**	**2.0**	**2.0**	**2.5**
	%N1	**45.7**	**50.4**	**54.5**	**58.0**	**61.4**
	KIAS	126	140	153	164	175
FLAPS 30 (VREF30 + 10)	**PITCH ATT**	**1.0**	**1.0**	**1.0**	**1.5**	**1.5**
	%N1	**52.1**	**57.2**	**61.8**	**65.6**	**68.8**
	KIAS	121	134	146	157	167
FLAPS 40 (VREF40 + 10)	**PITCH ATT**	**0.0**	**0.5**	**0.5**	**0.5**	**0.5**
	%N1	**56.0**	**61.6**	**66.4**	**70.5**	**74.3**
	KIAS	115	128	141	152	162

Airport Altitude = 8000 FT

FLAP POSITION (VREF+INCREMENT)		WEIGHT (1000 KG) 40	50	60	70	80
FLAPS 15 (VREF15 + 10)	**PITCH ATT**	**1.5**	**2.0**	**2.0**	**2.0**	**2.5**
	%N1	**46.4**	**51.1**	**55.2**	**58.8**	**62.2**
	KIAS	126	140	153	164	175
FLAPS 30 (VREF30 + 10)	**PITCH ATT**	**1.0**	**1.0**	**1.0**	**1.5**	**1.5**
	%N1	**52.8**	**57.9**	**62.5**	**66.3**	**69.6**
	KIAS	121	134	146	157	167
FLAPS 40 (VREF40 + 10)	**PITCH ATT**	**0.0**	**0.5**	**0.5**	**0.5**	**0.5**
	%N1	**56.7**	**62.4**	**67.2**	**71.5**	**75.1**
	KIAS	115	128	141	152	162

Airport Altitude = 9000 FT

FLAP POSITION (VREF+INCREMENT)		WEIGHT (1000 KG) 40	50	60	70	80
FLAPS 15 (VREF15 + 10)	**PITCH ATT**	**1.5**	**2.0**	**2.0**	**2.0**	**2.0**
	%N1	**47.1**	**51.8**	**55.9**	**59.6**	**63.0**
	KIAS	126	140	153	164	175
FLAPS 30 (VREF30 + 10)	**PITCH ATT**	**1.0**	**1.0**	**1.0**	**1.5**	**1.5**
	%N1	**53.5**	**58.8**	**63.3**	**67.1**	**70.5**
	KIAS	121	134	146	157	167
FLAPS 40 (VREF40 + 10)	**PITCH ATT**	**0.0**	**0.5**	**0.5**	**0.5**	**0.5**
	%N1	**57.5**	**63.2**	**68.1**	**72.3**	**76.0**
	KIAS	115	129	141	152	163

Flight With Unreliable Airspeed/ Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

FINAL APPROACH (1500 FT)

Gear Down, %N1 for 3° Glideslope

Airport Altitude = 10000 FT

FLAP POSITION (VREF+INCREMENT)		WEIGHT (1000 KG)				
		40	50	60	70	80
FLAPS 15 (VREF15 + 10)	**PITCH ATT**	**1.5**	**2.0**	**2.0**	**2.0**	**2.0**
	%N1	**47.7**	**52.5**	**56.7**	**60.4**	**63.7**
	KIAS	126	140	153	165	176
FLAPS 30 (VREF30 + 10)	**PITCH ATT**	**1.0**	**1.0**	**1.0**	**1.5**	**1.5**
	%N1	**54.2**	**59.6**	**64.1**	**67.9**	**71.3**
	KIAS	121	134	146	157	167
FLAPS 40 (VREF40 + 10)	**PITCH ATT**	**0.0**	**0.5**	**0.0**	**0.5**	**0.5**
	%N1	**58.3**	**64.1**	**68.9**	**73.3**	**76.8**
	KIAS	115	129	141	153	163

Airport Altitude = 11000 FT

FLAP POSITION (VREF+INCREMENT)		WEIGHT (1000 KG)				
		40	50	60	70	80
FLAPS 15 (VREF15 + 10)	**PITCH ATT**	**1.5**	**2.0**	**2.0**	**2.0**	**2.0**
	%N1	**48.3**	**53.2**	**57.4**	**61.2**	**64.4**
	KIAS	126	140	153	165	176
FLAPS 30 (VREF30 + 10)	**PITCH ATT**	**1.0**	**1.0**	**1.0**	**1.5**	**1.5**
	%N1	**55.0**	**60.4**	**64.9**	**68.7**	**72.1**
	KIAS	121	134	146	157	167
FLAPS 40 (VREF40 + 10)	**PITCH ATT**	**0.0**	**0.0**	**0.0**	**0.5**	**0.5**
	%N1	**59.2**	**64.9**	**69.9**	**74.1**	**77.7**
	KIAS	115	129	142	153	164

Airport Altitude = 12000 FT

FLAP POSITION (VREF+INCREMENT)		WEIGHT (1000 KG)				
		40	50	60	70	80
FLAPS 15 (VREF15 + 10)	**PITCH ATT**	**1.5**	**2.0**	**2.0**	**2.0**	**2.0**
	%N1	**49.0**	**53.9**	**58.2**	**62.0**	**65.2**
	KIAS	126	140	153	165	176
FLAPS 30 (VREF30 + 10)	**PITCH ATT**	**1.0**	**1.0**	**1.0**	**1.5**	**1.5**
	%N1	**55.7**	**61.2**	**65.7**	**69.5**	**72.9**
	KIAS	121	134	146	157	167
FLAPS 40 (VREF40 + 10)	**PITCH ATT**	**0.0**	**0.0**	**0.0**	**0.0**	**0.5**
	%N1	**60.0**	**65.7**	**70.8**	**75.0**	**78.6**
	KIAS	115	129	142	153	164

Flight With Unreliable Airspeed/ Turbulent Air Penetration
Altitude and/or vertical speed indications may also be unreliable.

FINAL APPROACH (1500 FT)
Gear Down, %N1 for 3° Glideslope

Airport Altitude = 13000 FT

FLAP POSITION (VREF+INCREMENT)		WEIGHT (1000 KG) 40	50	60	70	80
FLAPS 15 (VREF15 + 10)	**PITCH ATT**	**1.5**	**2.0**	**2.0**	**2.0**	**2.0**
	%N1	**49.7**	**54.7**	**59.0**	**62.8**	**65.9**
	KIAS	126	140	153	166	177
FLAPS 30 (VREF30 + 10)	**PITCH ATT**	**1.0**	**1.0**	**1.0**	**1.5**	**1.5**
	%N1	**56.5**	**62.0**	**66.5**	**70.4**	**73.7**
	KIAS	121	134	147	157	167
FLAPS 40 (VREF40 + 10)	**PITCH ATT**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**
	%N1	**60.8**	**66.6**	**71.7**	**75.8**	**79.5**
	KIAS	116	129	142	154	164

Airport Altitude = 14000 FT

FLAP POSITION (VREF+INCREMENT)		WEIGHT (1000 KG) 40	50	60	70	80
FLAPS 15 (VREF15 + 10)	**PITCH ATT**	**1.5**	**2.0**	**2.0**	**2.0**	**2.0**
	%N1	**50.5**	**55.4**	**59.9**	**63.6**	**66.7**
	KIAS	126	140	154	166	177
FLAPS 30 (VREF30 + 10)	**PITCH ATT**	**1.0**	**1.0**	**1.0**	**1.5**	**1.5**
	%N1	**57.5**	**62.9**	**67.4**	**71.3**	**74.5**
	KIAS	121	134	147	157	167
FLAPS 40 (VREF40 + 10)	**PITCH ATT**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**
	%N1	**61.8**	**67.6**	**72.7**	**76.8**	**80.5**
	KIAS	116	130	143	154	165

Airport Altitude = 14500 FT

FLAP POSITION (VREF+INCREMENT)		WEIGHT (1000 KG) 40	50	60	70	80
FLAPS 15 (VREF15 + 10)	**PITCH ATT**	**1.5**	**2.0**	**2.0**	**2.0**	**2.0**
	%N1	**51.0**	**55.9**	**60.4**	**64.0**	**67.1**
	KIAS	126	141	154	166	177
FLAPS 30 (VREF30 + 10)	**PITCH ATT**	**1.0**	**1.0**	**1.0**	**1.5**	**1.5**
	%N1	**58.1**	**63.4**	**67.9**	**71.7**	**74.9**
	KIAS	121	134	147	157	167
FLAPS 40 (VREF40 + 10)	**PITCH ATT**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**
	%N1	**62.4**	**68.2**	**73.2**	**77.3**	**81.0**
	KIAS	116	130	143	154	165

Flight With Unreliable Airspeed/ Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

GO-AROUND

Flaps 15, Gear Up, Set Go-Around Thrust

PRESSURE ALTITUDE (FT)		WEIGHT (1000 KG)				
		40	50	60	70	80
14500	**PITCH ATT**	**16.5**	**13.0**	**11.0**	**9.5**	**8.5**
	V/S (FT/MIN)	3400	2600	2100	1600	1300
	KIAS	126	140	153	164	175
10000	**PITCH ATT**	**19.5**	**15.5**	**13.0**	**11.0**	**10.0**
	V/S (FT/MIN)	3900	3100	2500	2000	1600
	KIAS	125	139	151	163	173
5000	**PITCH ATT**	**23.5**	**18.5**	**15.5**	**13.5**	**11.5**
	V/S (FT/MIN)	4500	3600	3000	2500	2100
	KIAS	125	138	150	161	172
SEA LEVEL	**PITCH ATT**	**27.5**	**21.5**	**18.0**	**15.5**	**13.5**
	V/S (FT/MIN)	5100	4200	3400	2900	2500
	KIAS	125	138	149	160	171
-2000	**PITCH ATT**	**27.5**	**22.0**	**18.0**	**15.5**	**13.5**
	V/S (FT/MIN)	5000	4100	3400	2800	2400
	KIAS	125	137	149	159	171

Intentionally
Blank

Performance Inflight — Chapter PI
All Engine — Section 71

Long Range Cruise Maximum Operating Altitude
Max Cruise Thrust
ISA + 10°C and Below

WEIGHT (1000 KG)	OPTIMUM ALT (FT)	TAT (°C)	MARGIN TO INITIAL BUFFET 'G' (BANK ANGLE)				
			1.20 (33°)	1.25 (36°)	1.30 (39°)	1.40 (44°)	1.50 (48°)
85	31100	-7	33400*	33400*	33400	31800	30400
80	32400	-10	35000*	35000*	34700	33100	31700
75	33800	-13	36400*	36400*	36100	34500	33100
70	35200	-16	37800*	37800*	37500	36000	34600
65	36800	-18	39200*	39200*	39000	37500	36100
60	38500	-18	40700*	40700*	40700	39200	37800
55	40300	-18	41000	41000	41000	41000	39600
50	41000	-18	41000	41000	41000	41000	41000
45	41000	-18	41000	41000	41000	41000	41000
40	41000	-18	41000	41000	41000	41000	41000

ISA + 15°C

WEIGHT (1000 KG)	OPTIMUM ALT (FT)	TAT (°C)	MARGIN TO INITIAL BUFFET 'G' (BANK ANGLE)				
			1.20 (33°)	1.25 (36°)	1.30 (39°)	1.40 (44°)	1.50 (48°)
85	31100	-1	31400*	31400*	31400*	31400*	30400
80	32400	-4	33600*	33600*	33600*	33100	31700
75	33800	-7	35400*	35400*	35400*	34500	33100
70	35200	-11	36800*	36800*	36800*	36000	34600
65	36800	-12	38200*	38200*	38200*	37500	36100
60	38500	-12	39600*	39600*	39600*	39200	37800
55	40300	-12	41000	41000	41000	41000	39600
50	41000	-12	41000	41000	41000	41000	41000
45	41000	-12	41000	41000	41000	41000	41000
40	41000	-12	41000	41000	41000	41000	41000

ISA + 20°C

WEIGHT (1000 KG)	OPTIMUM ALT (FT)	TAT (°C)	MARGIN TO INITIAL BUFFET 'G' (BANK ANGLE)				
			1.20 (33°)	1.25 (36°)	1.30 (39°)	1.40 (44°)	1.50 (48°)
85	31100	4	27900*	27900*	27900*	27900*	27900*
80	32400	1	30400*	30400*	30400*	30400*	30400*
75	33800	-2	33200*	33200*	33200*	33200*	33100
70	35200	-5	35400*	35400*	35400*	35400*	34600
65	36800	-7	36900*	36900*	36900*	36900*	36100
60	38500	-7	38300*	38300*	38300*	38300*	37800
55	40300	-7	39800*	39800*	39800*	39800*	39600
50	41000	-7	41000	41000	41000	41000	41000
45	41000	-7	41000	41000	41000	41000	41000
40	41000	-7	41000	41000	41000	41000	41000

***Denotes altitude thrust limited in level flight, 100 fpm residual rate of climb.**

Long Range Cruise Control

WEIGHT (1000 KG)		PRESSURE ALTITUDE (1000 FT)									
		23	25	27	29	31	33	35	37	39	41
85	%N1	84.5	85.8	87.1	88.3	89.7	91.6				
	MACH	.722	.743	.764	.782	.792	.793				
	KIAS	315	312	308	303	294	282				
	FF/ENG	1608	1591	1585	1581	1570	1571				
80	%N1	83.2	84.6	85.8	87.1	88.4	89.8	92.7			
	MACH	.706	.728	.750	.771	.786	.793	.792			
	KIAS	307	305	302	298	292	282	269			
	FF/ENG	1518	1506	1499	1495	1483	1475	1495			
75	%N1	81.6	83.2	84.5	85.8	87.1	88.4	90.1	94.6		
	MACH	.682	.713	.734	.756	.776	.790	.793	.790		
	KIAS	297	298	295	292	288	280	269	256		
	FF/ENG	1414	1421	1413	1407	1398	1388	1382	1452		
70	%N1	79.9	81.5	83.1	84.3	85.7	87.0	88.3	90.8		
	MACH	.659	.689	.718	.739	.761	.781	.792	.793		
	KIAS	286	288	288	285	281	277	269	257		
	FF/ENG	1313	1320	1329	1320	1312	1303	1294	1303		
65	%N1	78.3	79.7	81.4	82.8	84.1	85.5	86.8	88.7	92.1	
	MACH	.638	.663	.694	.721	.743	.765	.784	.792	.793	
	KIAS	276	276	278	277	274	271	266	257	245	
	FF/ENG	1221	1217	1232	1236	1227	1217	1207	1209	1233	
60	%N1	76.7	78.0	79.4	81.1	82.5	83.9	85.3	86.9	89.4	93.3
	MACH	.620	.640	.665	.698	.724	.746	.769	.786	.793	.792
	KIAS	268	266	266	268	267	264	260	255	245	234
	FF/ENG	1140	1124	1128	1142	1142	1132	1123	1124	1131	1165
55	%N1	75.1	76.2	77.5	78.9	80.6	82.1	83.5	85.2	87.4	89.9
	MACH	.604	.620	.640	.666	.699	.725	.748	.771	.787	.793
	KIAS	261	257	255	255	257	256	253	249	243	234
	FF/ENG	1072	1043	1035	1038	1050	1047	1038	1039	1044	1052
50	%N1	73.2	74.5	75.6	76.9	78.3	80.1	81.5	83.3	85.5	87.6
	MACH	.581	.602	.618	.639	.665	.698	.725	.748	.771	.787
	KIAS	250	249	246	244	243	245	244	241	238	232
	FF/ENG	993	974	954	946	947	956	953	951	959	964
45	%N1	70.9	72.4	73.7	74.9	76.1	77.5	79.3	81.2	83.3	85.5
	MACH	.555	.577	.598	.615	.635	.661	.694	.723	.746	.769
	KIAS	239	238	237	234	232	231	233	232	229	226
	FF/ENG	909	895	884	867	856	855	862	866	880	887
40	%N1	68.1	69.8	71.3	72.7	73.9	75.1	76.5	78.5	80.9	83.1
	MACH	.525	.547	.569	.591	.610	.629	.654	.686	.718	.740
	KIAS	225	225	225	224	222	219	218	219	220	217
	FF/ENG	821	812	821	810	794	779	774	782	794	797

Shaded area approximates optimum altitude.

Long Range Cruise Enroute Fuel and Time - Low Altitudes

Ground to Air Miles Conversions

AIR DISTANCE (NM)					GROUND DISTANCE (NM)	AIR DISTANCE (NM)				
HEADWIND COMPONENT (KTS)						TAILWIND COMPONENT (KTS)				
100	80	60	40	20		20	40	60	80	100
293	268	247	229	214	200	190	181	173	166	159
440	403	371	344	321	300	286	272	260	249	239
588	539	496	459	428	400	381	363	347	332	319
736	675	620	574	535	500	476	454	434	415	399
885	810	745	689	642	600	571	544	520	498	479
1034	946	869	804	749	700	667	636	607	582	558
1184	1083	994	920	856	800	762	727	694	665	638
1334	1220	1120	1036	964	900	857	817	781	748	718
1484	1357	1245	1152	1071	1000	952	908	867	831	798
1635	1494	1370	1267	1179	1100	1047	998	954	913	877
1787	1632	1496	1383	1286	1200	1142	1089	1040	996	956
1939	1771	1622	1499	1394	1300	1237	1180	1127	1079	1036
2092	1909	1749	1615	1501	1400	1332	1270	1213	1161	1115
2245	2048	1875	1732	1609	1500	1428	1361	1300	1244	1194
2399	2188	2002	1848	1717	1600	1523	1451	1386	1327	1273
2553	2327	2129	1965	1824	1700	1618	1542	1473	1409	1352
2708	2468	2256	2081	1932	1800	1713	1633	1559	1492	1431
2863	2608	2384	2198	2040	1900	1808	1723	1645	1574	1510
3019	2749	2512	2315	2148	2000	1903	1813	1731	1656	1589

Reference Fuel And Time Required at Check Point

AIR DIST (NM)	PRESSURE ALTITUDE (1000 FT)									
	10		14		20		24		28	
	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)
200	1.5	0:41	1.3	0:40	1.1	0:37	1.0	0:36	0.9	0:35
300	2.3	1:01	2.0	0:58	1.7	0:54	1.6	0:52	1.4	0:50
400	3.0	1:20	2.8	1:16	2.4	1:11	2.1	1:08	2.0	1:05
500	3.8	1:40	3.5	1:34	3.0	1:27	2.7	1:24	2.5	1:20
600	4.6	1:59	4.2	1:53	3.7	1:44	3.3	1:40	3.1	1:36
700	5.3	2:19	4.9	2:11	4.3	2:01	3.9	1:56	3.6	1:51
800	6.1	2:39	5.6	2:30	4.9	2:18	4.5	2:12	4.2	2:06
900	6.9	2:59	6.3	2:49	5.6	2:35	5.0	2:29	4.7	2:21
1000	7.6	3:19	7.0	3:08	6.2	2:52	5.6	2:45	5.3	2:37
1100	8.4	3:40	7.7	3:27	6.8	3:09	6.2	3:01	5.8	2:52
1200	9.1	4:00	8.4	3:46	7.4	3:27	6.8	3:17	6.3	3:08
1300	9.9	4:21	9.1	4:05	8.1	3:44	7.3	3:34	6.8	3:23
1400	10.6	4:41	9.8	4:25	8.7	4:01	7.9	3:50	7.4	3:39
1500	11.3	5:02	10.5	4:44	9.3	4:19	8.4	4:07	7.9	3:55
1600	12.1	5:23	11.2	5:04	9.9	4:37	9.0	4:23	8.4	4:11
1700	12.8	5:44	11.8	5:24	10.5	4:54	9.6	4:40	8.9	4:27
1800	13.5	6:05	12.5	5:44	11.1	5:12	10.1	4:57	9.4	4:42
1900	14.2	6:27	13.2	6:04	11.7	5:30	10.7	5:14	10.0	4:59
2000	15.0	6:48	13.8	6:24	12.3	5:48	11.2	5:30	10.5	5:15

Long Range Cruise Enroute Fuel and Time - Low Altitudes
Fuel Required Adjustments (1000 KG)

REFERENCE FUEL REQUIRED (1000 KG)	WEIGHT AT CHECK POINT (1000 KG)				
	40	50	60	70	80
1	-0.1	0.0	0.0	0.1	0.1
2	-0.2	-0.1	0.0	0.1	0.3
3	-0.4	-0.2	0.0	0.2	0.5
4	-0.5	-0.2	0.0	0.3	0.6
5	-0.6	-0.3	0.0	0.4	0.8
6	-0.8	-0.4	0.0	0.5	1.0
7	-0.9	-0.4	0.0	0.6	1.2
8	-1.0	-0.5	0.0	0.7	1.4
9	-1.1	-0.6	0.0	0.8	1.6
10	-1.3	-0.6	0.0	0.9	1.7
11	-1.4	-0.7	0.0	1.0	1.9
12	-1.5	-0.8	0.0	1.1	2.1
13	-1.6	-0.8	0.0	1.2	2.3
14	-1.7	-0.9	0.0	1.3	2.5
15	-1.9	-1.0	0.0	1.4	2.7

Long Range Cruise Enroute Fuel and Time - High Altitudes
Ground to Air Miles Conversions

AIR DISTANCE (NM)					GROUND DISTANCE (NM)	AIR DISTANCE (NM)				
HEADWIND COMPONENT (KTS)						TAIL WIND COMPONENT (KTS)				
100	80	60	40	20		20	40	60	80	100
537	503	472	445	422	400	382	365	350	337	325
802	752	707	667	632	600	574	550	527	507	489
1068	1002	942	889	843	800	766	734	704	677	653
1335	1252	1177	1112	1053	1000	957	918	881	848	817
1603	1504	1414	1335	1264	1200	1149	1102	1058	1018	981
1872	1756	1651	1558	1475	1400	1341	1286	1235	1188	1145
2142	2009	1888	1781	1686	1600	1533	1470	1411	1358	1309
2413	2262	2125	2005	1898	1800	1724	1653	1588	1528	1473
2684	2515	2362	2228	2109	2000	1916	1837	1764	1698	1637
2956	2769	2600	2452	2320	2200	2107	2021	1941	1867	1801
3229	3024	2839	2676	2532	2400	2299	2204	2117	2037	1964
3503	3280	3078	2901	2743	2600	2490	2388	2294	2207	2128
3778	3536	3317	3125	2955	2800	2682	2572	2470	2377	2292
4053	3792	3556	3350	3167	3000	2873	2756	2647	2546	2455
4329	4049	3796	3575	3379	3200	3065	2939	2823	2716	2618
4605	4306	4036	3800	3590	3400	3256	3122	2999	2885	2781
4883	4564	4276	4025	3802	3600	3448	3306	3175	3054	2944
5161	4823	4517	4251	4015	3800	3639	3489	3351	3223	3107
5440	5082	4758	4477	4227	4000	3830	3672	3526	3392	3270
5719	5341	5000	4702	4439	4200	4022	3856	3702	3561	3433
6000	5601	5242	4929	4652	4400	4213	4039	3878	3730	3595
6282	5863	5485	5155	4864	4600	4404	4222	4053	3898	3757
6566	6125	5728	5383	5077	4800	4595	4405	4229	4067	3919
6851	6388	5972	5610	5290	5000	4786	4588	4404	4235	4081

Long Range Cruise Enroute Fuel and Time - High Altitudes

Reference Fuel And Time Required at Check Point

AIR DIST (NM)	PRESSURE ALTITUDE (1000 FT)									
	31		33		35		37		39	
	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)
400	1.9	1:03	1.8	1:02	1.8	1:01	1.7	1:00	1.7	1:00
600	2.9	1:32	2.8	1:30	2.7	1:29	2.7	1:27	2.6	1:26
800	4.0	2:00	3.8	1:58	3.7	1:56	3.6	1:54	3.6	1:53
1000	5.0	2:29	4.9	2:26	4.7	2:24	4.6	2:21	4.5	2:19
1200	6.0	2:59	5.8	2:55	5.7	2:51	5.5	2:48	5.5	2:46
1400	7.0	3:28	6.8	3:23	6.6	3:19	6.5	3:15	6.4	3:12
1600	8.1	3:58	7.8	3:52	7.6	3:47	7.4	3:43	7.3	3:39
1800	9.0	4:29	8.8	4:21	8.5	4:16	8.3	4:10	8.2	4:06
2000	10.0	4:59	9.7	4:50	9.4	4:44	9.2	4:38	9.1	4:33
2200	11.0	5:30	10.7	5:20	10.4	5:13	10.1	5:06	10.0	5:00
2400	12.0	6:01	11.6	5:50	11.3	5:42	11.0	5:34	10.8	5:27
2600	12.9	6:32	12.5	6:20	12.2	6:11	11.9	6:02	11.7	5:54
2800	13.8	7:04	13.4	6:50	13.1	6:40	12.7	6:30	12.5	6:22
3000	14.8	7:36	14.4	7:21	13.9	7:09	13.6	6:58	13.4	6:49
3200	15.7	8:08	15.2	7:52	14.8	7:39	14.5	7:27	14.2	7:17
3400	16.6	8:40	16.1	8:23	15.7	8:09	15.3	7:56	15.0	7:45
3600	17.5	9:13	17.0	8:55	16.5	8:39	16.1	8:25	15.9	8:13
3800	18.4	9:46	17.9	9:27	17.4	9:10	17.0	8:54	16.7	8:41
4000	19.3	10:19	18.8	9:59	18.2	9:40	17.8	9:24	17.5	9:09
4200	20.2	10:53	19.6	10:32	19.1	10:12	18.6	9:54	18.3	9:38
4400	21.1	11:26	20.5	11:04	19.9	10:43	19.4	10:23	19.1	10:07
4600	22.0	12:00	21.3	11:37	20.7	11:15	20.2	10:54	19.8	10:36
4800	22.9	12:34	22.2	12:11	21.5	11:47	21.0	11:25	20.6	11:05
5000	23.7	13:08	23.0	12:44	22.4	12:20	21.8	11:55	21.4	11:34

Fuel Required Adjustments (1000 KG)

REFERENCE FUEL REQUIRED (1000 KG)	WEIGHT AT CHECKPOINT (1000 KG)				
	40	50	60	70	80
2	-0.3	-0.2	0.0	0.8	1.8
4	-0.6	-0.3	0.0	1.3	3.2
6	-0.8	-0.5	0.0	1.8	4.4
8	-1.1	-0.7	0.0	2.2	5.5
10	-1.5	-0.8	0.0	2.5	6.4
12	-1.8	-1.0	0.0	2.8	7.2
14	-2.1	-1.1	0.0	3.1	7.8
16	-2.4	-1.3	0.0	3.3	8.3
18	-2.7	-1.4	0.0	3.4	8.6
20	-3.1	-1.6	0.0	3.5	8.7
22	-3.4	-1.7	0.0	3.6	8.7
24	-3.7	-1.8	0.0	3.6	8.5
26	-4.1	-2.0	0.0	3.6	8.2

Long Range Cruise Wind-Altitude Trade

PRESSURE ALTITUDE (1000 FT)	CRUISE WEIGHT (1000 KG)								
	85	80	75	70	65	60	55	50	45
41					39	13	1	1	10
39				30	10	1	1	9	22
37		46	21	6	0	2	9	21	36
35	31	13	3	0	2	10	21	35	50
33	7	1	0	4	11	22	34	48	62
31	0	1	6	14	24	35	48	61	74
29	3	9	17	26	37	48	60	72	83
27	12	20	29	39	50	61	71	82	91

The above wind factor tables are for calculation of wind required to maintain present range capability at new pressure altitude, i.e., break-even wind.

Method:

1. **Read wind factors for present and new altitudes from table.**
2. **Determine difference (new altitude wind factor minus present altitude wind factor); This difference may be negative or positive.**
3. **Break-even wind at new altitude is present altitude wind plus difference from step 2.**

Descent

.78/280/250

PRESSURE ALTITUDE (FT)	TIME (MIN)	FUEL (KG)	DISTANCE (NM)				
			LANDING WEIGHT (1000 KG)				
			40	50	60	70	80
41000	26	360	100	117	130	138	142
39000	26	350	95	112	124	133	137
37000	25	350	91	106	119	127	132
35000	25	340	87	102	113	122	127
33000	24	340	83	97	109	117	122
31000	23	330	79	92	103	110	115
29000	22	330	74	87	96	103	108
27000	21	320	69	81	90	97	100
25000	20	310	65	76	84	90	93
23000	19	300	60	70	78	83	86
21000	18	290	56	65	72	76	79
19000	17	280	51	60	66	70	72
17000	15	270	47	54	60	63	65
15000	14	250	43	49	54	57	59
10000	11	210	30	34	36	38	38
5000	7	160	18	19	20	21	21
1500	4	130	9	9	9	9	9

Allowances for a straight-in approach are included.

Holding

Flaps Up

WEIGHT (1000 KG)		PRESSURE ALTITUDE (FT)								
		1500	5000	10000	15000	20000	25000	30000	35000	41000
90	%N1	65.9	68.3	72.3	76.2	80.6	84.9	89.3		
	KIAS	257	258	259	261	263	265	268		
	FF/ENG	1580	1560	1550	1540	1530	1540	1600		
85	%N1	64.4	67.0	70.7	74.8	79.1	83.4	87.7		
	KIAS	250	251	252	253	255	257	260		
	FF/ENG	1500	1480	1460	1460	1440	1450	1490		
80	%N1	62.7	65.6	69.1	73.3	77.5	81.9	86.1		
	KIAS	242	243	244	245	247	249	252		
	FF/ENG	1420	1400	1380	1370	1350	1360	1390		
75	%N1	61.0	64.0	67.5	71.7	75.8	80.2	84.4	89.4	
	KIAS	234	236	236	238	239	241	243	247	
	FF/ENG	1340	1320	1300	1290	1260	1260	1300	1360	
70	%N1	59.3	62.0	66.0	69.8	74.0	78.5	82.7	87.3	
	KIAS	227	227	228	229	231	232	235	238	
	FF/ENG	1270	1240	1220	1200	1180	1170	1200	1240	
65	%N1	57.6	60.1	64.3	67.9	72.2	76.5	80.9	85.3	
	KIAS	219	219	220	221	222	224	226	228	
	FF/ENG	1190	1160	1140	1120	1100	1080	1110	1130	
60	%N1	55.7	58.2	62.2	66.0	70.2	74.4	78.8	83.2	
	KIAS	210	210	211	212	213	214	216	219	
	FF/ENG	1110	1080	1060	1040	1020	1000	1020	1040	
55	%N1	53.7	56.2	59.9	64.0	67.9	72.2	76.6	81.1	89.0
	KIAS	200	201	202	203	204	205	207	209	212
	FF/ENG	1030	1010	980	960	940	920	930	940	1020
50	%N1	51.6	54.0	57.6	61.8	65.5	69.9	74.2	78.7	86.2
	KIAS	191	191	192	193	194	195	196	198	201
	FF/ENG	960	930	910	890	860	860	850	860	920
45	%N1	49.2	51.7	55.2	59.0	63.2	67.2	71.5	76.1	83.4
	KIAS	182	182	182	183	184	185	186	187	190
	FF/ENG	880	850	840	820	800	790	770	770	820
40	%N1	46.8	49.1	52.6	56.2	60.5	64.3	68.7	73.2	80.4
	KIAS	175	175	175	175	175	175	175	176	178
	FF/ENG	830	800	770	740	730	710	700	690	720

This table includes 5% additional fuel for holding in a racetrack pattern.

Intentionally
Blank

Performance Inflight — Chapter PI
Advisory Information — Section 72

ADVISORY INFORMATION

Normal Configuration Landing Distance

Flaps 15

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	70000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 70000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF15	ONE REV	NO REV
Dry Runway									
MAX MANUAL	1010	80/-55	25/35	-35/125	15/-10	25/-25	35	20	40
AUTOBRAKE MAX	1290	65/-65	30/45	-45/155	0/0	30/-30	60	0	5
AUTOBRAKE 3	1850	100/-105	50/75	-75/255	0/0	50/-50	100	0	0
AUTOBRAKE 2	2370	140/-150	75/105	-105/355	30/-45	70/-70	100	60	60
AUTOBRAKE 1	2630	170/-175	90/125	-125/420	70/-80	80/-80	95	205	300
Good Reported Braking Action									
MAX MANUAL	1380	70/-75	35/55	-60/205	35/-30	35/-35	50	65	150
AUTOBRAKE MAX	1480	75/-80	40/55	-60/215	30/-25	35/-40	55	75	165
AUTOBRAKE 3	1855	100/-105	50/75	-80/260	5/0	50/-50	100	5	10
AUTOBRAKE 2	2370	140/-150	75/105	-105/355	30/-45	70/-70	100	60	60
AUTOBRAKE 1	2630	170/-175	90/125	-125/420	70/-80	80/-80	95	205	300
Medium Reported Braking Action									
MAX MANUAL	1925	115/-115	60/85	-95/345	90/-70	55/-55	65	190	455
AUTOBRAKE MAX	1965	120/-120	60/90	-100/350	85/-65	55/-55	75	195	465
AUTOBRAKE 3	2060	120/-125	65/90	-100/360	65/-45	60/-60	100	140	395
AUTOBRAKE 2	2425	145/-155	75/110	-115/405	65/-60	70/-75	100	100	220
AUTOBRAKE 1	2645	170/-180	90/125	-125/440	90/-90	80/-80	95	220	355
Poor Reported Braking Action									
MAX MANUAL	2545	170/-170	90/130	-145/550	220/-145	75/-80	80	425	1110
AUTOBRAKE MAX	2550	170/-170	90/130	-145/550	220/-145	75/-80	80	420	1110
AUTOBRAKE 3	2570	170/-170	90/130	-150/550	215/-135	75/-80	90	425	1120
AUTOBRAKE 2	2730	180/-180	95/135	-155/570	200/-135	80/-85	100	350	965
AUTOBRAKE 1	2855	190/-190	100/145	-160/585	210/-150	85/-90	95	400	980

Reference distance is based on sea level, standard day, no wind or slope, VREF15, two-engine detent No. 2 reverse thrust, and auto speedbrakes.
For max manual braking and manual speedbrakes, increase reference landing distance by 60 m.
For autobrake and manual speedbrakes, increase reference landing distance by 55 m.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Actual (unfactored) distances are shown.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Normal Configuration Landing Distance

Flaps 30

BRAKING CONFIGURATION	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
	70000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 70000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF30	ONE REV	NO REV

Dry Runway

MAX MANUAL	960	65/-50	20/30	-35/120	10/-10	20/-20	35	15	35
AUTOBRAKE MAX	1210	60/-60	30/35	-45/150	0/0	30/-30	55	0	5
AUTOBRAKE 3	1715	90/-95	45/60	-75/245	0/-5	45/-45	90	0	0
AUTOBRAKE 2	2175	130/-135	65/85	-100/340	30/-40	65/-65	90	55	55
AUTOBRAKE 1	2405	150/-155	80/105	-120/400	65/-70	70/-70	85	170	270

Good Reported Braking Action

MAX MANUAL	1305	65/-70	35/45	-60/200	30/-30	35/-35	45	60	130
AUTOBRAKE MAX	1405	70/-75	35/50	-60/210	30/-25	35/-35	55	65	145
AUTOBRAKE 3	1720	90/-95	45/60	-75/250	5/-5	45/-50	90	5	10
AUTOBRAKE 2	2175	130/-135	65/85	-100/340	30/-40	65/-65	90	55	55
AUTOBRAKE 1	2405	150/-155	80/105	-120/400	65/-70	70/-70	85	170	270

Medium Reported Braking Action

MAX MANUAL	1800	105/-105	55/75	-95/335	85/-65	50/-50	60	165	385
AUTOBRAKE MAX	1840	110/-110	55/75	-95/340	80/-60	50/-50	70	165	395
AUTOBRAKE 3	1925	110/-115	60/75	-95/345	60/-50	55/-55	90	125	340
AUTOBRAKE 2	2235	130/-140	70/90	-110/385	65/-60	65/-65	90	95	195
AUTOBRAKE 1	2420	155/-160	80/105	-120/420	90/-80	70/-70	85	185	320

Poor Reported Braking Action

MAX MANUAL	2360	155/-150	80/110	-140/530	205/-135	65/-70	75	360	920
AUTOBRAKE MAX	2365	155/-155	80/110	-140/530	205/-130	70/-75	80	355	915
AUTOBRAKE 3	2390	155/-155	80/110	-140/535	200/-130	70/-75	80	365	930
AUTOBRAKE 2	2525	160/-160	85/115	-145/550	190/-125	75/-80	90	305	805
AUTOBRAKE 1	2625	170/-170	90/120	-150/565	200/-135	75/-80	85	340	830

Reference distance is based on sea level, standard day, no wind or slope, VREF30, two-engine detent No. 2 reverse thrust, and auto speedbrakes.
For max manual braking and manual speedbrakes, increase reference landing distance by 60 m.
For autobrake and manual speedbrakes, increase reference landing distance by 55 m.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Actual (unfactored) distances are shown.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Normal Configuration Landing Distance

Flaps 40

BRAKING CONFIGURATION	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
	70000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 70000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF40	ONE REV	NO REV
Dry Runway									
MAX MANUAL	920	65/-50	20/30	-35/120	10/-10	25/-25	35	15	30
AUTOBRAKE MAX	1140	65/-55	30/40	-45/145	0/0	30/-30	55	0	5
AUTOBRAKE 3	1595	105/-90	50/65	-70/235	0/0	50/-50	90	0	0
AUTOBRAKE 2	2040	145/-125	65/90	-95/330	20/-35	70/-70	95	30	30
AUTOBRAKE 1	2275	165/-150	75/105	-115/390	55/-65	80/-80	85	140	205
Good Reported Braking Action									
MAX MANUAL	1255	75/-65	35/50	-55/200	30/-25	35/-35	50	55	120
AUTOBRAKE MAX	1345	85/-70	40/50	-60/205	30/-25	35/-40	60	60	130
AUTOBRAKE 3	1605	105/-90	50/65	-70/240	10/-5	50/-50	90	5	10
AUTOBRAKE 2	2040	145/-125	65/90	-95/330	20/-35	70/-70	95	30	30
AUTOBRAKE 1	2275	165/-150	75/105	-115/390	55/-65	80/-80	85	140	205
Medium Reported Braking Action									
MAX MANUAL	1725	120/-105	55/80	-90/330	80/-65	55/-55	65	150	355
AUTOBRAKE MAX	1760	125/-105	60/80	-90/335	75/-60	55/-55	75	155	360
AUTOBRAKE 3	1810	130/-110	60/80	-95/340	65/-45	60/-60	90	125	335
AUTOBRAKE 2	2100	150/-130	70/95	-105/375	55/-55	70/-75	95	70	170
AUTOBRAKE 1	2290	165/-150	80/105	-115/410	80/-75	80/-80	85	150	255
Poor Reported Braking Action									
MAX MANUAL	2260	165/-145	80/115	-140/525	200/-130	75/-80	75	330	840
AUTOBRAKE MAX	2265	170/-145	80/115	-140/525	205/-130	75/-80	80	330	840
AUTOBRAKE 3	2285	170/-150	80/115	-140/525	195/-130	75/-80	80	335	850
AUTOBRAKE 2	2395	180/-155	85/120	-145/540	185/-120	80/-85	90	270	740
AUTOBRAKE 1	2495	185/-165	90/125	-150/550	195/-130	85/-90	85	305	745

Reference distance is based on sea level, standard day, no wind or slope, VREF40, two-engine detent No. 2 reverse thrust, and auto speedbrakes.
For max manual braking and manual speedbrakes, increase reference landing distance by 55 m.
For autobrake and manual speedbrakes, increase reference landing distance by 50 m.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Actual (unfactored) distances are shown.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

Airspeed Unreliable (Flaps 15)

VREF15

BRAKING CONFIGURATION	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
	70000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 70000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	1075	85/-60	25/40	-40/130	15/-10	25/-25	N/A	25	50
AUTOBRAKE MAX	1410	70/-70	35/50	-50/165	0/0	35/-35	N/A	0	5
AUTOBRAKE 2	2535	155/-160	80/115	-110/370	45/-55	75/-75	N/A	140	155

Good Reported Braking Action

MAX MANUAL	1465	75/-75	40/55	-60/210	35/-30	40/-40	N/A	80	180
AUTOBRAKE MAX	1580	80/-85	45/60	-65/220	30/-25	40/-40	N/A	90	200
AUTOBRAKE 2	2535	155/-160	80/115	-110/370	45/-55	75/-75	N/A	140	155

Medium Reported Braking Action

MAX MANUAL	2020	120/-120	65/90	-100/350	90/-70	55/-60	N/A	215	525
AUTOBRAKE MAX	2075	120/-125	65/95	-100/355	85/-65	60/-60	N/A	220	540
AUTOBRAKE 3	2240	125/-130	70/100	-105/370	60/-50	65/-65	N/A	135	410

Poor Reported Braking Action

MAX MANUAL	2640	170/-170	95/135	-150/550	215/-140	75/-80	N/A	460	1235
AUTOBRAKE MAX	2650	175/-170	95/135	-150/550	215/-135	80/-85	N/A	460	1230
AUTOBRAKE 3	2695	170/-170	95/135	-150/555	200/-130	80/-85	N/A	450	1235

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Actual (unfactored) distances are shown.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance
Airspeed Unreliable (Flaps 30)
VREF30

BRAKING CONFIGURATION	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
	70000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 70000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV
Dry Runway									
MAX MANUAL	1025	65/-55	25/30	-35/125	15/-10	25/-25	N/A	20	45
AUTOBRAKE MAX	1325	60/-65	30/40	-45/155	0/0	30/-30	N/A	0	5
AUTOBRAKE 2	2335	135/-145	75/95	-105/350	45/-50	70/-70	N/A	120	150
Good Reported Braking Action									
MAX MANUAL	1390	70/-70	40/50	-60/205	35/-30	35/-35	N/A	70	155
AUTOBRAKE MAX	1505	75/-80	40/55	-60/215	30/-25	40/-40	N/A	80	175
AUTOBRAKE 2	2335	135/-145	75/95	-105/350	45/-50	70/-70	N/A	120	150
Medium Reported Braking Action									
MAX MANUAL	1895	110/-110	60/80	-95/340	85/-65	50/-55	N/A	185	445
AUTOBRAKE MAX	1955	110/-115	60/80	-95/345	80/-65	55/-55	N/A	190	460
AUTOBRAKE 3	2085	115/-115	65/85	-100/355	65/-50	60/-60	N/A	120	350
Poor Reported Braking Action									
MAX MANUAL	2455	155/-155	85/115	-140/535	200/-130	70/-75	N/A	390	1020
AUTOBRAKE MAX	2475	160/-155	85/115	-140/535	195/-125	70/-75	N/A	390	1020
AUTOBRAKE 3	2505	155/-155	85/115	-145/540	195/-125	75/-80	N/A	385	1020

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Actual (unfactored) distances are shown.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance
Airspeed Unreliable (Flaps 40)
VREF40

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	70000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 70000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV
Dry Runway									
MAX MANUAL	985	60/-50	25/35	-35/125	10/-10	20/-20	N/A	20	40
AUTOBRAKE MAX	1250	65/-60	30/45	-45/150	5/0	30/-30	N/A	0	5
AUTOBRAKE 2	2205	150/-135	75/100	-100/340	35/-45	65/-65	N/A	95	105
Good Reported Braking Action									
MAX MANUAL	1340	75/-70	40/50	-60/205	35/-30	35/-35	N/A	65	145
AUTOBRAKE MAX	1445	85/-75	40/55	-60/215	30/-25	35/-35	N/A	70	160
AUTOBRAKE 2	2205	150/-135	75/100	-100/340	35/-45	65/-65	N/A	95	105
Medium Reported Braking Action									
MAX MANUAL	1825	120/-105	60/80	-95/335	80/-65	50/-50	N/A	175	410
AUTOBRAKE MAX	1875	125/-110	60/85	-95/340	80/-60	50/-55	N/A	175	420
AUTOBRAKE 3	1975	125/-110	65/90	-100/350	65/-50	55/-55	N/A	125	345
Poor Reported Braking Action									
MAX MANUAL	2360	165/-150	85/120	-140/530	200/-130	70/-70	N/A	365	940
AUTOBRAKE MAX	2375	170/-150	85/120	-140/530	200/-125	70/-75	N/A	360	935
AUTOBRAKE 3	2400	170/-150	85/120	-140/530	195/-125	70/-75	N/A	365	950

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Actual (unfactored) distances are shown.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

All Flaps Up Landing

VREF40 + 55

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	70000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 70000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	1395	235/-80	75/145	-50/270	25/-20	55/-35	70	50	150
AUTOBRAKE MAX	1840	115/-80	55/115	-60/200	5/-5	50/-50	75	10	25
AUTOBRAKE 2	3545	215/-210	125/165	-135/440	55/-75	110/-110	120	175	175

Good Reported Braking Action

MAX MANUAL	1855	100/-95	55/75	-70/240	45/-40	50/-50	50	110	255
AUTOBRAKE MAX	2025	105/-95	60/80	-75/250	30/-25	55/-55	75	100	255
AUTOBRAKE 2	3545	215/-210	125/165	-135/440	55/-75	110/-110	120	175	175

Medium Reported Braking Action

MAX MANUAL	2665	165/-155	95/125	-115/400	120/-95	80/-80	75	325	795
AUTOBRAKE MAX	2715	165/-155	95/130	-115/405	110/-90	80/-80	80	330	805
AUTOBRAKE 3	2990	170/-150	100/140	-125/425	75/-50	90/-90	125	195	590

Poor Reported Braking Action

MAX MANUAL	3600	245/-225	140/195	-175/635	290/-195	110/-115	95	730	2005
AUTOBRAKE MAX	3590	245/-225	140/195	-175/635	290/-190	110/-115	95	725	1995
AUTOBRAKE 3	3640	245/-215	140/195	-175/640	270/-170	115/-120	120	705	1985

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Actual (unfactored) distances are shown.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

ANTISKID INOPERATIVE (Flaps 15)

VREF15

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	70000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 70000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	1785	95/-100	50/70	-80/290	55/-45	45/-45	60	130	300
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Good Reported Braking Action

MAX MANUAL	2010	115/-115	60/85	-100/350	85/-65	55/-55	65	190	465
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Medium Reported Braking Action

MAX MANUAL	2590	165/-165	90/125	-145/550	205/-135	70/-75	80	420	1135
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Poor Reported Braking Action

MAX MANUAL	3490	245/-235	130/190	-245/1020	1915/-310	95/-120	95	1020	3435
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Actual (unfactored) distances are shown.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance
ANTISKID INOPERATIVE (Flaps 30)
VREF30

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	70000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 70000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	1680	90/-90	45/60	-80/280	55/-45	40/-45	60	110	255
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Good Reported Braking Action

MAX MANUAL	1880	105/-110	55/75	-95/340	80/-60	50/-50	65	165	395
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Medium Reported Braking Action

MAX MANUAL	2410	150/-150	80/110	-140/530	190/-125	65/-70	75	355	935
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Poor Reported Braking Action

MAX MANUAL	3230	220/-215	115/165	-235/985	1755/-290	85/-110	85	870	2800
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Actual (unfactored) distances are shown.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

ANTISKID INOPERATIVE (Flaps 40)

VREF40

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	70000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 70000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	1605	100/-90	45/65	-80/275	55/-45	40/-40	60	100	235
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Good Reported Braking Action

MAX MANUAL	1800	115/-105	55/75	-95/335	75/-60	45/-50	65	150	360
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Medium Reported Braking Action

MAX MANUAL	2305	160/-145	80/110	-140/525	190/-125	65/-70	75	330	855
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Poor Reported Braking Action

MAX MANUAL	3100	230/-205	115/165	-230/975	1720/-285	85/-105	85	815	2580
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Actual (unfactored) distances are shown.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

Jammed or Restricted Flight Controls (Flaps 15)

VREF15

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	70000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 70000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV
Dry Runway									
MAX MANUAL	1005	75/-55	25/30	-35/125	15/-10	20/-25	35	20	45
AUTOBRAKE MAX	1290	65/-65	30/45	-45/155	0/0	30/-30	60	0	5
AUTOBRAKE 2	2345	145/-150	75/105	-105/355	35/-45	70/-70	95	80	80
Good Reported Braking Action									
MAX MANUAL	1370	70/-75	35/50	-60/205	35/-30	35/-35	45	70	160
AUTOBRAKE MAX	1465	75/-80	40/55	-60/215	30/-25	35/-35	55	80	180
AUTOBRAKE 2	2345	145/-150	75/105	-105/355	35/-45	70/-70	95	80	80
Medium Reported Braking Action									
MAX MANUAL	1895	115/-115	60/85	-95/340	85/-70	50/-55	65	200	485
AUTOBRAKE MAX	1935	115/-120	60/85	-95/345	80/-65	55/-55	70	205	495
AUTOBRAKE 3	2045	120/-120	60/90	-100/355	60/-40	60/-60	100	140	410
Poor Reported Braking Action									
MAX MANUAL	2490	165/-160	90/125	-145/540	210/-135	70/-75	75	435	1170
AUTOBRAKE MAX	2490	165/-160	90/125	-145/540	210/-135	70/-75	80	435	1170
AUTOBRAKE 3	2515	165/-165	90/125	-145/545	200/-125	75/-80	90	435	1175

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Actual (unfactored) distances are shown.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance
LEADING EDGE FLAPS TRANSIT (Flaps 15)
VREF15 + 15

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	70000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 70000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV
Dry Runway									
MAX MANUAL	1125	80/-60	25/45	-40/135	15/-15	25/-25	35	25	60
AUTOBRAKE MAX	1470	70/-70	35/50	-50/165	0/0	35/-35	65	0	5
AUTOBRAKE 2	2650	160/-170	85/120	-115/375	50/-60	80/-80	90	160	185
Good Reported Braking Action									
MAX MANUAL	1540	80/-80	45/60	-65/220	35/-30	40/-40	50	90	200
AUTOBRAKE MAX	1655	85/-85	45/65	-65/225	35/-30	45/-45	60	100	220
AUTOBRAKE 2	2650	160/-170	85/120	-115/375	50/-60	80/-80	90	160	185
Medium Reported Braking Action									
MAX MANUAL	2120	125/-125	70/95	-100/360	95/-75	60/-60	65	235	575
AUTOBRAKE MAX	2175	125/-130	70/100	-100/365	90/-70	60/-65	75	240	590
AUTOBRAKE 3	2350	130/-135	70/105	-110/380	65/-55	70/-70	95	150	450
Poor Reported Braking Action									
MAX MANUAL	2755	180/-175	100/140	-150/560	220/-145	80/-85	75	495	1325
AUTOBRAKE MAX	2765	180/-180	100/140	-150/565	220/-140	80/-85	85	490	1325
AUTOBRAKE 3	2820	180/-175	100/140	-155/565	205/-135	85/-90	90	475	1320

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Actual (unfactored) distances are shown.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance
LOSS OF SYSTEM A (Flaps 15)
VREF15

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	70000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 70000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	1125	70/-55	25/40	-40/135	15/-15	25/-25	45	30	70
AUTOBRAKE MAX	1290	60/-65	30/45	-45/150	0/0	30/-30	60	0	25
AUTOBRAKE 2	2440	140/-155	70/105	-110/365	0/-10	75/-75	135	0	0

Good Reported Braking Action

MAX MANUAL	1610	90/-90	45/70	-70/230	50/-40	45/-45	70	120	285
AUTOBRAKE MAX	1620	90/-95	50/70	-70/235	40/-35	45/-45	75	120	280
AUTOBRAKE 2	2440	140/-155	70/105	-110/365	0/-10	75/-75	135	0	0

Medium Reported Braking Action

MAX MANUAL	2235	140/-145	75/110	-110/380	120/-95	65/-65	90	325	835
AUTOBRAKE MAX	2220	140/-140	75/110	-110/380	125/-95	65/-65	90	320	830
AUTOBRAKE 3	2220	140/-140	75/110	-110/380	125/-85	65/-65	90	320	830

Poor Reported Braking Action

MAX MANUAL	2920	205/-200	110/160	-160/595	275/-180	85/-90	105	675	1985
AUTOBRAKE MAX	2915	205/-200	110/160	-160/595	280/-185	85/-90	105	675	1980
AUTOBRAKE 3	2915	205/-200	110/160	-160/595	280/-185	85/-90	105	675	1980

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Actual (unfactored) distances are shown.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

LOSS OF SYSTEM A (Flaps 30)

VREF30

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	70000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 70000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	1055	60/-50	25/35	-40/130	15/-15	25/-25	45	25	60
AUTOBRAKE MAX	1210	55/-60	30/35	-45/145	0/0	30/-30	55	0	20
AUTOBRAKE 2	2255	130/-140	65/85	-105/350	0/-15	65/-65	125	0	0

Good Reported Braking Action

MAX MANUAL	1500	80/-85	45/55	-65/225	45/-40	40/-40	65	100	235
AUTOBRAKE MAX	1520	85/-85	45/55	-65/225	40/-30	40/-40	70	100	235
AUTOBRAKE 2	2255	130/-140	65/85	-105/350	0/-15	65/-65	125	0	0

Medium Reported Braking Action

MAX MANUAL	2060	130/-130	70/90	-105/365	110/-85	60/-60	85	270	675
AUTOBRAKE MAX	2050	130/-130	70/90	-105/365	115/-90	60/-60	85	265	670
AUTOBRAKE 3	2055	130/-125	70/90	-105/365	110/-75	60/-60	90	265	670

Poor Reported Braking Action

MAX MANUAL	2680	185/-180	100/135	-155/575	255/-165	80/-85	100	555	1560
AUTOBRAKE MAX	2680	185/-180	100/135	-155/575	260/-170	80/-85	100	555	1560
AUTOBRAKE 3	2680	185/-180	100/135	-155/575	260/-170	80/-85	100	555	1560

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Actual (unfactored) distances are shown.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance
LOSS OF SYSTEM A (Flaps 40)
VREF40

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	70000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 70000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	1005	70/-50	25/35	-35/125	15/-15	20/-25	45	25	50
AUTOBRAKE MAX	1140	65/-55	30/40	-40/140	0/0	25/-25	55	0	25
AUTOBRAKE 2	2085	145/-130	65/90	-100/335	0/-5	60/-60	125	0	0

Good Reported Braking Action

MAX MANUAL	1430	90/-80	45/60	-65/220	45/-35	35/-35	70	90	205
AUTOBRAKE MAX	1440	95/-80	45/60	-65/220	35/-30	35/-40	70	90	205
AUTOBRAKE 2	2085	145/-130	65/90	-100/335	0/-5	60/-60	125	0	0

Medium Reported Braking Action

MAX MANUAL	1950	140/-120	70/95	-100/360	105/-85	55/-55	85	235	590
AUTOBRAKE MAX	1945	140/-120	70/95	-100/355	110/-85	55/-55	85	235	585
AUTOBRAKE 3	1945	140/-120	70/95	-100/355	110/-75	55/-55	90	235	585

Poor Reported Braking Action

MAX MANUAL	2530	195/-170	95/135	-150/560	245/-160	75/-80	95	490	1350
AUTOBRAKE MAX	2535	195/-170	100/140	-150/560	250/-160	75/-80	95	490	1355
AUTOBRAKE 3	2535	195/-170	100/140	-150/560	250/-160	75/-80	95	490	1355

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Actual (unfactored) distances are shown.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

LOSS OF SYSTEM A AND SYSTEM B (Flaps 15)

VREF15

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	70000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 70000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV
Dry Runway									
MAX MANUAL	1595	75/-80	40/60	-60/200	40/-35	40/-40	85	-5	65
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								
Good Reported Braking Action									
MAX MANUAL	2335	130/-135	70/100	-100/345	110/-90	65/-65	110	100	440
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								
Medium Reported Braking Action									
MAX MANUAL	3115	195/-195	105/155	-150/535	235/-170	90/-90	130	370	1410
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								
Poor Reported Braking Action									
MAX MANUAL	3890	265/-260	145/215	-215/800	515/-290	110/-120	140	835	3365
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Actual (unfactored) distances are shown.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

LOSS OF SYSTEM B (Flaps 15)

VREF15

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	70000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 70000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	1120	50/-55	25/40	-40/145	15/-15	25/-25	40	35	70
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Good Reported Braking Action

MAX MANUAL	1435	75/-80	40/55	-60/215	35/-30	35/-35	55	85	190
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Medium Reported Braking Action

MAX MANUAL	1990	120/-120	65/90	-100/350	95/-75	55/-55	70	230	570
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Poor Reported Braking Action

MAX MANUAL	2610	175/-175	95/135	-150/555	225/-150	75/-80	85	495	1365
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Actual (unfactored) distances are shown.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance
MANUAL REVERSION (Flaps 15)
VREF15

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	70000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 70000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	1595	75/-80	40/60	-60/200	40/-35	40/-40	85	-5	65
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Good Reported Braking Action

MAX MANUAL	2335	130/-135	70/100	-100/345	110/-90	65/-65	110	100	440
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Medium Reported Braking Action

MAX MANUAL	3115	195/-195	105/155	-150/535	235/-170	90/-90	130	370	1410
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Poor Reported Braking Action

MAX MANUAL	3890	265/-260	145/215	-215/800	515/-290	110/-120	140	835	3365
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Actual (unfactored) distances are shown.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

One Engine Inoperative Landing (Flaps 15)

VREF15

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	70000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 70000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	1020	80/-55	25/35	-40/130	15/-10	25/-25	35	0	25
AUTOBRAKE MAX	1290	65/-65	30/45	-45/155	0/0	30/-30	60	0	5
AUTOBRAKE 2	2420	140/-150	70/100	-110/360	5/-25	75/-75	120	0	0

Good Reported Braking Action

MAX MANUAL	1425	75/-75	40/55	-60/215	40/-35	35/-35	50	0	85
AUTOBRAKE MAX	1530	80/-85	40/55	-65/225	35/-30	40/-40	60	0	95
AUTOBRAKE 2	2420	140/-150	70/100	-110/360	5/-25	75/-75	120	0	0

Medium Reported Braking Action

MAX MANUAL	2055	120/-125	65/90	-105/370	110/-85	60/-60	70	0	275
AUTOBRAKE MAX	2100	125/-130	65/90	-105/375	100/-80	60/-60	80	0	280
AUTOBRAKE 3	2155	125/-130	65/95	-105/375	90/-65	60/-65	95	0	255

Poor Reported Braking Action

MAX MANUAL	2830	185/-185	95/135	-165/605	290/-185	85/-90	90	0	680
AUTOBRAKE MAX	2830	185/-185	95/135	-165/605	290/-180	85/-90	95	0	680
AUTOBRAKE 3	2865	190/-190	100/135	-165/605	280/-180	85/-90	95	0	685

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Actual (unfactored) distances are shown.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

One Engine Inoperative Landing (Flaps 30)

VREF30

BRAKING CONFIGURATION	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
	70000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 70000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV
Dry Runway									
MAX MANUAL	965	60/-50	20/30	-35/125	15/-10	20/-20	35	0	20
AUTOBRAKE MAX	1210	60/-60	30/35	-45/150	0/0	30/-30	55	0	0
AUTOBRAKE 2	2225	125/-135	65/85	-100/345	10/-30	65/-65	105	0	5
Good Reported Braking Action									
MAX MANUAL	1340	70/-70	35/45	-60/210	35/-30	35/-35	50	0	75
AUTOBRAKE MAX	1445	75/-75	40/50	-65/215	35/-25	35/-35	60	0	85
AUTOBRAKE 2	2225	125/-135	65/85	-100/345	10/-30	65/-65	105	0	5
Medium Reported Braking Action									
MAX MANUAL	1905	110/-115	55/75	-100/355	100/-75	55/-55	65	0	230
AUTOBRAKE MAX	1955	115/-120	60/75	-100/360	95/-70	55/-55	80	0	235
AUTOBRAKE 3	2000	115/-120	60/80	-100/365	85/-65	55/-60	85	0	215
Poor Reported Braking Action									
MAX MANUAL	2595	165/-165	85/115	-155/580	260/-165	75/-80	85	0	550
AUTOBRAKE MAX	2600	165/-170	85/115	-155/580	265/-160	80/-80	95	0	555
AUTOBRAKE 3	2635	170/-170	85/115	-155/585	260/-170	80/-80	85	0	560

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Actual (unfactored) distances are shown.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

Stabilizer Trim Inoperative (Flaps 15)

VREF15

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	70000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 70000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	1005	75/-55	25/30	-35/125	15/-10	20/-25	35	20	45
AUTOBRAKE MAX	1290	65/-65	30/45	-45/155	0/0	30/-30	60	0	5
AUTOBRAKE 2	2345	145/-150	75/105	-105/355	35/-45	70/-70	95	80	80

Good Reported Braking Action

MAX MANUAL	1370	70/-75	35/50	-60/205	35/-30	35/-35	45	70	160
AUTOBRAKE MAX	1465	75/-80	40/55	-60/215	30/-25	35/-35	55	80	180
AUTOBRAKE 2	2345	145/-150	75/105	-105/355	35/-45	70/-70	95	80	80

Medium Reported Braking Action

MAX MANUAL	1895	115/-115	60/85	-95/340	85/-70	50/-55	65	200	485
AUTOBRAKE MAX	1935	115/-120	60/85	-95/345	80/-65	55/-55	70	205	495
AUTOBRAKE 3	2045	120/-120	60/90	-100/355	60/-40	60/-60	100	140	410

Poor Reported Braking Action

MAX MANUAL	2490	165/-160	90/125	-145/540	210/-135	70/-75	75	435	1170
AUTOBRAKE MAX	2490	165/-160	90/125	-145/540	210/-135	70/-75	80	435	1170
AUTOBRAKE 3	2515	165/-165	90/125	-145/545	200/-125	75/-80	90	435	1175

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Actual (unfactored) distances are shown.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

Trailing Edge Flap Asymmetry (1 ≤ Flap Lever <15)

VREF40 + 30

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	70000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 70000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV
Dry Runway									
MAX MANUAL	1135	100/-60	30/65	-40/140	15/-15	25/-25	40	30	60
AUTOBRAKE MAX	1500	85/-70	40/55	-50/175	5/0	40/-40	65	5	15
AUTOBRAKE 2	2715	175/-165	95/125	-115/380	50/-60	80/-80	95	160	185
Good Reported Braking Action									
MAX MANUAL	1495	80/-75	45/60	-60/215	35/-30	40/-40	45	80	175
AUTOBRAKE MAX	1645	90/-80	50/65	-65/225	25/-20	45/-45	65	75	180
AUTOBRAKE 2	2715	175/-165	95/125	-115/380	50/-60	80/-80	95	160	185
Medium Reported Braking Action									
MAX MANUAL	2095	130/-120	70/95	-100/355	90/-70	60/-60	60	225	540
AUTOBRAKE MAX	2155	135/-125	75/100	-100/360	85/-70	60/-60	70	230	550
AUTOBRAKE 3	2375	140/-130	80/105	-110/380	60/-50	70/-70	100	130	385
Poor Reported Braking Action									
MAX MANUAL	2775	190/-175	105/145	-150/560	220/-145	80/-85	75	490	1310
AUTOBRAKE MAX	2785	190/-175	105/145	-150/565	215/-140	85/-85	85	485	1305
AUTOBRAKE 3	2845	190/-170	105/145	-155/570	205/-130	85/-90	95	460	1290

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Actual (unfactored) distances are shown.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance
Trailing Edge Flap Asymmetry (Flap Lever 15 or 25)
VREF15

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	70000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 70000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	1005	75/-55	25/30	-35/125	15/-10	20/-25	35	20	45
AUTOBRAKE MAX	1290	65/-65	30/45	-45/155	0/0	30/-30	60	0	5
AUTOBRAKE 2	2345	145/-150	75/105	-105/355	35/-45	70/-70	95	80	80

Good Reported Braking Action

MAX MANUAL	1370	70/-75	35/50	-60/205	35/-30	35/-35	45	70	160
AUTOBRAKE MAX	1465	75/-80	40/55	-60/215	30/-25	35/-35	55	80	180
AUTOBRAKE 2	2345	145/-150	75/105	-105/355	35/-45	70/-70	95	80	80

Medium Reported Braking Action

MAX MANUAL	1895	115/-115	60/85	-95/340	85/-70	50/-55	65	200	485
AUTOBRAKE MAX	1935	115/-120	60/85	-95/345	80/-65	55/-55	70	205	495
AUTOBRAKE 3	2045	120/-120	60/90	-100/355	60/-40	60/-60	100	140	410

Poor Reported Braking Action

MAX MANUAL	2490	165/-160	90/125	-145/540	210/-135	70/-75	75	435	1170
AUTOBRAKE MAX	2490	165/-160	90/125	-145/540	210/-135	70/-75	80	435	1170
AUTOBRAKE 3	2515	165/-165	90/125	-145/545	200/-125	75/-80	90	435	1175

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Actual (unfactored) distances are shown.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

Trailing Edge Flap Asymmetry (Flap Lever 30)

VREF30

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	70000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 70000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV
Dry Runway									
MAX MANUAL	955	60/-50	20/30	-35/120	10/-10	20/-20	35	20	40
AUTOBRAKE MAX	1210	55/-60	30/35	-45/150	0/0	30/-30	55	0	5
AUTOBRAKE 2	2160	130/-135	65/85	-100/340	30/-40	65/-60	90	75	75
Good Reported Braking Action									
MAX MANUAL	1295	65/-70	35/45	-55/200	30/-25	30/-35	45	60	140
AUTOBRAKE MAX	1390	70/-75	35/50	-60/210	30/-25	35/-35	55	70	155
AUTOBRAKE 2	2160	130/-135	65/85	-100/340	30/-40	65/-60	90	75	75
Medium Reported Braking Action									
MAX MANUAL	1775	105/-105	55/75	-90/330	80/-65	50/-50	60	170	410
AUTOBRAKE MAX	1815	105/-110	55/75	-95/335	75/-60	50/-50	70	175	420
AUTOBRAKE 3	1910	110/-110	55/75	-95/345	60/-45	55/-55	90	125	355
Poor Reported Braking Action									
MAX MANUAL	2310	150/-145	80/110	-140/525	195/-125	65/-70	70	370	965
AUTOBRAKE MAX	2315	150/-150	80/110	-140/525	195/-125	65/-70	80	370	965
AUTOBRAKE 3	2340	150/-150	80/110	-140/525	190/-120	65/-70	80	375	980

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Actual (unfactored) distances are shown.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance
Trailing Edge Flap Disagree (1 ≤ Indicated Flaps <15)
VREF40 + 30

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	70000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 70000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV
Dry Runway									
MAX MANUAL	1135	100/-60	30/65	-40/140	15/-15	25/-25	40	30	60
AUTOBRAKE MAX	1500	85/-70	40/55	-50/175	5/0	40/-40	65	5	15
AUTOBRAKE 2	2715	175/-165	95/125	-115/380	50/-60	80/-80	95	160	185
Good Reported Braking Action									
MAX MANUAL	1495	80/-75	45/60	-60/215	35/-30	40/-40	45	80	175
AUTOBRAKE MAX	1645	90/-80	50/65	-65/225	25/-20	45/-45	65	75	180
AUTOBRAKE 2	2715	175/-165	95/125	-115/380	50/-60	80/-80	95	160	185
Medium Reported Braking Action									
MAX MANUAL	2095	130/-120	70/95	-100/355	90/-70	60/-60	60	225	540
AUTOBRAKE MAX	2155	135/-125	75/100	-100/360	85/-70	60/-60	70	230	550
AUTOBRAKE 3	2375	140/-130	80/105	-110/380	60/-50	70/-70	100	130	385
Poor Reported Braking Action									
MAX MANUAL	2775	190/-175	105/145	-150/560	220/-145	80/-85	75	490	1310
AUTOBRAKE MAX	2785	190/-175	105/145	-150/565	215/-140	85/-85	85	485	1305
AUTOBRAKE 3	2845	190/-170	105/145	-155/570	205/-130	85/-90	95	460	1290

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Actual (unfactored) distances are shown.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

Trailing Edge Flap Disagree (15 ≤ Indicated Flaps <30)

VREF15

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	70000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 70000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV
Dry Runway									
MAX MANUAL	1005	75/-55	25/30	-35/125	15/-10	20/-25	35	20	45
AUTOBRAKE MAX	1290	65/-65	30/45	-45/155	0/0	30/-30	60	0	5
AUTOBRAKE 2	2345	145/-150	75/105	-105/355	35/-45	70/-70	95	80	80
Good Reported Braking Action									
MAX MANUAL	1370	70/-75	35/50	-60/205	35/-30	35/-35	45	70	160
AUTOBRAKE MAX	1465	75/-80	40/55	-60/215	30/-25	35/-35	55	80	180
AUTOBRAKE 2	2345	145/-150	75/105	-105/355	35/-45	70/-70	95	80	80
Medium Reported Braking Action									
MAX MANUAL	1895	115/-115	60/85	-95/340	85/-70	50/-55	65	200	485
AUTOBRAKE MAX	1935	115/-120	60/85	-95/345	80/-65	55/-55	70	205	495
AUTOBRAKE 3	2045	120/-120	60/90	-100/355	60/-40	60/-60	100	140	410
Poor Reported Braking Action									
MAX MANUAL	2490	165/-160	90/125	-145/540	210/-135	70/-75	75	435	1170
AUTOBRAKE MAX	2490	165/-160	90/125	-145/540	210/-135	70/-75	80	435	1170
AUTOBRAKE 3	2515	165/-165	90/125	-145/545	200/-125	75/-80	90	435	1175

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Actual (unfactored) distances are shown.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance
Trailing Edge Flap Disagree (30 ≤ Indicated Flaps <40)
VREF30

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	70000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 70000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	955	60/-50	20/30	-35/120	10/-10	20/-20	35	20	40
AUTOBRAKE MAX	1210	55/-60	30/35	-45/150	0/0	30/-30	55	0	5
AUTOBRAKE 2	2160	130/-135	65/85	-100/340	30/-40	65/-60	90	75	75

Good Reported Braking Action

MAX MANUAL	1295	65/-70	35/45	-55/200	30/-25	30/-35	45	60	140
AUTOBRAKE MAX	1390	70/-75	35/50	-60/210	30/-25	35/-35	55	70	155
AUTOBRAKE 2	2160	130/-135	65/85	-100/340	30/-40	65/-60	90	75	75

Medium Reported Braking Action

MAX MANUAL	1775	105/-105	55/75	-90/330	80/-65	50/-50	60	170	410
AUTOBRAKE MAX	1815	105/-110	55/75	-95/335	75/-60	50/-50	70	175	420
AUTOBRAKE 3	1910	110/-110	55/75	-95/345	60/-45	55/-55	90	125	355

Poor Reported Braking Action

MAX MANUAL	2310	150/-145	80/110	-140/525	195/-125	65/-70	70	370	965
AUTOBRAKE MAX	2315	150/-150	80/110	-140/525	195/-125	65/-70	80	370	965
AUTOBRAKE 3	2340	150/-150	80/110	-140/525	190/-120	65/-70	80	375	980

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Actual (unfactored) distances are shown.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

Trailing Edge Flaps Up Landing

VREF40 + 40

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	70000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 70000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV
Dry Runway									
MAX MANUAL	1240	130/-70	40/100	-45/155	15/-15	30/-30	45	35	70
AUTOBRAKE MAX	1630	90/-70	45/70	-55/180	5/0	40/-40	70	5	15
AUTOBRAKE 2	3080	190/-185	105/140	-125/410	50/-65	95/-95	110	140	140
Good Reported Braking Action									
MAX MANUAL	1670	90/-85	50/70	-65/225	40/-35	45/-45	50	95	210
AUTOBRAKE MAX	1805	95/-90	55/70	-70/235	30/-25	50/-50	70	100	225
AUTOBRAKE 2	3080	190/-185	105/140	-125/410	50/-65	95/-95	110	140	140
Medium Reported Braking Action									
MAX MANUAL	2375	150/-135	80/110	-110/380	105/-85	70/-70	70	270	655
AUTOBRAKE MAX	2415	150/-140	85/115	-110/385	100/-80	70/-70	80	275	665
AUTOBRAKE 3	2625	155/-140	90/120	-115/400	70/-45	80/-80	115	170	505
Poor Reported Braking Action									
MAX MANUAL	3175	220/-200	120/170	-165/600	260/-175	95/-100	85	600	1625
AUTOBRAKE MAX	3165	220/-200	120/170	-165/600	260/-170	95/-100	90	595	1615
AUTOBRAKE 3	3210	220/-195	125/170	-165/605	245/-155	100/-100	110	590	1620

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Actual (unfactored) distances are shown.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Recommended Brake Cooling Schedule

Reference Brake Energy Per Brake (Millions of Foot Pounds)

		WIND CORRECTED BRAKES ON SPEED (KIAS)																	
		80			100			120			140			160			180		
WEIGHT (1000 KG)	OAT (°C)	PRESSURE ALTITUDE (1000 FT)																	
		0	5	10	0	5	10	0	5	10	0	5	10	0	5	10	0	5	10
80	0	15.8	17.9	20.5	23.1	26.2	30.0	31.4	35.7	41.1	40.6	46.2	53.3	50.4	57.4	66.5	59.8	68.3	79.4
	10	16.3	18.5	21.2	23.8	27.1	31.0	32.4	36.9	42.4	41.9	47.7	55.0	52.0	59.3	68.6	61.8	70.4	81.9
	15	16.6	18.8	21.5	24.2	27.5	31.5	32.9	37.4	43.0	42.5	48.4	55.8	52.8	60.1	69.6	62.7	71.4	83.0
	20	16.8	19.1	21.8	24.5	27.9	31.9	33.4	38.0	43.6	43.1	49.0	56.5	53.5	60.9	70.5	63.5	72.3	84.0
	30	17.3	19.6	22.4	25.2	28.6	32.8	34.3	38.9	44.7	44.2	50.3	57.9	54.8	62.4	72.2	65.0	74.0	85.9
	40	17.5	19.9	22.7	25.5	29.0	33.2	34.8	39.5	45.4	44.9	51.1	59.0	55.8	63.5	73.6	66.2	75.5	87.8
	50	17.5	19.9	22.8	25.7	29.2	33.5	35.0	39.9	45.9	45.4	51.7	59.8	56.6	64.6	75.0	67.4	77.0	89.9
70	0	14.3	16.2	18.5	20.7	23.6	27.0	28.1	32.0	36.7	36.2	41.2	47.5	44.9	51.1	59.1	54.1	61.6	71.5
	10	14.8	16.8	19.2	21.4	24.4	27.9	29.1	33.0	37.9	37.4	42.6	49.0	46.4	52.8	61.0	55.8	63.6	73.7
	15	15.0	17.1	19.5	21.8	24.7	28.3	29.5	33.5	38.5	38.0	43.2	49.7	47.0	53.6	61.9	56.6	64.5	74.8
	20	15.2	17.3	19.7	22.1	25.1	28.7	29.9	34.0	39.0	38.5	43.8	50.4	47.7	54.3	62.7	57.3	65.3	75.7
	30	15.7	17.8	20.3	22.7	25.8	29.5	30.7	34.9	40.0	39.5	44.9	51.7	48.9	55.6	64.2	58.8	66.9	77.5
	40	15.9	18.0	20.5	23.0	26.1	29.9	31.1	35.4	40.6	40.1	45.6	52.5	49.7	56.6	65.4	59.8	68.2	79.1
	50	15.9	18.0	20.6	23.1	26.2	30.1	31.3	35.7	41.0	40.5	46.1	53.2	50.3	57.4	66.5	60.7	69.4	80.7
60	0	12.8	14.6	16.6	18.4	20.9	23.9	24.8	28.2	32.3	31.7	36.1	41.5	39.3	44.7	51.6	47.4	53.9	62.4
	10	13.3	15.1	17.2	19.0	21.6	24.7	25.6	29.1	33.3	32.8	37.3	42.9	40.6	46.2	53.3	48.9	55.7	64.4
	15	13.5	15.3	17.5	19.3	22.0	25.1	26.0	29.5	33.8	33.3	37.9	43.5	41.2	46.9	54.0	49.6	56.5	65.3
	20	13.7	15.5	17.7	19.6	22.3	25.5	26.4	29.9	34.3	33.8	38.4	44.1	41.8	47.5	54.7	50.3	57.2	66.1
	30	14.1	16.0	18.2	20.1	22.9	26.1	27.1	30.7	35.2	34.6	39.4	45.2	42.8	48.7	56.1	51.5	58.6	67.8
	40	14.2	16.1	18.4	20.4	23.2	26.5	27.4	31.2	35.7	35.1	40.0	46.0	43.5	49.5	57.1	52.4	59.7	69.1
	50	14.2	16.2	18.5	20.5	23.3	26.6	27.6	31.4	36.0	35.4	40.3	46.5	44.0	50.1	57.9	53.1	60.6	70.3
50	0	11.4	12.9	14.7	16.1	18.3	20.9	21.4	24.3	27.9	27.3	31.0	35.6	33.5	38.1	43.9	40.3	45.8	52.9
	10	11.8	13.4	15.2	16.6	18.9	21.6	22.2	25.2	28.8	28.2	32.0	36.7	34.6	39.4	45.3	41.6	47.3	54.6
	15	11.9	13.6	15.5	16.9	19.2	21.9	22.5	25.6	29.2	28.6	32.5	37.3	35.2	40.0	46.0	42.2	48.0	55.4
	20	12.1	13.8	15.7	17.1	19.5	22.2	22.8	25.9	29.7	29.0	32.9	37.8	35.6	40.5	46.6	42.8	48.7	56.1
	30	12.5	14.1	16.1	17.6	20.0	22.8	23.4	26.6	30.4	29.8	33.8	38.8	36.6	41.6	47.8	43.9	49.9	57.5
	40	12.6	14.3	16.3	17.8	20.2	23.1	23.7	27.0	30.9	30.2	34.3	39.4	37.1	42.2	48.6	44.6	50.8	58.5
	50	12.6	14.3	16.3	17.9	20.3	23.2	23.8	27.1	31.1	30.4	34.6	39.7	37.4	42.6	49.1	45.1	51.4	59.4
40	0	10.0	11.3	12.9	13.8	15.6	17.8	18.1	20.6	23.5	22.8	25.9	29.6	27.8	31.6	36.3	33.2	37.7	43.4
	10	10.3	11.7	13.3	14.2	16.2	18.4	18.7	21.2	24.3	23.5	26.7	30.6	28.7	32.7	37.5	34.3	39.0	44.8
	15	10.5	11.9	13.5	14.4	16.4	18.7	19.0	21.6	24.7	23.9	27.1	31.1	29.2	33.1	38.0	34.8	39.5	45.5
	20	10.6	12.0	13.7	14.7	16.6	19.0	19.3	21.9	25.0	24.2	27.5	31.5	29.6	33.6	38.6	35.3	40.1	46.1
	30	10.9	12.4	14.1	15.1	17.1	19.5	19.8	22.5	25.7	24.9	28.3	32.4	30.4	34.5	39.6	36.2	41.1	47.3
	40	11.0	12.5	14.3	15.2	17.3	19.7	20.0	22.8	26.0	25.2	28.7	32.8	30.8	35.0	40.2	36.7	41.8	48.0
	50	11.0	12.5	14.3	15.3	17.3	19.8	20.1	22.9	26.2	25.3	28.8	33.1	31.0	35.3	40.5	37.0	42.2	48.6

***To correct for wind, enter table with the brakes on speed minus one half the headwind or plus 1.5 times the tailwind. If ground speed is used for brakes on speed, ignore wind and enter table with sea level, 15°C.**

Adjusted Brake Energy Per Brake (Millions of Foot Pounds)
No Reverse Thrust

		REFERENCE BRAKE ENERGY PER BRAKE (MILLIONS OF FOOT POUNDS)								
EVENT		10	20	30	40	50	60	70	80	90
RTO MAX MAN		10	20	30	40	50	60	70	80	90
LANDING	MAX MAN	7.6	15.9	24.8	34.3	44.3	54.6	65.2	76.0	86.9
	MAX AUTO	7.1	14.7	22.8	31.5	40.9	51.1	62.0	73.7	86.4
	AUTOBRAKE 3	6.6	13.5	20.8	28.5	36.9	45.9	55.7	66.5	78.4
	AUTOBRAKE 2	6.0	12.1	18.4	25.1	32.2	40.0	48.4	57.8	68.1
	AUTOBRAKE 1	5.6	11.0	16.4	22.1	28.0	34.4	41.5	49.4	58.3

ADVISORY INFORMATION

Recommended Brake Cooling Schedule

Adjusted Brake Energy Per Brake (Millions of Foot Pounds)

Two Engine Detent Reverse Thrust

		REFERENCE BRAKE ENERGY PER BRAKE (MILLIONS OF FOOT POUNDS)								
EVENT		10	20	30	40	50	60	70	80	90
RTO MAX MAN		10	20	30	40	50	60	70	80	90
LANDING	MAX MAN	7.2	15.0	23.4	32.2	41.5	51.2	61.2	71.5	82.1
	MAX AUTO	5.9	12.3	19.4	27.2	35.7	45.0	55.1	66.2	78.3
	AUTOBRAKE 3	4.1	8.8	14.0	20.0	26.6	34.0	42.1	51.1	60.9
	AUTOBRAKE 2	2.2	4.8	8.1	11.9	16.3	21.4	27.2	33.6	40.8
	AUTOBRAKE 1	1.7	3.5	5.5	7.9	10.7	14.1	18.3	23.3	29.2

Cooling Time (Minutes) - Category H Steel Brakes

	EVENT ADJUSTED BRAKE ENERGY (MILLIONS OF FOOT POUNDS)								
	16 & BELOW	17	20	23	25	28	32	33 TO 48	49 & ABOVE
	BRAKE TEMPERATURE MONITOR SYSTEM INDICATION ON CDS								
	UP TO 2.4	2.6	3.1	3.5	3.9	4.4	4.9	5.0 TO 7.5	7.5 & ABOVE
INFLIGHT GEAR DOWN	NO SPECIAL PROCEDURE REQUIRED	1	2	3	4	5	6	CAUTION	FUSE PLUG MELT ZONE
GROUND		10	20	30	40	50	60		

Cooling Time (Minutes) - Category P Carbon Brakes

	EVENT ADJUSTED BRAKE ENERGY (MILLIONS OF FOOT POUNDS)								
	16 & BELOW	17	19	20.9	23.5	26.9	29.4	30 TO 41	41 & ABOVE
	BRAKE TEMPERATURE MONITOR SYSTEM INDICATION ON CDS								
	UP TO 2.5	2.6	3	3.3	3.8	4.5	4.9	5.0 TO 7.1	7.1 & ABOVE
INFLIGHT GEAR DOWN	NO SPECIAL PROCEDURE REQUIRED	1	4	5	6	7	7.6	CAUTION	FUSE PLUG MELT ZONE
GROUND		6.7	16.0	24.1	35.2	45.9	53.3		

Observe maximum quick turnaround limit.
Table shows energy per brake added by a single stop with all brakes operating. Energy is assumed to be equally distributed among the operating brakes. Total energy is the sum of residual energy plus energy added.
Add 1.0 million foot pounds per brake for each taxi mile.

When in caution zone, wheel fuse plugs may melt. Delay takeoff and inspect after one hour. If overheat occurs after takeoff, extend gear soon for at least 7 minutes.

When in fuse plug melt zone, clear runway immediately. Unless required, do not set parking brake. Do not approach gear or attempt to taxi for one hour. Tire, wheel and brake replacement may be required. If overheat occurs after takeoff, extend gear soon for at least 12 minutes.

Brake temperature monitor system (BTMS) indication on CDS systems page may be used 10 to 15 minutes after airplane has come to a complete stop or inflight with gear retracted to determine recommended cooling schedule.

Performance Inflight — Chapter PI
Engine Inoperative — Section 73

ENGINE INOP

Initial Max Continuous %N1

Based on .79M, A/C high and anti-ice off

TAT (°C)	PRESSURE ALTITUDE (1000 FT)								
	25	27	29	31	33	35	37	39	41
20	96.8	96.6	96.3	96.1	95.9	95.4	95.0	94.7	93.9
15	97.4	97.2	96.9	96.8	96.6	96.2	95.7	95.5	94.8
10	98.0	97.8	97.5	97.4	97.4	96.9	96.5	96.3	95.7
5	98.3	98.6	98.3	98.1	98.1	97.7	97.3	97.1	96.6
0	97.5	98.7	99.2	99.0	98.9	98.5	98.2	98.0	97.5
-5	96.7	98.0	99.1	99.8	99.7	99.3	98.9	98.7	98.4
-10	96.0	97.2	98.4	99.6	100.5	100.2	99.8	99.6	99.4
-15	95.2	96.4	97.6	98.8	100.1	101.0	100.8	100.6	100.3
-20	94.4	95.6	96.8	98.0	99.3	100.5	101.1	100.8	100.6
-25	93.6	94.9	96.0	97.2	98.5	99.7	100.2	100.0	99.8
-30	92.8	94.1	95.2	96.4	97.7	98.8	99.4	99.2	99.0
-35	92.0	93.2	94.4	95.6	96.8	98.0	98.5	98.3	98.1
-40	91.2	92.4	93.5	94.7	96.0	97.1	97.6	97.4	97.2

%N1 Adjustments for Engine Bleeds

BLEED CONFIGURATION	PRESSURE ALTITUDE (1000 FT)								
	25	27	29	31	33	35	37	39	41
ENGINE ANTI-ICE ON	-1.2	-1.1	-1.0	-0.9	-0.8	-0.8	-0.8	-0.8	-0.8
ENGINE & WING ANTI-ICE ON	-4.2	-4.4	-4.5	-4.7	-5.0	-4.8	-4.8	-4.8	-4.8

ENGINE INOP

Max Continuous %N1

37000 FT to 29000 FT Pressure Altitudes

37000 FT PRESS ALT		TAT (°C)											
KIAS	M	-55	-50	-45	-40	-35	-30	-25	-20	-15	-10	-5	0
160	.51	96.6	97.6	98.5	99.4	100.2	99.6	98.8	97.6	96.3	94.7	93.2	91.8
200	.63	96.0	96.9	97.8	98.7	99.6	100.4	100.1	99.3	98.4	97.5	96.3	95.2
240	.74	95.1	96.0	96.8	97.7	98.6	99.4	100.3	100.7	100.0	99.2	98.4	97.5
280	.86	94.3	95.2	96.1	97.0	97.8	98.7	99.5	100.4	101.2	100.9	100.0	99.1
35000 FT PRESS ALT		TAT (°C)											
KIAS	M	-55	-50	-45	-40	-35	-30	-25	-20	-15	-10	-5	0
160	.49	96.5	97.4	98.3	99.2	100.1	99.8	99.0	98.0	96.8	95.4	94.0	92.7
200	.60	96.1	97.0	97.9	98.8	99.7	100.6	100.5	99.6	98.6	97.6	96.5	95.4
240	.71	95.0	95.9	96.8	97.7	98.6	99.4	100.3	100.8	100.2	99.5	98.6	97.7
280	.82	93.8	94.6	95.5	96.4	97.3	98.1	98.9	99.8	100.6	100.3	99.5	98.8
33000 FT PRESS ALT		TAT (°C)											
KIAS	M	-50	-45	-40	-35	-30	-25	-20	-15	-10	-5	0	5
160	.47	97.4	98.3	99.2	100.0	100.8	100.0	99.1	97.9	96.7	95.3	93.9	92.6
200	.58	97.0	97.9	98.8	99.7	100.6	101.4	100.6	99.6	98.6	97.5	96.3	95.1
240	.68	95.9	96.8	97.7	98.5	99.4	100.2	101.1	100.9	100.2	99.4	98.4	97.4
280	.79	94.3	95.1	96.0	96.8	97.7	98.5	99.3	100.2	100.5	99.7	98.9	98.1
320	.89	93.6	94.5	95.4	96.2	97.1	97.9	98.7	99.5	100.3	101.1	100.7	99.8
31000 FT PRESS ALT		TAT (°C)											
KIAS	M	-50	-45	-40	-35	-30	-25	-20	-15	-10	-5	0	5
160	.45	97.3	98.2	99.1	100.0	100.9	101.1	100.2	99.2	98.0	96.6	95.2	93.9
200	.55	97.1	98.0	98.9	99.7	100.6	101.5	101.6	100.7	99.7	98.6	97.4	96.2
240	.66	95.6	96.5	97.4	98.3	99.1	100.0	100.8	101.3	100.5	99.8	98.8	97.8
280	.76	93.8	94.7	95.5	96.4	97.2	98.0	98.8	99.7	100.5	99.8	98.9	98.0
320	.85	92.4	93.2	94.1	94.9	95.7	96.5	97.4	98.2	98.9	99.7	99.9	99.1
29000 FT PRESS ALT		TAT (°C)											
KIAS	M	-45	-40	-35	-30	-25	-20	-15	-10	-5	0	5	10
160	.43	98.1	99.0	99.9	100.8	101.6	101.2	100.2	99.1	97.9	96.4	95.1	93.8
200	.53	97.5	98.4	99.3	100.2	101.0	101.9	101.3	100.4	99.3	98.2	96.9	95.8
240	.63	96.3	97.1	98.0	98.9	99.7	100.5	101.4	101.1	100.2	99.2	98.3	97.2
280	.73	94.2	95.0	95.9	96.7	97.5	98.3	99.1	99.9	100.1	99.1	98.2	97.5
320	.82	92.1	92.9	93.7	94.5	95.3	96.1	96.9	97.7	98.5	99.2	98.5	97.6
360	.91	92.1	92.9	93.7	94.5	95.3	96.1	96.9	97.7	98.5	99.2	100.0	100.1

%N1 Adjustments for Engine Bleeds

BLEED CONFIGURATION	PRESSURE ALTITUDE (1000 FT)				
	29	31	33	35	37
ENGINE ANTI-ICE ON	-0.9	-0.9	-0.8	-0.8	-0.8
ENGINE & WING ANTI-ICE ON	-4.1	-4.3	-4.5	-4.7	-4.7

ENGINE INOP

Max Continuous %N1
27000 FT to 20000 FT Pressure Altitudes

27000 FT PRESS ALT		TAT (°C)											
KIAS	M	-45	-40	-35	-30	-25	-20	-15	-10	-5	0	5	10
160	.41	98.0	98.8	99.7	100.6	101.4	102.2	101.2	100.2	99.0	97.8	96.4	95.1
200	.51	96.9	97.8	98.7	99.6	100.4	101.2	101.8	100.8	99.9	98.8	97.6	96.4
240	.60	95.6	96.5	97.4	98.2	99.1	99.9	100.7	101.3	100.4	99.4	98.5	97.5
280	.70	93.6	94.4	95.3	96.1	96.9	97.7	98.5	99.3	100.1	99.4	98.4	97.6
320	.79	91.6	92.4	93.2	94.0	94.8	95.6	96.4	97.2	98.0	98.7	98.6	97.8
360	.88	91.0	91.8	92.6	93.4	94.2	95.0	95.8	96.6	97.3	98.1	98.8	99.4
25000 FT PRESS ALT		TAT (°C)											
KIAS	M	-40	-35	-30	-25	-20	-15	-10	-5	0	5	10	15
160	.39	98.8	99.7	100.5	101.4	102.2	102.4	101.4	100.3	99.1	97.7	96.5	95.2
200	.49	97.5	98.3	99.2	100.0	100.9	101.7	101.5	100.6	99.5	98.4	97.3	96.2
240	.58	95.7	96.5	97.4	98.2	99.0	99.9	100.7	100.5	99.5	98.6	97.6	96.7
280	.67	93.9	94.7	95.5	96.3	97.1	97.9	98.7	99.5	99.5	98.6	97.6	96.9
320	.76	91.7	92.6	93.4	94.2	95.0	95.8	96.5	97.3	98.0	98.6	97.8	97.2
360	.85	90.4	91.2	92.1	92.9	93.7	94.5	95.3	96.1	96.9	97.6	98.4	98.2
24000 FT PRESS ALT		TAT (°C)											
KIAS	M	-40	-35	-30	-25	-20	-15	-10	-5	0	5	10	15
160	.38	98.6	99.5	100.4	101.2	102.1	102.9	101.9	100.8	99.6	98.4	97.1	95.8
200	.48	97.5	98.4	99.2	100.1	100.9	101.8	102.2	101.1	100.1	99.0	97.8	96.7
240	.57	95.9	96.8	97.6	98.5	99.3	100.1	100.9	101.2	100.2	99.2	98.2	97.3
280	.66	94.2	95.1	95.9	96.7	97.5	98.3	99.1	99.9	100.4	99.4	98.3	97.5
320	.75	92.1	93.0	93.8	94.6	95.4	96.2	96.9	97.7	98.5	99.2	98.6	97.8
360	.83	90.6	91.4	92.2	93.1	93.9	94.7	95.5	96.2	97.0	97.8	98.5	98.6
22000 FT PRESS ALT		TAT (°C)											
KIAS	M	-35	-30	-25	-20	-15	-10	-5	0	5	10	15	20
160	.37	99.1	100.0	100.9	101.7	102.5	102.8	101.8	100.7	99.5	98.2	97.0	95.8
200	.46	98.4	99.3	100.1	101.0	101.8	102.6	102.3	101.2	100.0	98.9	97.8	96.8
240	.55	97.2	98.1	98.9	99.7	100.5	101.3	102.1	101.6	100.5	99.4	98.5	97.5
280	.63	95.7	96.5	97.4	98.2	99.0	99.8	100.6	101.3	101.0	99.8	98.9	98.1
320	.72	93.9	94.7	95.5	96.3	97.1	97.9	98.6	99.4	100.1	100.2	99.3	98.6
360	.80	92.2	93.0	93.8	94.6	95.4	96.1	96.9	97.7	98.4	99.2	99.7	99.1
20000 FT PRESS ALT		TAT (°C)											
KIAS	M	-35	-30	-25	-20	-15	-10	-5	0	5	10	15	20
160	.35	98.7	99.5	100.4	101.2	102.0	102.8	102.5	101.5	100.4	99.2	98.0	96.8
200	.44	98.3	99.2	100.0	100.9	101.7	102.5	103.3	102.3	101.1	100.0	98.9	97.8
240	.53	97.5	98.4	99.2	100.0	100.8	101.7	102.5	103.1	101.8	100.5	99.5	98.6
280	.61	96.2	97.0	97.8	98.7	99.5	100.3	101.1	101.8	102.5	101.3	100.1	99.3
320	.69	94.7	95.5	96.3	97.1	97.9	98.7	99.5	100.2	101.0	101.7	100.9	99.9
360	.77	93.0	93.8	94.6	95.4	96.2	97.0	97.7	98.5	99.2	100.0	100.7	100.4

%N1 Adjustments for Engine Bleeds

BLEED CONFIGURATION	PRESSURE ALTITUDE (1000 FT)				
	20	22	24	25	27
ENGINE ANTI-ICE ON	-0.9	-0.9	-1.0	-1.0	-1.0
ENGINE & WING ANTI-ICE ON	-3.6	-3.8	-3.8	-3.9	-4.0

ENGINE INOP

Max Continuous %N1
18000 FT to 12000 FT Pressure Altitudes

18000 FT PRESS ALT		TAT (°C)											
KIAS	M	-30	-25	-20	-15	-10	-5	0	5	10	15	20	25
160	.34	98.5	99.3	100.2	101.0	101.8	102.6	101.6	100.3	99.2	98.1	97.0	95.9
200	.42	98.7	99.6	100.4	101.2	102.0	102.8	103.1	101.7	100.4	99.3	98.3	97.3
240	.51	97.8	98.7	99.5	100.3	101.1	101.9	102.7	102.5	101.1	99.9	99.0	98.1
280	.59	96.3	97.1	97.9	98.7	99.5	100.3	101.0	101.8	101.6	100.5	99.6	98.8
320	.67	94.8	95.6	96.4	97.2	97.9	98.7	99.5	100.2	101.0	100.9	100.0	99.2
360	.75	93.0	93.8	94.6	95.3	96.1	96.9	97.6	98.4	99.1	99.9	100.2	99.6
16000 FT PRESS ALT		TAT (°C)											
KIAS	M	-30	-25	-20	-15	-10	-5	0	5	10	15	20	25
160	.33	97.1	98.0	98.8	99.6	100.4	101.2	101.6	100.3	99.1	98.1	97.1	96.1
200	.41	98.0	98.8	99.6	100.4	101.2	102.0	102.8	102.5	101.3	100.2	99.3	98.3
240	.49	97.1	97.9	98.7	99.5	100.3	101.1	101.9	102.7	101.8	100.5	99.6	98.7
280	.57	95.6	96.4	97.2	98.0	98.8	99.6	100.3	101.1	101.8	100.9	99.8	99.0
320	.64	94.0	94.8	95.6	96.4	97.2	97.9	98.7	99.4	100.2	100.9	100.2	99.4
360	.72	92.1	92.9	93.7	94.5	95.3	96.1	96.9	97.7	98.4	99.2	99.9	99.6
14000 FT PRESS ALT		TAT (°C)											
KIAS	M	-25	-20	-15	-10	-5	0	5	10	15	20	25	30
160	.31	96.6	97.4	98.2	99.0	99.8	100.6	100.4	99.1	98.0	97.1	96.2	95.3
200	.39	97.1	97.9	98.7	99.5	100.3	101.1	101.8	101.5	101.0	100.1	99.3	98.4
240	.47	96.6	97.4	98.2	99.0	99.8	100.6	101.3	101.8	101.1	100.3	99.5	98.7
280	.54	95.5	96.3	97.1	97.8	98.6	99.4	100.1	100.9	101.0	100.1	99.2	98.5
320	.62	94.1	94.9	95.7	96.5	97.2	98.0	98.7	99.5	100.2	100.3	99.5	98.8
360	.69	92.2	93.1	93.9	94.7	95.5	96.3	97.0	97.8	98.6	99.3	99.6	99.0
12000 FT PRESS ALT		TAT (°C)											
KIAS	M	-20	-15	-10	-5	0	5	10	15	20	25	30	35
160	.30	96.3	97.0	97.8	98.6	99.4	100.1	99.3	98.1	97.1	96.3	95.4	94.5
200	.38	97.1	97.9	98.7	99.5	100.3	101.0	101.5	100.8	99.8	99.0	98.2	97.3
240	.45	96.5	97.3	98.0	98.8	99.6	100.3	101.1	101.0	100.1	99.4	98.6	97.9
280	.52	95.5	96.3	97.0	97.8	98.6	99.3	100.0	100.8	100.3	99.4	98.6	98.0
320	.60	94.0	94.8	95.6	96.4	97.2	97.9	98.7	99.4	100.2	99.7	98.9	98.2
360	.67	92.3	93.2	94.0	94.8	95.6	96.4	97.1	97.9	98.7	99.4	99.1	98.5

%N1 Adjustments for Engine Bleeds

BLEED CONFIGURATION	PRESSURE ALTITUDE (1000 FT)			
	12	14	16	18
ENGINE ANTI-ICE ON	-0.9	-0.9	-0.9	-0.9
ENGINE & WING ANTI-ICE ON	-3.2	-3.4	-3.4	-3.5

ENGINE INOP

Max Continuous %N1
10000 FT to 1000 FT Pressure Altitudes

10000 FT PRESS ALT		TAT (°C)											
KIAS	M	-20	-15	-10	-5	0	5	10	15	20	25	30	35
160	.29	95.2	96.0	96.8	97.6	98.3	99.1	99.8	98.6	97.4	96.6	95.8	94.9
200	.36	96.0	96.7	97.5	98.3	99.0	99.8	100.5	100.5	99.4	98.5	97.8	97.0
240	.43	95.6	96.4	97.2	97.9	98.7	99.4	100.2	100.9	100.1	99.2	98.4	97.7
280	.51	94.5	95.3	96.1	96.9	97.6	98.4	99.1	99.9	100.4	99.5	98.7	98.0
320	.58	93.0	93.9	94.7	95.5	96.2	97.0	97.8	98.6	99.3	99.7	99.0	98.2
360	.65	91.6	92.4	93.2	94.0	94.8	95.6	96.4	97.2	98.0	98.7	99.1	98.5

5000 FT PRESS ALT		TAT (°C)											
KIAS	M	-10	-5	0	5	10	15	20	25	30	35	40	45
160	.26	94.9	95.7	96.4	97.2	98.0	98.8	99.2	98.3	97.4	96.6	95.9	95.1
200	.33	94.7	95.5	96.3	97.1	97.8	98.6	99.4	98.9	98.0	97.3	96.6	95.8
240	.40	94.0	94.8	95.6	96.4	97.2	97.9	98.7	99.5	98.7	97.9	97.2	96.5
280	.46	93.3	94.1	94.9	95.7	96.5	97.3	98.1	98.8	98.9	98.2	97.5	96.8
320	.53	92.5	93.3	94.1	94.9	95.7	96.5	97.2	98.0	98.7	98.4	97.7	97.1
360	.59	91.5	92.3	93.1	93.9	94.7	95.5	96.2	97.0	97.8	98.5	98.0	97.3

3000 FT PRESS ALT		TAT (°C)											
KIAS	M	-5	0	5	10	15	20	25	30	35	40	45	50
160	.26	94.8	95.6	96.4	97.2	98.0	98.7	98.8	97.9	97.1	96.4	95.6	94.8
200	.32	94.5	95.3	96.1	96.9	97.6	98.4	99.2	98.3	97.5	96.8	96.1	95.3
240	.38	94.1	94.9	95.6	96.4	97.2	98.0	98.7	98.8	98.0	97.2	96.6	95.9
280	.45	93.2	94.0	94.8	95.6	96.4	97.2	97.9	98.7	98.3	97.5	96.9	96.2
320	.51	92.5	93.3	94.1	94.9	95.7	96.4	97.2	98.0	98.5	97.8	97.1	96.5
360	.57	91.6	92.4	93.2	94.0	94.7	95.5	96.3	97.1	97.8	98.1	97.4	96.8

1000 FT PRESS ALT		TAT (°C)											
KIAS	M	-5	0	5	10	15	20	25	30	35	40	45	50
160	.25	93.9	94.7	95.4	96.2	97.0	97.8	98.5	98.2	97.4	96.7	96.0	95.2
200	.31	93.5	94.3	95.1	95.9	96.7	97.4	98.2	98.5	97.8	97.0	96.3	95.6
240	.37	93.0	93.8	94.6	95.4	96.1	96.9	97.7	98.4	98.1	97.3	96.6	95.9
280	.43	92.3	93.2	93.9	94.7	95.5	96.3	97.1	97.8	98.3	97.6	96.9	96.2
320	.49	91.6	92.4	93.2	94.0	94.8	95.6	96.3	97.1	97.9	97.9	97.2	96.5
360	.55	90.7	91.5	92.3	93.1	93.9	94.7	95.4	96.2	96.9	97.7	97.3	96.6

%N1 Adjustments for Engine Bleeds

BLEED CONFIGURATION	PRESSURE ALTITUDE (1000 FT)			
	1	3	5	10
ENGINE ANTI-ICE ON	-0.6	-0.8	-0.8	-0.8
ENGINE & WING ANTI-ICE ON	-2.9	-3.0	-3.1	-3.2

ENGINE INOP

MAX CONTINUOUS THRUST

Driftdown Speed/Level Off Altitude

100 ft/min residual rate of climb

WEIGHT (1000 KG)		OPTIMUM DRIFTDOWN SPEED (KIAS)	LEVEL OFF ALTITUDE (FT)		
START DRIFTDOWN	LEVEL OFF		ISA + 10°C & BELOW	ISA + 15°C	ISA + 20°C
85	82	256	18200	17000	15800
80	77	249	19800	18700	17400
75	72	241	21300	20400	19200
70	67	233	22800	21900	20900
65	62	225	24500	23600	22600
60	57	216	26500	25500	24500
55	53	207	28600	27700	26700
50	48	198	30700	30000	29000
45	43	188	32900	32200	31300
40	38	179	35300	34600	33700

Includes APU fuel burn.

ENGINE INOP

MAX CONTINUOUS THRUST

Driftdown/LRC Cruise Range Capability

Ground to Air Miles Conversion

AIR DISTANCE (NM)					GROUND DISTANCE (NM)	AIR DISTANCE (NM)				
HEADWIND COMPONENT (KTS)						TAILWIND COMPONENT (KTS)				
100	80	60	40	20		20	40	60	80	100
141	130	121	113	106	100	94	89	85	81	77
282	260	242	226	212	200	188	179	170	162	154
422	390	363	339	318	300	283	268	255	243	232
563	520	484	452	424	400	378	358	340	324	310
703	650	604	565	530	500	472	448	426	406	387
843	779	725	678	636	600	567	537	511	487	465
982	909	846	791	742	700	661	627	596	569	543
1122	1038	966	903	848	800	756	717	682	650	621
1262	1168	1087	1016	954	900	851	807	767	732	699
1401	1297	1207	1129	1060	1000	945	897	853	813	777
1541	1426	1328	1242	1166	1100	1040	986	938	895	855
1680	1556	1448	1355	1272	1200	1135	1076	1024	976	933
1820	1685	1569	1467	1378	1300	1229	1166	1109	1057	1010
1960	1815	1689	1580	1484	1400	1324	1256	1195	1139	1088
2100	1944	1810	1693	1590	1500	1418	1346	1280	1220	1166
2240	2074	1931	1806	1697	1600	1513	1435	1365	1302	1244
2381	2204	2052	1919	1803	1700	1607	1525	1450	1383	1321
2522	2334	2173	2032	1909	1800	1702	1615	1536	1464	1399

Driftdown/Cruise Fuel and Time

AIR DIST (NM)	FUEL REQUIRED (1000 KG)										TIME (HR:MIN)
	WEIGHT AT START OF DRIFTDOWN (1000 KG)										
	40	45	50	55	60	65	70	75	80	85	
100	0.4	0.4	0.4	0.4	0.4	0.5	0.5	0.5	0.5	0.6	0:18
200	0.8	0.9	0.9	0.9	1.0	1.1	1.2	1.2	1.3	1.3	0:35
300	1.3	1.4	1.5	1.5	1.7	1.8	1.9	2.0	2.1	2.2	0:52
400	1.7	1.8	2.0	2.1	2.3	2.5	2.6	2.8	2.9	3.1	1:10
500	2.1	2.3	2.5	2.7	2.9	3.1	3.3	3.5	3.7	3.9	1:27
600	2.5	2.8	3.0	3.2	3.5	3.7	4.0	4.2	4.4	4.7	1:44
700	2.9	3.2	3.5	3.8	4.0	4.3	4.6	4.9	5.2	5.5	2:01
800	3.3	3.6	4.0	4.3	4.6	4.9	5.3	5.6	5.9	6.3	2:18
900	3.7	4.1	4.4	4.8	5.2	5.5	5.9	6.3	6.6	7.0	2:35
1000	4.1	4.5	4.9	5.3	5.7	6.1	6.6	7.0	7.4	7.8	2:52
1100	4.5	4.9	5.4	5.8	6.3	6.7	7.2	7.6	8.1	8.6	3:09
1200	4.9	5.4	5.9	6.3	6.8	7.3	7.8	8.3	8.8	9.3	3:26
1300	5.3	5.8	6.3	6.8	7.4	7.9	8.4	9.0	9.5	10.1	3:43
1400	5.6	6.2	6.8	7.3	7.9	8.5	9.1	9.6	10.2	10.8	4:00
1500	6.0	6.6	7.2	7.8	8.5	9.1	9.7	10.3	10.9	11.5	4:17
1600	6.4	7.0	7.7	8.3	9.0	9.6	10.3	10.9	11.6	12.3	4:35
1700	6.8	7.4	8.1	8.8	9.5	10.2	10.9	11.6	12.3	13.0	4:52
1800	7.1	7.9	8.6	9.3	10.0	10.8	11.5	12.2	12.9	13.7	5:09

Includes APU fuel burn.
Driftdown at optimum driftdown speed and cruise at LRC speed.

ENGINE INOP

MAX CONTINUOUS THRUST

Long Range Cruise Altitude Capability

100 ft/min residual rate of climb

WEIGHT (1000 KG)	PRESSURE ALTITUDE (FT)		
	ISA + 10°C & BELOW	ISA + 15°C	ISA + 20°C
85	15400	13200	10200
80	17300	15600	13000
75	19300	17700	15600
70	21000	19800	17800
65	22600	21500	20100
60	24200	23200	21900
55	26500	25000	23800
50	29200	27900	26200
45	31500	30600	29300
40	33900	33000	31900

With engine anti-ice on, decrease altitude capability by 1300 ft.
With engine and wing anti-ice on, decrease altitude capability by 5900 ft.

ENGINE INOP

Long Range Cruise Control

WEIGHT (1000 KG)		PRESSURE ALTITUDE (1000 FT)										
		10	15	17	19	21	23	25	27	29	31	33
85	%N1	91.7	95.4	97.8								
	MACH	.548	.582	.597								
	KIAS	304	294	291								
	FF/ENG	3048	2989	3006								
80	%N1	90.3	93.7	95.7	98.5							
	MACH	.536	.572	.586	.601							
	KIAS	297	289	285	281							
	FF/ENG	2883	2820	2805	2840							
75	%N1	88.7	92.2	93.8	96.0							
	MACH	.524	.562	.575	.589							
	KIAS	290	284	279	276							
	FF/ENG	2718	2662	2629	2625							
70	%N1	87.1	90.6	92.0	93.8	96.2						
	MACH	.510	.549	.564	.577	.592						
	KIAS	283	277	274	270	266						
	FF/ENG	2553	2499	2471	2440	2452						
65	%N1	85.4	88.9	90.3	91.8	93.7	96.4					
	MACH	.496	.534	.550	.565	.579	.594					
	KIAS	274	269	267	264	260	256					
	FF/ENG	2390	2336	2310	2281	2258	2283					
60	%N1	83.6	87.0	88.5	89.9	91.5	93.5	96.3				
	MACH	.480	.519	.535	.550	.566	.579	.595				
	KIAS	266	261	259	257	254	250	246				
	FF/ENG	2226	2172	2146	2120	2096	2080	2113				
55	%N1	81.5	85.0	86.4	87.9	89.4	91.0	93.1	96.0			
	MACH	.464	.502	.518	.534	.550	.566	.579	.595			
	KIAS	256	253	251	249	246	244	239	236			
	FF/ENG	2059	2008	1983	1958	1936	1916	1906	1941			
50	%N1	79.3	82.8	84.3	85.7	87.2	88.7	90.3	92.5	95.5		
	MACH	.446	.483	.499	.515	.531	.548	.564	.578	.594		
	KIAS	246	243	242	240	238	236	233	229	226		
	FF/ENG	1894	1845	1821	1796	1774	1754	1740	1735	1765		
45	%N1	76.9	80.4	81.8	83.3	84.7	86.2	87.7	89.3	91.6	94.6	
	MACH	.427	.463	.479	.495	.511	.528	.544	.561	.576	.592	
	KIAS	236	233	231	230	228	226	224	222	218	215	
	FF/ENG	1733	1680	1658	1635	1613	1593	1578	1570	1564	1589	
40	%N1	74.5	77.7	79.2	80.6	82.1	83.5	85.0	86.5	88.1	90.3	93.2
	MACH	.407	.441	.456	.472	.488	.505	.521	.539	.556	.571	.587
	KIAS	225	222	220	219	218	216	214	213	210	207	204
	FF/ENG	1575	1516	1494	1473	1453	1434	1419	1409	1401	1395	1409

ENGINE INOP

MAX CONTINUOUS THRUST

Long Range Cruise Diversion Fuel and Time

Ground to Air Miles Conversion

AIR DISTANCE (NM) HEADWIND COMPONENT (KTS) 100	80	60	40	20	GROUND DISTANCE (KTS)	AIR DISTANCE (NM) TAILWIND COMPONENT (KTS) 20	40	60	80	100
295	270	248	230	214	200	190	180	172	164	158
594	543	498	461	429	400	379	361	344	328	315
895	817	749	692	643	600	569	541	516	492	472
1196	1091	999	923	858	800	759	722	687	656	629
1500	1368	1252	1155	1073	1000	949	902	859	820	785
1805	1645	1504	1387	1288	1200	1138	1081	1030	983	942
2113	1924	1758	1621	1504	1400	1327	1261	1201	1146	1098
2422	2204	2013	1854	1719	1600	1517	1442	1372	1309	1253
2733	2485	2267	2087	1935	1800	1707	1621	1543	1472	1409

Reference Fuel and Time Required at Check Point

AIR DIST (NM)	PRESSURE ALTITUDE (1000 FT) 10 FUEL (1000 KG)	10 TIME (HR:MIN)	14 FUEL (1000 KG)	14 TIME (HR:MIN)	18 FUEL (1000 KG)	18 TIME (HR:MIN)	22 FUEL (1000 KG)	22 TIME (HR:MIN)	26 FUEL (1000 KG)	26 TIME (HR:MIN)
200	1.4	0:42	1.2	0:41	1.1	0:39	1.0	0:38	0.9	0:37
400	2.9	1:22	2.6	1:18	2.4	1:15	2.2	1:13	2.1	1:11
600	4.4	2:02	4.0	1:57	3.7	1:52	3.4	1:48	3.3	1:44
800	5.8	2:42	5.4	2:35	5.0	2:28	4.6	2:23	4.4	2:18
1000	7.3	3:23	6.7	3:14	6.2	3:05	5.8	2:58	5.6	2:52
1200	8.7	4:05	8.0	3:53	7.4	3:43	6.9	3:33	6.7	3:26
1400	10.1	4:47	9.4	4:33	8.7	4:20	8.1	4:09	7.8	4:01
1600	11.5	5:29	10.7	5:13	9.9	4:58	9.2	4:45	8.8	4:36
1800	12.9	6:12	11.9	5:53	11.1	5:36	10.3	5:22	9.9	5:10

Fuel Required Adjustments (1000 KG)

REFERENCE FUEL REQUIRED (1000 KG)	WEIGHT AT CHECK POINT (1000 KG) 40	50	60	70	80
1	-0.1	-0.1	0.0	0.1	0.2
2	-0.3	-0.1	0.0	0.3	0.6
3	-0.4	-0.2	0.0	0.5	1.0
4	-0.6	-0.3	0.0	0.7	1.4
5	-0.7	-0.4	0.0	0.9	1.8
6	-0.9	-0.4	0.0	1.1	2.2
7	-1.0	-0.5	0.0	1.3	2.6
8	-1.2	-0.6	0.0	1.5	2.9
9	-1.3	-0.7	0.0	1.6	3.3
10	-1.5	-0.7	0.0	1.8	3.7
11	-1.6	-0.8	0.0	2.0	4.1
12	-1.8	-0.9	0.0	2.1	4.4
13	-1.9	-1.0	0.0	2.3	4.8
14	-2.0	-1.0	0.0	2.4	5.2

Includes APU fuel burn.

ENGINE INOP

MAX CONTINUOUS THRUST

Holding

Flaps Up

WEIGHT (1000 KG)		PRESSURE ALTITUDE (FT)							
		1500	5000	10000	15000	20000	25000	30000	35000
90	%N1	82.9	85.7	90.0	95.1				
	KIAS	257	258	259	261				
	FF/ENG	2910	2910	2930	3020				
85	%N1	81.2	84.1	88.3	92.9				
	KIAS	250	251	252	253				
	FF/ENG	2740	2740	2750	2810				
80	%N1	79.6	82.4	86.6	91.0	98.6			
	KIAS	242	243	244	245	247			
	FF/ENG	2590	2570	2570	2610	2770			
75	%N1	77.9	80.6	84.8	89.2	95.3			
	KIAS	234	236	236	238	239			
	FF/ENG	2430	2410	2400	2430	2500			
70	%N1	76.1	78.7	82.9	87.1	92.3			
	KIAS	227	227	228	229	231			
	FF/ENG	2270	2250	2240	2250	2280			
65	%N1	74.1	76.8	80.8	85.1	89.7	98.0		
	KIAS	219	219	220	221	222	224		
	FF/ENG	2110	2090	2070	2080	2090	2260		
60	%N1	71.9	74.8	78.6	82.9	87.4	94.0		
	KIAS	210	210	211	212	213	214		
	FF/ENG	1960	1940	1910	1910	1910	1980		
55	%N1	69.6	72.4	76.3	80.5	84.9	90.1		
	KIAS	200	201	202	203	204	205		
	FF/ENG	1810	1780	1760	1740	1740	1770		
50	%N1	67.1	69.8	73.9	77.9	82.3	87.0	95.2	
	KIAS	191	191	192	193	194	195	196	
	FF/ENG	1660	1630	1610	1580	1570	1580	1700	
45	%N1	64.5	67.1	71.2	75.2	79.5	84.0	89.8	
	KIAS	182	182	182	183	184	185	186	
	FF/ENG	1510	1480	1450	1430	1410	1410	1460	
40	%N1	61.4	64.3	68.1	72.3	76.3	80.8	85.6	94.5
	KIAS	175	175	175	175	175	175	175	176
	FF/ENG	1360	1340	1310	1280	1250	1240	1270	1370

This table includes 5% additional fuel for holding in a racetrack pattern.

Intentionally
Blank

Performance Inflight — Chapter PI
Alternate Mode EEC — Section 74

ALTERNATE MODE EEC

Alternate Mode EEC Limit Weight

PERFORMANCE LIMIT	NORMAL MODE PERFORMANCE LIMIT WEIGHT (1000 KG)										
	46	50	54	58	62	66	70	74	78	82	86
FIELD	43.8	47.6	51.4	55.2	58.9	62.7	66.5	70.2	74.0	77.8	81.6
CLIMB	43.0	46.7	50.5	54.2	58.0	61.7	65.5	69.2	73.0	76.7	80.5
OBSTACLE	43.0	46.7	50.5	54.3	58.0	61.8	65.5	69.3	73.0	76.8	80.5
TIRE	45.8	49.8	53.8	57.8	61.8	65.8	69.8	73.8	77.8	81.8	85.8
BRAKE	45.3	49.3	53.3	57.3	61.3	65.3	69.3	73.3	77.3	81.3	85.3

Alternate Mode EEC Takeoff Speed Adjustment

TAKEOFF SPEEDS	TAKEOFF SPEED ADJUSTMENT (KTS)
DRY V1	+1
WET V1	+2
VR	+1
V2	0

Alternate Mode EEC Max Takeoff %N1

Based on engine bleeds for packs on, engine and wing anti-ice on or off

OAT		AIRPORT PRESSURE ALTITUDE (FT)												
°C	°F	-2000	-1000	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
60	140	92.6	93.2	93.6	93.7	93.8	93.9	94.0	94.1	94.0	93.7	93.6	93.5	93.5
55	131	93.2	93.8	94.3	94.4	94.5	94.6	94.7	94.9	94.7	94.4	94.1	93.5	92.8
50	122	93.8	94.4	94.9	95.1	95.2	95.4	95.5	95.6	95.5	95.2	94.9	94.4	93.9
45	113	94.6	95.2	95.6	95.8	95.9	96.1	96.2	96.3	96.2	95.9	95.6	95.3	94.9
40	104	95.2	95.9	96.4	96.5	96.6	96.7	96.8	97.0	96.9	96.6	96.3	96.2	95.9
35	95	95.8	96.5	97.2	97.3	97.4	97.5	97.6	97.7	97.6	97.3	97.0	96.9	96.8
30	86	95.4	96.6	98.1	98.1	98.2	98.2	98.3	98.3	98.2	98.1	97.8	97.7	97.7
25	77	94.6	95.9	97.3	97.9	98.5	98.6	98.5	98.5	98.5	98.5	98.4	98.4	98.5
20	68	93.8	95.1	96.6	97.1	97.7	98.0	98.3	98.6	98.6	98.7	98.6	98.6	98.6
15	59	93.0	94.3	95.8	96.4	97.0	97.3	97.6	97.9	98.3	98.7	98.9	98.9	98.9
10	50	92.3	93.6	95.0	95.6	96.2	96.5	96.8	97.2	97.5	97.9	98.3	98.8	99.3
5	41	91.5	92.8	94.2	94.8	95.4	95.8	96.1	96.4	96.8	97.2	97.6	98.1	98.5
0	32	90.7	92.0	93.4	94.1	94.7	95.0	95.3	95.7	96.0	96.4	96.8	97.3	97.8
-5	23	89.8	91.2	92.6	93.3	93.9	94.2	94.5	94.9	95.3	95.7	96.1	96.5	97.0
-10	14	89.0	90.4	91.8	92.5	93.1	93.4	93.8	94.1	94.5	94.9	95.3	95.8	96.2
-15	5	88.2	89.5	91.0	91.7	92.3	92.6	93.0	93.4	93.7	94.1	94.5	95.0	95.4
-20	-4	87.4	88.7	90.2	90.8	91.5	91.8	92.2	92.6	93.0	93.4	93.7	94.2	94.6
-25	-13	86.5	87.9	89.4	90.0	90.7	91.0	91.4	91.8	92.2	92.6	93.0	93.4	93.8
-30	-22	85.7	87.0	88.5	89.2	89.8	90.2	90.6	91.0	91.4	91.8	92.1	92.6	93.0
-35	-31	84.8	86.2	87.7	88.3	89.0	89.4	89.7	90.2	90.6	90.9	91.3	91.8	92.2
-40	-40	83.9	85.3	86.8	87.5	88.1	88.5	88.9	89.3	89.7	90.1	90.5	90.9	91.4
-45	-49	83.1	84.4	86.0	86.6	87.3	87.7	88.1	88.5	88.9	89.3	89.7	90.1	90.5
-50	-58	82.2	83.5	85.1	85.7	86.4	86.8	87.2	87.7	88.1	88.4	88.8	89.3	89.7

%N1 Adjustments for Engine Bleed

BLEED CONFIGURATION	AIRPORT PRESSURE ALTITUDE (FT)												
	-2000	-1000	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
PACKS OFF	0.7	0.7	0.8	0.9	0.9	0.9	1.0	1.0	1.0	1.0	1.0	1.0	1.0

Intentionally
Blank

Performance Inflight — Chapter PI
Gear Down — Section 75

GEAR DOWN

Long Range Cruise Altitude Capability
Max Cruise Thrust, 100 ft/min residual rate of climb

WEIGHT (1000 KG)	PRESSURE ALTITUDE (FT)		
	ISA + 10°C & BELOW	ISA + 15°C	ISA + 20°C
85	15100	12000	8900
80	17900	15100	12100
75	20800	18000	15300
70	23300	20900	18200
65	25800	24000	21300
60	28300	26800	24900
55	30600	29400	27800
50	32700	31700	30400
45	34900	33900	32700
40	37300	36300	35200

GEAR DOWN

Long Range Cruise Control

WEIGHT (1000 KG)		PRESSURE ALTITUDE (1000 FT)									
		10	21	23	25	27	29	31	33	35	37
85	%N1	86.2									
	MACH	.482									
	KIAS	267									
	FF/ENG	2446									
80	%N1	84.5									
	MACH	.468									
	KIAS	259									
	FF/ENG	2294									
75	%N1	82.8	92.1								
	MACH	.454	.554								
	KIAS	251	248								
	FF/ENG	2145	2123								
70	%N1	80.9	90.1	92.1							
	MACH	.440	.541	.557							
	KIAS	243	242	240							
	FF/ENG	1998	1981	1971							
65	%N1	78.9	88.2	89.8	92.0	95.0					
	MACH	.425	.524	.543	.560	.578					
	KIAS	235	234	233	231	229					
	FF/ENG	1855	1832	1825	1824	1858					
60	%N1	76.8	85.9	87.7	89.4	91.7	94.9				
	MACH	.409	.504	.525	.544	.562	.580				
	KIAS	226	225	225	224	222	220				
	FF/ENG	1716	1678	1679	1676	1681	1716				
55	%N1	74.7	83.6	85.3	87.1	88.9	91.3	94.6			
	MACH	.393	.484	.504	.525	.545	.562	.581			
	KIAS	217	216	216	216	215	213	211			
	FF/ENG	1577	1530	1527	1531	1534	1539	1573			
50	%N1	72.2	81.0	82.7	84.5	86.3	88.1	90.6	93.9		
	MACH	.376	.463	.482	.502	.523	.544	.561	.580		
	KIAS	207	206	206	206	206	205	203	201		
	FF/ENG	1442	1385	1381	1381	1389	1392	1395	1429		
45	%N1	69.5	78.3	80.0	81.7	83.4	85.2	87.1	89.5	92.9	
	MACH	.358	.441	.458	.477	.498	.520	.541	.559	.578	
	KIAS	197	196	196	196	196	196	195	193	191	
	FF/ENG	1311	1244	1237	1237	1242	1247	1251	1252	1280	
40	%N1	66.6	75.2	76.9	78.6	80.3	82.0	83.9	85.8	88.0	91.8
	MACH	.340	.417	.434	.452	.471	.491	.513	.535	.554	.573
	KIAS	187	185	185	185	185	185	185	185	183	181
	FF/ENG	1186	1109	1097	1095	1100	1103	1105	1108	1109	1136

GEAR DOWN

Long Range Cruise Enroute Fuel and Time

Ground to Air Miles Conversion

AIR DISTANCE (NM) HEADWIND COMPONENT (KTS)					GROUND DISTANCE (NM)	AIR DISTANCE (NM) TAILWIND COMPONENT (KTS)				
100	80	60	40	20		20	40	60	80	100
324	290	260	236	217	200	188	178	168	160	153
655	584	523	474	435	400	377	357	338	321	307
990	881	787	713	653	600	566	535	507	482	460
1330	1181	1054	953	871	800	755	713	676	642	613
1675	1485	1323	1195	1091	1000	943	891	844	803	766
2026	1792	1593	1436	1310	1200	1131	1069	1013	962	918
2383	2104	1866	1680	1530	1400	1319	1246	1180	1121	1069
2746	2420	2142	1925	1751	1600	1507	1423	1347	1279	1220
3116	2740	2420	2171	1972	1800	1695	1600	1514	1437	1370

Reference Fuel and Time Required at Check Point

AIR DIST (NM)	PRESSURE ALTITUDE (1000 FT)									
	10		14		20		24		28	
	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)
200	2.4	0:49	2.2	0:47	1.9	0:44	1.7	0:42	1.6	0:41
400	5.0	1:36	4.6	1:32	4.1	1:25	3.8	1:20	3.5	1:17
600	7.5	2:25	6.9	2:17	6.2	2:06	5.7	1:59	5.4	1:54
800	9.9	3:14	9.2	3:03	8.2	2:48	7.7	2:38	7.3	2:31
1000	12.3	4:05	11.4	3:51	10.2	3:31	9.6	3:18	9.1	3:08
1200	14.6	4:56	13.6	4:39	12.2	4:14	11.4	3:59	10.8	3:46
1400	16.9	5:49	15.7	5:28	14.1	4:59	13.2	4:40	12.6	4:25
1600	19.1	6:43	17.8	6:19	16.0	5:44	15.0	5:22	14.2	5:04
1800	21.3	7:39	19.9	7:11	17.9	6:30	16.7	6:05	15.9	5:43

Fuel Required Adjustments (1000 KG)

REFERENCE FUEL REQUIRED (1000 KG)	WEIGHT AT CHECK POINT (1000 KG)				
	40	50	60	70	80
2	-0.3	-0.2	0.0	0.3	0.7
4	-0.6	-0.3	0.0	0.6	1.4
6	-1.0	-0.5	0.0	0.9	2.0
8	-1.3	-0.7	0.0	1.2	2.6
10	-1.6	-0.8	0.0	1.4	3.2
12	-2.0	-1.0	0.0	1.6	3.7
14	-2.3	-1.2	0.0	1.9	4.2
16	-2.7	-1.3	0.0	2.1	4.6
18	-3.0	-1.5	0.0	2.2	5.0
20	-3.3	-1.7	0.0	2.4	5.4
22	-3.7	-1.8	0.0	2.5	5.7

GEAR DOWN

Descent

VREF40 + 70 KIAS

PRESSURE ALTITUDE (FT)	TIME (MIN)	FUEL (KG)	DISTANCE (NM)
41000	21	280	90
39000	20	280	86
37000	19	270	81
35000	19	270	77
33000	18	260	72
31000	17	260	68
29000	16	250	64
27000	16	240	60
25000	15	240	56
23000	14	230	52
21000	13	220	48
19000	12	220	44
17000	12	210	40
15000	11	200	36
10000	8	170	26
5000	6	140	16
1500	4	120	9

Allowances for a straight-in approach are included.

GEAR DOWN

Holding

Flaps Up

WEIGHT (1000 KG)		PRESSURE ALTITUDE (FT)							
		1500	5000	10000	15000	20000	25000	30000	35000
90	%N1	77.5	80.2	84.5	89.0				
	KIAS	233	233	233	233				
	FF/ENG	2390	2380	2380	2400				
85	%N1	76.0	78.7	82.9	87.3				
	KIAS	228	228	228	228				
	FF/ENG	2260	2250	2240	2260				
80	%N1	74.4	77.1	81.3	85.6	90.2			
	KIAS	223	223	223	223	223			
	FF/ENG	2130	2120	2100	2110	2130			
75	%N1	72.6	75.5	79.5	83.8	88.4			
	KIAS	218	218	218	218	218			
	FF/ENG	2010	1990	1970	1980	1980			
70	%N1	70.7	73.7	77.6	81.9	86.4	92.0		
	KIAS	213	213	213	213	213	213		
	FF/ENG	1880	1860	1850	1840	1840	1880		
65	%N1	68.9	71.7	75.8	80.0	84.4	89.2		
	KIAS	207	207	207	207	207	207		
	FF/ENG	1770	1740	1720	1710	1700	1720		
60	%N1	67.0	69.7	73.9	77.9	82.3	86.9	94.4	
	KIAS	201	201	201	201	201	201	201	
	FF/ENG	1650	1620	1600	1580	1570	1580	1670	
55	%N1	64.9	67.6	71.7	75.7	80.1	84.6	90.2	
	KIAS	195	195	195	195	195	195	195	
	FF/ENG	1530	1510	1480	1460	1440	1440	1490	
50	%N1	62.5	65.4	69.3	73.5	77.7	82.2	86.9	
	KIAS	189	189	189	189	189	189	189	
	FF/ENG	1420	1390	1360	1340	1320	1320	1340	
45	%N1	60.0	63.0	66.8	71.0	75.1	79.6	84.2	91.2
	KIAS	182	182	182	182	182	182	182	182
	FF/ENG	1300	1280	1250	1230	1200	1190	1210	1260
40	%N1	57.7	60.3	64.4	68.3	72.6	76.9	81.3	86.5
	KIAS	175	175	175	175	175	175	175	175
	FF/ENG	1190	1170	1150	1120	1090	1070	1090	1100

This table includes 5% additional fuel for holding in a racetrack pattern.

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Performance Inflight — Chapter PI
Gear Down, Engine Inop — Section 76

GEAR DOWN

ENGINE INOP

MAX CONTINUOUS THRUST

Driftdown Speed/Level Off Altitude

100 ft/min residual rate of climb

WEIGHT (1000 KG)		OPTIMUM DRIFTDOWN SPEED (KIAS)	LEVEL OFF ALTITUDE (FT)		
START DRIFTOWN	LEVEL OFF		ISA + 10°C & BELOW	ISA + 15°C	ISA + 20°C
80	76	222	3800	2100	
75	71	217	6200	4700	2600
70	66	212	8600	7300	5300
65	62	207	11000	9800	8000
60	57	201	13300	12400	11000
55	52	195	15800	15000	14000
50	47	189	18400	17500	16700
45	43	182	20900	20100	19200
40	38	176	23300	22500	21700

Includes APU fuel burn.

Long Range Cruise Altitude Capability

100 ft/min residual rate of climb

WEIGHT (1000 KG)	PRESSURE ALTITUDE (FT)		
	ISA + 10°C & BELOW	ISA + 15°C	ISA + 20°C
75	1100		
70	4200	2000	
65	7300	5600	2900
60	10400	8900	6500
55	13100	12100	10300
50	16000	15200	14200
45	19100	18200	17300
40	22100	21300	20300

GEAR DOWN

ENGINE INOP

MAX CONTINUOUS THRUST

Long Range Cruise Control

WEIGHT (1000 KG)		PRESSURE ALTITUDE (1000 FT)								
		5	7	9	11	13	15	17	19	21
70	%N1	95.1								
	MACH	.389								
	KIAS	235								
	FF/ENG	3802								
65	%N1	92.8	94.6	97.2						
	MACH	.376	.389	.402						
	KIAS	228	227	226						
	FF/ENG	3509	3512	3554						
60	%N1	90.5	92.1	93.9	96.6					
	MACH	.364	.375	.388	.402					
	KIAS	220	219	218	218					
	FF/ENG	3226	3220	3222	3266					
55	%N1	88.1	89.6	91.3	93.1	95.7				
	MACH	.351	.362	.374	.387	.400				
	KIAS	212	211	210	209	209				
	FF/ENG	2960	2941	2933	2936	2974				
50	%N1	85.7	87.1	88.6	90.2	91.9	94.5	98.5		
	MACH	.338	.348	.359	.371	.384	.398	.412		
	KIAS	204	203	202	201	200	199	198		
	FF/ENG	2710	2680	2660	2651	2654	2677	2758		
45	%N1	83.1	84.4	85.8	87.3	88.9	90.6	93.0	96.8	
	MACH	.325	.334	.344	.355	.367	.380	.393	.408	
	KIAS	196	195	193	192	191	190	189	189	
	FF/ENG	2471	2435	2405	2384	2375	2372	2377	2436	
40	%N1	80.3	81.6	82.9	84.3	85.7	87.3	89.1	91.1	94.4
	MACH	.311	.320	.329	.339	.349	.361	.374	.387	.402
	KIAS	188	186	184	183	182	181	180	179	179
	FF/ENG	2244	2201	2165	2136	2114	2099	2088	2082	2119

GEAR DOWN
ENGINE INOP

MAX CONTINUOUS THRUST

Long Range Cruise Diversion Fuel and Time

Ground to Air Miles Conversion

AIR DISTANCE (NM)					GROUND DISTANCE (NM)	AIR DISTANCE (NM)				
HEADWIND COMPONENT (KTS)						TAILWIND COMPONENT (KTS)				
100	80	60	40	20		20	40	60	80	100
167	148	132	119	109	100	94	88	82	78	74
341	300	266	239	218	200	187	174	164	155	147
516	454	402	361	328	300	280	261	245	231	219
692	608	537	482	438	400	373	348	326	307	291
869	763	673	603	548	500	465	434	407	383	363
1048	919	809	725	658	600	558	521	488	459	434
1228	1076	947	847	768	700	651	607	568	535	506
1410	1234	1084	970	879	800	744	693	648	610	577
1593	1392	1222	1092	989	900	836	779	729	685	648
1778	1552	1361	1215	1100	1000	929	865	809	760	719

Reference Fuel and Time Required at Check Point

AIR DIST (NM)	PRESSURE ALTITUDE (1000 FT)					
	6		10		14	
	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)
100	1.3	0:27	1.1	0:26	1.0	0:26
200	2.6	0:53	2.4	0:50	2.3	0:48
300	4.0	1:18	3.7	1:15	3.6	1:12
400	5.3	1:44	4.9	1:39	4.8	1:35
500	6.6	2:10	6.2	2:04	6.0	1:58
600	7.9	2:37	7.4	2:29	7.2	2:22
700	9.2	3:04	8.6	2:55	8.3	2:46
800	10.4	3:31	9.8	3:20	9.5	3:10
900	11.7	3:58	11.0	3:46	10.6	3:35
1000	12.9	4:25	12.1	4:12	11.7	3:59

Fuel Required Adjustments (1000 KG)

REFERENCE FUEL REQUIRED (1000 KG)	WEIGHT AT CHECK POINT (1000 KG)				
	40	50	60	70	80
1	-0.2	-0.1	0.0	0.1	0.3
2	-0.3	-0.2	0.0	0.3	0.6
3	-0.5	-0.3	0.0	0.5	1.0
4	-0.7	-0.4	0.0	0.7	1.3
5	-0.9	-0.4	0.0	0.9	1.7
6	-1.0	-0.5	0.0	1.0	2.0
7	-1.2	-0.6	0.0	1.2	2.4
8	-1.4	-0.7	0.0	1.4	2.7
9	-1.5	-0.8	0.0	1.5	3.0
10	-1.7	-0.9	0.0	1.7	3.4
11	-1.9	-1.0	0.0	1.9	3.7
12	-2.1	-1.1	0.0	2.0	4.0
13	-2.2	-1.1	0.0	2.2	4.4

Includes APU fuel burn.

GEAR DOWN

ENGINE INOP

MAX CONTINUOUS THRUST

Holding

Flaps Up

WEIGHT (1000 KG)		PRESSURE ALTITUDE (FT) 1500	5000	10000	15000	20000
80	%N1	93.6				
	KIAS	223				
	FF/ENG	4160				
75	%N1	91.5	94.8			
	KIAS	218	218			
	FF/ENG	3880	3920			
70	%N1	89.4	92.6			
	KIAS	213	213			
	FF/ENG	3600	3640			
65	%N1	87.4	90.4	95.7		
	KIAS	207	207	207		
	FF/ENG	3340	3360	3430		
60	%N1	85.1	88.1	92.7		
	KIAS	201	201	201		
	FF/ENG	3090	3090	3130		
55	%N1	82.7	85.7	90.2	96.9	
	KIAS	195	195	195	195	
	FF/ENG	2840	2840	2850	2970	
50	%N1	80.1	83.1	87.4	92.4	
	KIAS	189	189	189	189	
	FF/ENG	2600	2590	2590	2630	
45	%N1	77.5	80.4	84.7	89.3	97.1
	KIAS	182	182	182	182	182
	FF/ENG	2380	2360	2340	2360	2470
40	%N1	74.9	77.6	81.9	86.2	91.6
	KIAS	175	175	175	175	175
	FF/ENG	2160	2140	2120	2120	2130

This table includes 5% additional fuel for holding in a racetrack pattern.

Performance Inflight — Chapter PI
Text — Section 77

Introduction

This chapter contains information to supplement performance data from the Flight Management Computer (FMC). In addition, sufficient inflight data is provided to complete a flight with the FMC inoperative. In the event of conflict between data presented in this chapter and that contained in the approved Airplane Flight Manual, the Flight Manual shall always take precedence.

General

Takeoff Speeds

The speeds presented in the Takeoff Speeds table as well as FMC computed takeoff speeds can be used for all performance conditions except where adjustments must be made for anti-skid inoperative, thrust reversers inoperative, improved climb, contaminated runway situations, or brake energy limits.

V1 adjustments are not necessary for equal amounts of clearway and stopway. V1 for takeoff limit weights based on unequal clearway and stopway should be obtained from computerized takeoff speeds calculations for the specific takeoff conditions.

These speeds may be used for weights less than or equal to the performance limited weight subject to the restrictions noted above.

The FMC will protect for minimum control speeds by increasing V1, VR and V2 as required. However, the FMC will not compute takeoff speeds for weights where the required speed increase exceeds the maximum certified speed increase. This typically occurs at full rated thrust and light weights. In this case, the message "V SPEEDS UNAVAILABLE" will appear on the FMC scratchpad and the takeoff speed entries will be blank. In this situation, manually verify takeoff speeds using an approved source of takeoff performance information. Upon verifying the takeoff speeds, takeoff is permitted. When selected takeoff speeds cannot be verified, the options are to select a lower number flap setting, select derate thrust and/or increase airplane gross weight (e.g. add fuel). Selecting derate thrust is the preferred method as this will reduce the minimum control speeds. Note that the assumed temperature method will not help this condition as the minimum control speeds are determined at the actual temperature and therefore are not reduced by an assumed temperature selection.

Normal takeoff speeds, V1, VR, and V2 are read from either the dry or wet table by entering with takeoff flap setting and brake release weight. Use the tables provided to adjust takeoff speeds for altitude and actual temperature or assumed temperature for reduced thrust takeoffs. Slope and wind adjustments to V1 are obtained by entering the Slope and Wind V1 Adjustment table.

V1(MCG)

Regulations prohibit scheduling takeoff with a V1 less than minimum V1 for control on the ground, V1(MCG). It is therefore necessary to compare the adjusted V1 to V1(MCG). The V1(MCG) presented in this manual is conservative for all weight and bleed configurations.

To find V1(MCG) enter the V1(MCG) table with the airport pressure altitude and actual OAT. If the adjusted V1 is less than V1(MCG), set V1 equal to V1(MCG). If the adjusted VR is less than V1(MCG), set VR equal to V1(MCG), and determine a new V2 by adding the difference between the normal VR and V1(MCG) to the normal V2. No takeoff weight adjustment is necessary provided that the actual field length exceeds the minimum field length shown in the Field and Climb Limit Weight table in chapter Performance Dispatch.

Stab Trim

To find takeoff stabilizer trim setting, enter Stab Trim Setting table with anticipated brake release weight and center of gravity (C.G. % MAC) and read required stabilizer trim units.

VREF

This table contains flaps 40, 30 and 15 reference speeds for a given weight.

Flap Maneuver Speeds

This table provides flap maneuver speeds for various flap settings. During flap retraction, selection of the next flap position is initiated when reaching the maneuver speed for the existing flap position. During flap retraction, at least adequate maneuver capability or 30° of bank (15° of bank and 15° overshoot) to stick shaker is provided at the flap retraction speed. Full maneuver capability or at least 40° of bank (25° of bank and 15° overshoot) is provided when the airplane has accelerated to the recommended maneuver speed for the selected flap position.

During flap extension, selection of the flaps to the next flap position should be made when approaching, and before decelerating below, the maneuver speed for the existing flap position. The flap extension speed schedule varies with airplane weight and provides full maneuver capability or at least 40° of bank (25° of bank and 15° overshoot) to stick shaker at all weights.

Slush/Standing Water Takeoff

Experience has shown that aircraft performance may deteriorate significantly on runways covered with snow, slush, standing water or ice. Therefore, reductions in field/obstacle limited takeoff weight and revised takeoff speeds are necessary. The tables are intended for guidance in accordance with advisory material and assume an engine failure at the critical point during the takeoff.

The entire runway is assumed to be completely covered by a contaminant of uniform thickness and density. Therefore this information is conservative when operating under typical cold weather conditions where patches of slush exist and some degree of sanding is common. Takeoffs in slush or standing water depths greater than 13 mm (0.5 inches) are not recommended because of possible airplane damage as a result of spray impingement on the airplane structure. The use of assumed temperature for reduced thrust is not allowed on contaminated runways. Interpolation for slush/standing water depths between the values shown is permitted.

Takeoff weight determination:

1. Enter the Weight Adjustment table with the dry field/obstacle limit weight to obtain the weight reduction for the slush/standing water depth and airport pressure altitude.
2. Adjust field length available for temperature by amount shown beneath V1(MCG) limit weight table.
3. Enter the V1(MCG) Limit Weight table with the adjusted field length and pressure altitude to obtain the slush/standing water limit weight with respect to minimum field length required for V1(MCG) speed.
4. The maximum allowable takeoff weight in slush/standing water is the lesser of the limit weights found in steps 1 and 3.

Takeoff speed determination:

1. Determine takeoff speeds V1, VR and V2 for actual brake release weight using the Dry Runway Takeoff Speeds table for the appropriate flap setting and thrust rating.
2. If V1(MCG) limited, set V1=V1(MCG). If not limited by V1(MCG) considerations, enter the V1 Adjustment table with actual brake release weight to determine the V1 reduction to apply to V1 speed. If the adjusted V1 is less than V1(MCG), set V1=V1(MCG).

Slippery Runway Takeoff

Airplane braking action is reported as good, medium or poor, depending on existing runway conditions. If braking action is reported as good, conditions should not be expected to be as good as on clean, dry runways. The value “good” is comparative and is intended to mean that airplanes should not experience braking or directional control difficulties when stopping. The performance level used to calculate the “good” data is consistent with wet runway testing done on early Boeing jets. The performance level used to calculate the “poor” data reflects a runway covered with wet ice. Performance is based on a 15 ft screen height at the end of the runway. The tables provided are used in the same manner as the Slush/Standing Water tables.

Anti-Skid Inoperative

When operating with anti-skid inoperative, the field limit weight and V1 must be reduced to account for the effect on accelerate-stop performance. Anti-skid inoperative is only allowed on a dry runway. A simplified method which conservatively accounts for the effects of anti-skid inoperative is to reduce the normal dry field/obstacle limited weight by 8200 kg and the V1 associated with the reduced weight by the amount shown in the table below.

ANTI-SKID INOPERATIVE V1 ADJUSTMENTS	
FIELD LENGTH (M)	V1 ADJUSTMENT (KIAS)
2000	-20
2500	-17
3000	-14
3500	-12
4000	-10

If the resulting V1 is less than V1(MCG), takeoff is permitted with V1 set equal to V1(MCG) provided the dry accelerate-stop distance adjusted for wind and slope exceeds approximately 1800 m.

Detailed analysis for the specific case from the Airplane Flight Manual may yield a less restrictive penalty.

Thrust Reverser Inoperative

When dispatching on a wet runway with both thrust reversers operative, an operative anti-skid system, and all brakes operating, regulations allow deceleration credit for one thrust reverser in the engine failure case and two thrust reversers in the all engine stop case.

When dispatching on a wet runway with one thrust reverser inoperative, the field/obstacle limited weight and V1 must be reduced to account for the effect on accelerate-stop performance. A simplified method, which conservatively accounts for this, is to reduce the normal wet runway/field/obstacle limited weight by 900 kg and the V1 associated with the reduced weight by 2 knots.

If the resulting V1 is less than minimum V1, takeoff is permitted with V1 set equal to V1(MCG) provided the accelerate-stop distance available adjusted for wind and slope exceeds approximately 1200 m.

Detailed analysis for the specific case from the Airplane Flight Manual may yield a less restrictive penalty.

Takeoff %N1

To find Max Takeoff %N1 based on normal engine bleed for air conditioning packs on, enter Takeoff %N1 Table with airport pressure altitude and airport OAT and read %N1. Apply %N1 adjustments as provided when applicable.

Assumed Temperature Reduced Thrust

Regulations permit the use of up to 25% takeoff thrust reduction for operation with assumed temperature reduced thrust. Use of assumed temperature reduced thrust is not allowed with anti-skid inoperative or on runways contaminated with standing water, ice, slush, or snow. Use of assumed temperature reduced thrust is not recommended if potential windshear conditions exist.

To find the maximum allowable assumed temperature enter the Maximum Assumed Temperature table with airport pressure altitude and OAT. Compare this temperature to that at which the airplane is performance limited as determined from available takeoff performance data. Next, enter the Maximum Takeoff %N1 table with airport pressure altitude and the lower of the two temperatures previously determined, to obtain a maximum takeoff %N1. Do not use an assumed temperature less than the minimum assumed temperature shown. Enter the %N1 Adjustment table with OAT and the difference between the assumed and actual OAT to obtain a %N1 adjustment. Subtract the %N1 adjustment from the maximum takeoff %N1 found previously to determine the assumed temperature reduced thrust %N1.

Apply %N1 adjustments as provided when applicable.

Max Climb %N1

This table shows Max Climb %N1 for a 280/.78 climb speed schedule, normal engine bleed for packs on or off and anti-ice off. Enter the table with airport pressure altitude and TAT and read %N1. %N1 adjustments are shown for anti-ice operation.

Go-around %N1

To find Max Go-around %N1 based on normal engine bleed for packs on (AUTO) and anti-ice on or off, enter the Go-around %N1 table with airport pressure altitude and reported OAT or TAT and read %N1. For packs OFF or HIGH operation, apply the %N1 adjustment shown below the table.

Flight with Unreliable Airspeed / Turbulent Air Penetration

Pitch attitude and average %N1 information is provided for use in all phases of flight in the event of unreliable airspeed/Mach indications resulting from blocking or freezing of the pitot system. Loss of radome or turbulent air may also cause unreliable airspeed/Mach indications. The cruise table in this section may also be used for turbulent air penetration.

Pitch attitude is shown in bold type for emphasis since altitude and/or vertical speed indications may also be unreliable.

All Engines

Long Range Cruise Maximum Operating Altitude

These tables provide the maximum operating altitude in the same manner as the FMC. Maximum altitudes are shown for a given cruise weight and maneuver capability. This table considers both thrust and buffet limits, providing the more limiting of the two. Any data that is thrust limited is denoted by an asterisk and represents only a thrust limited condition in level flight with 100 ft/min residual rate of climb. Flying above these altitudes with sustained banks in excess of approximately 15° may cause the airplane to lose speed and/or altitude. The altitudes shown in the table are limited to the maximum certified altitude of 41000 ft.

Long Range Cruise Control

These tables provide target %N1, Long Range Cruise Mach number, IAS and standard day fuel flow per engine for the airplane weight and pressure altitude. As indicated by the shaded area, at optimum altitude .79M approximates the Long Range Cruise Mach schedule.

Long Range Cruise Enroute Fuel and Time

Long Range Cruise Enroute Fuel and Time tables are provided to determine remaining time and fuel required to destination. The data is based on Long Range Cruise and .78/280/250 descent. Tables are presented for low altitudes and high altitudes.

To determine remaining fuel and time required, first enter the Ground to Air Miles Conversion table to convert ground distance and enroute wind to an equivalent still air distance for use with the Reference Fuel and Time tables. Next, enter the Reference Fuel and Time table with air distance from the Ground to Air Miles Conversion table and the desired altitude and read Reference Fuel and Time Required. Lastly, enter the Fuel Required Adjustment table with the Reference Fuel and the actual weight at checkpoint to obtain fuel required to destination.

APU Operation During Flight

For APU operation during flight, increase fuel flow according to the table in the Engine Inoperative text section.

Long Range Cruise Wind-Altitude Trade

Wind is a factor which may justify operations considerably below optimum altitude. For example, a favorable wind component may have an effect on ground speed which more than compensates for the loss in air range.

Using this table, it is possible to determine the break-even wind (advantage necessary or disadvantage that can be tolerated) to maintain the same range at another altitude and long range cruise speed. The tables make no allowance for climb or descent time, fuel or distance, and are based on comparing ground fuel mileage.

Descent

Time, fuel, and distance for descent are shown for a .78/280/250 descent speed schedule. Enter the table with top of descent pressure altitude and read distance, time and fuel. Data is based on flight idle thrust descent in zero wind. Allowances are included for a straight-in approach with gear down and landing flaps at the outer marker.

Holding

Target %N1, indicated airspeed and fuel flow per engine information is tabulated for holding with flaps up based on the FMC optimum holding speed schedule. This is the higher of the maximum endurance speed and the maneuvering speed. Small variations in airspeed will not appreciably affect the overall endurance time. Enter the table with weight and pressure altitude to read %N1, IAS and fuel flow per engine.

Advisory Information

Normal Configuration Landing Distance

The normal configuration distance tables are provided as advisory information to help determine the actual landing distance performance of the airplane for different runway surface conditions and brake configurations.

Flaps 15, 30, and 40 landing distances and adjustments are provided for dry runways as well as runways with good, medium, and poor reported braking action, which are commonly referred to as slippery runway conditions.

If the surface is affected by water, snow or ice, and the braking action is reported as "good", conditions should not be expected to be as good as on clean, dry runways. The value "good" is comparative and is intended to mean that airplanes should not experience braking or directional control difficulties when landing. The performance level used to calculate the "good" data is consistent with wet runway testing done on early Boeing jets. The performance level used to calculate "poor" data reflects runways covered with wet ice.

Dry runway landing performance is shown for max manual braking configuration and autobrake settings max, 3, 2, and 1. The autobrake performance may be used to assist in the selection of the most desirable autobrake setting for a given field length. Selection of an autobrake setting results in a constant rate of deceleration. Maximum effort manual braking should achieve shorter landing distance than the max autobrake setting. The reference landing distance is a reference distance from 50 ft above the threshold to stop based on a reference landing weight and normal approach speed for the selected landing flap at sea level, zero wind, zero slope, and two engine detent reverse thrust. Subsequent columns provide adjustments for off-reference landing weight, altitude, wind, slope, temperature, speed, and reverse thrust. Each adjustment is independently added to the reference landing distance.

Non-normal Configuration Landing Distance

Advisory information is provided to support non-normal configurations that affect the landing performance of the airplane. Landing distances and adjustments are provided for dry runways and runways with good, medium, and poor reported braking action.

Enter the table with the applicable non-normal configuration and read the normal approach speed. The reference landing distance is a reference distance from 50 ft above the threshold to stop based on a reference landing weight and speed at sea level, zero wind, and zero slope. Subsequent columns provide adjustments for off-reference landing weight, altitude, wind, slope, and speed conditions. Each adjustment is independently added to the reference landing distance. Landing distance includes the effect of reverse thrust.

Recommended Brake Cooling Schedule

Advisory information is provided to assist in avoiding the problems associated with hot brakes. For normal operation, most landings are at weights below the AFM quick turnaround limit weight.

Use of the recommended cooling schedule will help avoid brake overheat and fuse plug problems that could result from repeated landings at short time intervals or a rejected takeoff.

Enter the Recommended Brake Cooling Schedule table with the airplane weight and brakes on speed, adjusted for wind at the appropriate temperature and altitude condition. Instructions for applying wind adjustments are included below the table. Linear interpolation may be used to obtain intermediate values. The resulting number is the reference brake energy per brake in millions of foot-pounds, and represents the amount of energy absorbed by each brake during a rejected takeoff. Notes providing adjustments for wind are included below the table.

To determine the energy per brake absorbed during landing, enter the appropriate Adjusted Brake Energy Per Brake table (No Reverse Thrust or 2 Engine Reverse) with the reference brake energy per brake and the type of braking used during landing (Max Manual, Max Auto, or Autobrake). The resulting number is the adjusted brake energy per brake and represents the energy absorbed in each brake during the landing.

The recommended cooling time is found in the appropriate (steel or carbon brakes) final table by entering with the adjusted brake energy per brake. Times are provided for ground cooling and inflight gear down cooling.

Brake Temperature Monitor System (BTMS) indications are also shown. If brake cooling is determined from the BTMS, use the hottest brake indication 10 to 15 minutes after the airplane has come to a complete stop, or inflight with gear retracted to determine recommended cooling schedule.

Engine Inoperative

Initial Max Continuous %N1

The Initial Max Continuous %N1 setting for use following an engine failure is shown. The table is based on the typical all engine cruise speed of .79M to provide a target %N1 setting at the start of driftdown. Once driftdown is established, the Max Continuous %N1 table should be used to determine %N1 for the given conditions.

Max Continuous %N1

Power setting is based on one engine operating with one A/C pack operating and all anti-ice bleeds off. Enter the table with pressure altitude, TAT, and IAS or Mach to read %N1.

It is desirable to maintain engine thrust level within the limits of the Max Cruise thrust rating. However, where thrust level in excess of Max Cruise rating is required, such as for meeting terrain clearance, ATC altitude assignments, or to attain maximum range capability, it is permissible to use the thrust needed up to the Max Continuous thrust rating. The Max Continuous thrust rating is intended primarily for emergency use at the discretion of the pilot and is the maximum thrust that may be used continuously.

Driftdown Speed/Level Off Altitude

The table shows optimum driftdown speed as a function of cruise weight at start of driftdown. Also shown are the approximate weight and pressure altitude at which the airplane will level off considering 100 ft/min residual rate of climb.

The level off altitude is dependent on air temperature (ISA deviation).

Driftdown/LRC Range Capability

This table shows the range capability from the start of driftdown. Driftdown is continued to level off altitude. As weight decreases due to fuel burn, the airplane is accelerated to Long Range Cruise speed. Cruise is continued at level off altitude and Long Range Cruise speed.

To determine fuel required, enter the Ground to Air Miles Conversion table with the desired ground distance and adjust for anticipated winds to obtain air distance to destination. Then enter the Driftdown/Cruise Fuel and Time table with air distance and weight at start of driftdown to determine fuel and time required. If altitudes other than the level off altitude is used, fuel and time required may be obtained by using the Engine Inoperative Long Range Cruise Enroute Fuel and Time table.

Long Range Cruise Altitude Capability

The table shows the maximum altitude that can be maintained at a given weight and air temperature (ISA deviation), based on Long Range Cruise speed, Max Continuous thrust, and 100 ft/min residual rate of climb.

Long Range Cruise Control

The table provides target %N1, engine inoperative Long Range Cruise Mach number, IAS and fuel flow for the airplane weight and pressure altitude. The fuel flow values in this table reflect single engine fuel burn.

APU Operation During Flight

For APU operation during flight, increase fuel flow according to the following table. These increments include the APU fuel flow and the effect of increased drag from the APU door.

PRESSURE ALTITUDE (1000 FT)	APU FUEL FLOW (KG/HR)
39	45
35	45
31	50
25	60
20	65
15	75
10	85
5	95

Long Range Cruise Diversion Fuel and Time

Tables are provided for crews to determine the fuel and time required to proceed to an alternate airfield with one engine inoperative. The data is based on single engine Long Range Cruise speed and .78/280/250 descent. Enter with Air Distance as determined from the Ground to Air Miles Conversion table and read Fuel and Time required at the cruise pressure altitude. Adjust the fuel obtained for deviation from the reference weight at checkpoint as required by entering the off reference fuel adjustments table with the fuel required for the reference weight and the actual weight at checkpoint. Read fuel required and time for the actual weight.

Holding

Single engine holding data is provided in the same format as the all engine holding data and is based on the same assumptions.

Gear Down Landing Rate of Climb Available

Rate of climb data is provided as guidance information in the event an engine inoperative landing (manual or autoland) is planned. The tables show gear down rate of climb available for Flaps 15 and Flaps 30. Enter the table with TAT and pressure altitude to read rate of climb available. Apply adjustments shown to correct for weight.

Alternate Mode EEC

Introduction

This section contains performance data for airplane operation with the Electronic Engine Control (EEC) in the alternate mode (ALTN EEC switch illuminated) for applicable thrust ratings. The data includes engine bleed effects for normal air conditioning operation i.e., two packs on at normal flow all engines operating.

Operation with derate and/or assumed temperature reduced thrust is not permitted with the EEC in alternate mode.

Limit Weight

A simplified method which conservatively accounts for the effects of EEC in alternate mode is to reduce the normal mode (ON EEC switch illuminated) performance limited weights. The Limit Weight table provides takeoff field, climb, obstacle, tire speed and brake energy limit weights. To determine limit weights for operations with the EEC in the alternate mode, enter the table with the limit weights for normal mode EEC operation and read the associated limit weight for each performance condition. The most limiting of the takeoff weights must be used. Analysis from the Airplane Flight Manual - Digital Performance Information may yield less restrictive limit weights.

Takeoff Speed Adjustment

Takeoff speeds for the reduced weight should be increased by the amount shown in the Takeoff Speeds Adjustment table. The adjusted V1 should not exceed the adjusted VR.

Note: The FMC does not incorporate alternate mode EEC performance in its takeoff speeds calculations.

Max Takeoff %N1

The alternate mode EEC thrust schedule provides equal or greater thrust than the normal mode thrust for the same thrust lever position. Thrust limit protection is not provided in alternate mode EEC and maximum rated thrust may be reached at thrust lever position less than full forward. As a result, thrust overboost may occur if the target alternate mode EEC Max Takeoff %N1 settings are not observed.

To find alternate mode EEC Max Takeoff %N1 based on normal engine bleed for air conditioning packs on, enter the Alternate Mode EEC Max Takeoff %N1 table with airport pressure altitude and airport OAT and read %N1. For packs off apply the %N1 adjustment provided below the table. No %N1 adjustment is required for engine or wing anti-ice.

Gear Down

This section contains performance for airplane operation with the landing gear extended. The data is based on engine bleeds for normal air conditioning.

Note: The Flight Management Computer System (FMCS) does not contain special provisions for operation with landing gear extended. As a result, the FMCS may generate inappropriate enroute speed schedules, display non-conservative predictions of fuel burn, estimated time of arrival (ETA), maximum altitude, and compute overly shallow descent path. An accurate estimated time of arrival (ETA) is available if current speed or Mach is entered into the VNAV cruise page.

Tables for gear down performance in this section are identical in format and used in the same manner as tables for the gear up configuration previously described.

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Performance Inflight — Chapter PI

Table of Contents — Section 80

737-900ERW CFM56-7B27 C FT LB FAA CATH/P

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General

The table below shows the airplanes that have been identified with the following performance package. Note, some airplanes may be identified with more than one performance package. This configuration table information reflects the Boeing delivered configuration updated for service bulletin incorporations in conformance with the policy stated in the introduction section of the FCOM. The performance data is prepared for the owner/operator named on the title page. The intent of this information is to assist flight crews and airlines in knowing which performance package is applicable to a given airplane. The performance package model identification information is based on Boeing's knowledge of the airline's fleet at a point in time approximately three months prior to the page date. Notice of Errata (NOE) will not be provided to airlines to identify airplanes that are moved between performance packages within this manual or airplanes added to the airline's fleet whose performance packages are already represented in this manual. These types of changes will be updated in the next block revision. Owners/operators are responsible for ensuring the operational documentation they are using is complete and matches the current configuration of their airplanes, and the accuracy and validity of all information furnished by the owner/operator or any other party. Owners/operators receiving active revision service are responsible to ensure that any modifications to the listed airplanes are properly reflected in this manual.

Serial and tabulation number are supplied by Boeing.

Registry Number	Serial Number	Tabulation Number
YX910	YX910	YX910

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Performance Inflight — Chapter PI
General — Section 80

Takeoff Speeds - Dry Runway
V1, VR, V2 for Max Takeoff Thrust

WEIGHT (1000 LB)	FLAPS 1			FLAPS 5			FLAPS 10			FLAPS 15			FLAPS 25		
	V1	VR	V2	V1	VR	V2	V1	VR	V2	V1	VR	V2	V1	VR	V2
190	168	171	178	160	163	170	152	154	161	150	152	159			
180	163	166	174	156	158	166	147	150	157	145	148	155	143	143	151
170	158	161	170	151	153	162	143	145	153	141	143	151	138	139	147
160	153	155	165	146	148	158	138	140	149	136	138	147	133	134	143
150	148	150	161	141	143	154	133	135	145	131	133	143	128	129	139
140	143	144	156	136	137	149	128	129	141	126	128	139	123	124	135
130	136	138	151	130	131	144	122	124	137	121	122	135	118	119	131
120	130	131	145	123	124	139	117	118	132	115	116	130	112	113	126
110	123	124	140	117	118	134	111	111	127	109	110	125	106	107	122
100	116	116	134	111	111	128	104	105	121	103	103	120	100	100	116
90	109	109	128	103	104	122	98	98	116	96	97	114	93	94	111

Check V1(MCG).

V1, VR, V2 Adjustments*

TEMP		V1							VR							V2						
		PRESS ALT (1000 FT)							PRESS ALT (1000 FT)							PRESS ALT (1000 FT)						
°C	°F	-2	0	2	4	6	8	10	-2	0	2	4	6	8	10	-2	0	2	4	6	8	10
70	158	5	6						5	6						-3	-3					
60	140	4	5	6	7				3	4	5	6				-2	-2	-3	-3			
50	122	2	3	4	5	6	7	9	2	3	4	5	6	7	9	-1	-2	-2	-2	-3	-4	-4
40	104	1	1	2	3	5	6	7	1	2	3	4	5	6	8	-1	-1	-1	-2	-2	-3	-4
30	86	0	0	1	2	4	5	6	0	0	1	3	4	5	7	0	0	-1	-1	-2	-2	-3
20	68	0	0	1	2	3	4	6	0	0	1	2	3	4	6	0	0	0	-1	-1	-2	-3
-60	-76	0	0	1	2	3	4	6	0	0	1	2	3	4	5	0	0	0	-1	-1	-2	-2

Slope and Wind V1 Adjustments*

WEIGHT (1000 LB)	SLOPE (%)					WIND (KTS)							
	-2	-1	0	1	2	-15	-10	-5	0	10	20	30	40
190	-3	-2	0	2	2	-2	-1	-1	0	0	0	1	1
170	-2	-1	0	1	2	-2	-1	-1	0	0	1	1	1
150	-2	-1	0	1	1	-2	-1	-1	0	0	1	1	1
130	-1	0	0	1	1	-2	-1	0	0	0	1	1	1
110	-1	0	0	0	0	-2	-1	0	0	0	0	0	0
90	0	0	0	0	0	-1	-1	0	0	0	0	0	0

***V1 not to exceed VR.**

V1(MCG)
Max Takeoff Thrust

TEMP		PRESSURE ALTITUDE (FT)						
°C	°F	-2000	0	2000	4000	6000	8000	10000
70	158	95	92					
60	140	95	92	90	89			
50	122	97	95	90	89	87	84	81
40	104	101	99	95	92	88	84	81
30	86	104	103	99	95	91	87	82
20	68	104	104	100	96	93	89	85
-60	-76	106	105	101	98	94	91	87

Takeoff Speeds - Wet Runway

V1, VR, V2 for Max Takeoff Thrust

WEIGHT	FLAPS 1			FLAPS5			FLAPS 10			FLAPS 15			FLAPS 25		
(1000 LB)	V1	VR	V2	V1	VR	V2	V1	VR	V2	V1	VR	V2	V1	VR	V2
190	163	171	178	154	163	170	146	154	161	144	152	159			
180	157	166	174	149	158	166	141	150	157	139	148	155	135	143	151
170	151	161	170	144	153	162	136	145	153	134	143	151	130	139	147
160	145	155	165	138	148	158	130	140	149	129	138	147	125	134	143
150	140	150	161	133	143	154	125	135	145	124	133	143	120	129	139
140	134	144	156	127	137	149	120	129	141	118	128	139	115	124	135
130	127	138	151	121	131	144	114	124	137	113	122	135	109	119	131
120	121	131	145	115	124	139	108	118	132	107	116	130	104	113	126
110	114	124	140	108	118	134	102	111	127	100	110	125	97	107	122
100	106	116	134	101	111	128	95	105	121	94	103	120	91	100	116
90	99	109	128	94	104	122	88	98	116	87	97	114	84	94	111

Check V1(MCG).

V1, VR, V2 Adjustment*

TEMP		V1							VR							V2						
		PRESS ALT (1000 FT)							PRESS ALT (1000 FT)							PRESS ALT (1000 FT)						
°C	°F	-2	0	2	4	6	8	10	-2	0	2	4	6	8	10	-2	0	2	4	6	8	10
70	158	8	9						5	6						-3	-3					
60	140	5	6	7	9				3	4	5	6				-2	-2	-3	-3			
50	122	3	4	5	6	8	10	12	2	3	4	5	6	7	9	-1	-2	-2	-2	-3	-4	-4
40	104	1	2	3	4	5	7	10	1	2	3	4	5	6	8	-1	-1	-1	-2	-2	-3	-4
30	86	0	0	1	3	4	6	8	0	0	1	3	4	5	7	0	0	-1	-1	-2	-2	-3
20	68	0	0	1	3	4	5	7	0	0	1	2	3	4	6	0	0	0	-1	-1	-2	-3
-60	-76	0	0	1	3	4	5	7	0	0	1	2	3	4	5	0	0	0	-1	-1	-2	-2

Slope and Wind V1 Adjustment*

WEIGHT	SLOPE (%)					WIND (KTS)							
(1000 LB)	-2	-1	0	1	2	-15	-10	-5	0	10	20	30	40
190	-4	-2	0	3	6	-4	-2	-1	0	1	2	2	3
170	-4	-2	0	2	5	-4	-2	-1	0	1	2	2	3
150	-3	-2	0	2	4	-4	-2	-1	0	1	2	2	3
130	-3	-1	0	2	3	-4	-3	-1	0	1	2	2	3
110	-2	-1	0	1	2	-5	-3	-1	0	1	2	3	4
90	-2	-1	0	1	2	-5	-3	-2	0	1	2	3	4

***V1 not to exceed VR.**

V1(MCG)
Max Takeoff Thrust

TEMP		PRESSURE ALTITUDE (FT)						
°C	°F	-2000	0	2000	4000	6000	8000	10000
70	158	95	92					
60	140	95	92	90	89			
50	122	97	95	90	89	87	84	81
40	104	101	99	95	92	88	84	81
30	86	104	103	99	95	91	87	82
20	68	104	104	100	96	93	89	85
-60	-76	106	105	101	98	94	91	87

Stab Trim Setting
Max Takeoff Thrust
Flaps 1 and 5

WEIGHT (1000 LB)	C.G. (%MAC)										
	6	8	9	20	25	26	28	30	32	34	36
190	8 1/2	8 1/4	8	6 1/4	5 1/2	5 1/4	5	4 3/4	4 1/2	4	3 3/4
180	8 1/4	8	7 3/4	6	5 1/4	5 1/4	4 3/4	4 1/2	4 1/4	4	3 1/2
160	7 3/4	7 1/2	7 1/4	5 3/4	5	4 3/4	4 1/2	4 1/4	4	3 1/2	3 1/4
140	7 1/4	7	6 3/4	5 1/4	4 1/2	4 1/4	4	3 3/4	3 1/2	3 1/4	3
120	6 1/2	6 1/4	6 1/4	4 3/4	4	4	3 3/4	3 1/2	3	2 3/4	2 3/4
90-100	5 3/4	5 1/2	5 1/2	4	3 1/2	3 1/4	3	2 3/4	2 3/4	2 3/4	2 3/4

Flaps 10, 15 and 25

WEIGHT (1000 LB)	C.G. (%MAC)										
	6	8	9	20	25	26	28	30	32	34	36
190	8 1/2	8	7 3/4	5 1/2	4 1/2	4 1/2	4	3 3/4	3 1/4	3	2 3/4
180	8 1/4	7 3/4	7 3/4	5 1/4	4 1/2	4 1/4	3 3/4	3 1/2	3 1/4	2 3/4	2 3/4
160	7 3/4	7 1/4	7 1/4	5	4	3 3/4	3 1/2	3 1/4	2 3/4	2 3/4	2 3/4
140	7 1/4	7	6 3/4	4 1/2	3 3/4	3 1/2	3 1/4	2 3/4	2 3/4	2 3/4	2 3/4
120	6 1/2	6 1/4	6	4	3 1/4	3	2 3/4	2 3/4	2 3/4	2 3/4	2 3/4
90-100	6	5 1/2	5 1/4	3 1/2	2 3/4	2 3/4	2 3/4	2 3/4	2 3/4	2 3/4	2 3/4

VREF

Based on 10000 ft reference pressure altitude

WEIGHT (1000 LB)	FLAPS		
	40	30	15
190	159	162	172
180	155	158	167
170	150	154	162
160	145	150	158
150	141	145	152
140	136	140	147
130	130	135	142
120	124	130	136
110	119	124	130
100	112	118	124
90	106	112	117

Flap Maneuver Speeds

FLAP POSITION	MANEUVER SPEED
UP	VREF40 + 70
1	VREF40 + 50
5	VREF40 + 30
10	VREF40 + 30
15	VREF40 + 20
25	VREF40 + 10
30	VREF30
40	VREF40

ADVISORY INFORMATION

Slush/Standing Water Takeoff

Maximum Reverse Thrust

Weight Adjustments (1000 LB)

DRY FIELD/OBSTACLE LIMIT WEIGHT (1000 LB)	SLUSH/STANDING WATER DEPTH								
	0.12 INCHES (3 mm)			0.25 INCHES (6 mm)			0.50 INCHES (13 mm)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
190	-21.6	-26.0	-30.4	-26.2	-30.6	-35.0	-36.1	-42.7	-49.4
180	-20.2	-24.6	-29.0	-24.1	-28.5	-32.9	-32.4	-39.1	-45.7
170	-18.6	-23.0	-27.5	-21.9	-26.3	-30.7	-28.9	-35.5	-42.2
160	-17.0	-21.4	-25.8	-19.7	-24.1	-28.5	-25.5	-32.1	-38.8
150	-15.3	-19.7	-24.1	-17.5	-21.9	-26.3	-22.2	-28.8	-35.5
140	-13.5	-17.9	-22.3	-15.3	-19.7	-24.1	-19.0	-25.6	-32.3
130	-11.6	-16.1	-20.5	-13.0	-17.4	-21.8	-15.9	-22.6	-29.2
120	-9.7	-14.1	-18.5	-10.7	-15.1	-19.5	-13.0	-19.6	-26.3
110	-7.6	-12.0	-16.4	-8.4	-12.8	-17.2	-10.1	-16.8	-23.5
100	-5.5	-9.9	-14.3	-6.0	-10.4	-14.8	-7.4	-14.1	-20.7
90	-3.3	-7.7	-12.1	-3.6	-8.0	-12.4	-4.8	-11.5	-18.1

V1(MCG) Limit Weight (1000 LB)

ADJUSTED FIELD LENGTH (FT)	SLUSH/STANDING WATER DEPTH								
	0.12 INCHES (3 mm)			0.25 INCHES (6 mm)			0.50 INCHES (13 mm)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
4000							77.2		
4400	81.4			88.5			100.9	71.8	
4800	105.8	75.8		113.0	82.9		125.4	95.4	
5200	131.4	100.1	70.3	138.7	107.2	77.4	151.0	119.6	89.9
5600	158.7	125.4	94.5	166.0	132.7	101.5	177.8	145.0	114.0
6000	187.8	152.3	119.5	195.0	159.6	126.7	205.9	171.5	139.1
6400		180.9	145.9		188.2	153.2		199.4	165.3
6800			174.2			181.4			192.9
7200			204.2						

1. **Enter Weight Adjustment table with slush/standing water depth and dry field/obstacle limit weight to obtain slush/standing water weight adjustment.**
2. **Adjust field length available by -80 ft/+80 ft for every 5°C above/below 4°C.**
3. **Find V1(MCG) limit weight for adjusted field length and pressure altitude.**
4. **Max allowable slush/standing water limited weight is lesser of weights from 1 and 3.**

ADVISORY INFORMATION

Slush/Standing Water Takeoff
Maximum Reverse Thrust
V1 Adjustment (KIAS)

WEIGHT (1000 LB)	SLUSH/STANDING WATER DEPTH								
	0.12 INCHES (3 mm)			0.25 INCHES (6 mm)			0.50 INCHES (13 mm)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
190	-17	-12	-7	-10	-5	0	0	0	0
180	-19	-14	-9	-12	-7	-2	0	0	0
170	-20	-15	-10	-14	-9	-4	-1	0	0
160	-21	-16	-11	-16	-11	-6	-4	0	0
150	-22	-17	-12	-18	-13	-8	-8	-3	0
140	-23	-18	-13	-20	-15	-10	-11	-6	-1
130	-24	-19	-14	-21	-16	-11	-14	-9	-4
120	-25	-20	-15	-23	-18	-13	-17	-12	-7
110	-26	-21	-16	-24	-19	-14	-19	-14	-9
100	-27	-22	-17	-25	-20	-15	-22	-17	-12
90	-28	-23	-18	-27	-22	-17	-24	-19	-14

1. **Obtain V1, VR and V2 for the actual weight using the Dry Runway Takeoff Speeds table.**
2. **If V1(MCG) limited, set V1 = V1(MCG). If not V1(MCG) limited, enter V1 Adjustment table with the actual weight to obtain V1 speed adjustment. If adjusted V1 is less than V1(MCG), set V1 = V1(MCG). V1 not to exceed VR.**

ADVISORY INFORMATION

Slush/Standing Water Takeoff
No Reverse Thrust
Weight Adjustments (1000 LB)

DRY FIELD/OBSTACLE LIMIT WEIGHT (1000 LB)	SLUSH/STANDING WATER DEPTH								
	0.12 INCHES (3 mm)			0.25 INCHES (6 mm)			0.50 INCHES (13 mm)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
190	-28.8	-34.3	-39.8	-33.5	-39.0	-44.5	-43.3	-52.1	-61.0
180	-27.0	-32.5	-38.0	-31.0	-36.5	-42.0	-39.3	-48.1	-56.9
170	-25.2	-30.7	-36.2	-28.4	-34.0	-39.5	-35.4	-44.2	-53.0
160	-23.2	-28.7	-34.2	-25.9	-31.4	-36.9	-31.6	-40.5	-49.3
150	-21.2	-26.7	-32.2	-23.4	-28.9	-34.4	-28.0	-36.9	-45.7
140	-19.1	-24.6	-30.1	-20.8	-26.4	-31.9	-24.6	-33.4	-42.2
130	-17.0	-22.5	-28.0	-18.3	-23.8	-29.3	-21.2	-30.1	-38.9
120	-14.7	-20.2	-25.7	-15.8	-21.3	-26.8	-18.1	-26.9	-35.7
110	-12.4	-17.9	-23.4	-13.2	-18.7	-24.2	-15.0	-23.8	-32.6
100	-10.0	-15.5	-21.0	-10.7	-16.2	-21.7	-12.1	-20.9	-29.7
90	-7.6	-13.1	-18.6	-8.1	-13.6	-19.1	-9.4	-18.2	-27.0

V1(MCG) Limit Weight (1000 LB)

ADJUSTED FIELD LENGTH (FT)	SLUSH/STANDING WATER DEPTH								
	0.12 INCHES (3 mm)			0.25 INCHES (6 mm)			0.50 INCHES (13 mm)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
5600							77.0		
6000							107.2	70.1	
6400				91.8			138.9	100.1	
6800	96.2			129.1	83.4		172.6	131.4	93.2
7200	136.4	87.6		168.1	120.4	75.0	208.3	164.6	124.1
7600	182.4	126.7	79.0	208.9	159.0	111.7		200.0	156.8
8000		171.2	117.3		199.4	150.0			191.7
8400			160.3			190.0			
8800			209.9						

1. **Enter Weight Adjustment table with slush/standing water depth and dry field/obstacle limit weight to obtain slush/standing water weight adjustment.**
2. **Adjust field length available by -130 ft/+130 ft for every 5°C above/below 4°C.**
3. **Find V1(MCG) limit weight for adjusted field length and pressure altitude.**
4. **Max allowable slush/standing water limited weight is lesser of weights from 1 and 3.**

ADVISORY INFORMATION

Slush/Standing Water Takeoff
No Reverse Thrust
V1 Adjustment (KIAS)

WEIGHT (1000 LB)	SLUSH/STANDING WATER DEPTH								
	0.12 INCHES (3 mm)			0.25 INCHES (6 mm)			0.50 INCHES (13 mm)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
190	-26	-16	-6	-16	-6	0	0	0	0
180	-28	-18	-8	-19	-9	0	0	0	0
170	-30	-20	-10	-22	-12	-2	-2	0	0
160	-32	-22	-12	-25	-15	-5	-7	0	0
150	-34	-24	-14	-28	-18	-8	-13	-3	0
140	-36	-26	-16	-31	-21	-11	-18	-8	0
130	-37	-27	-17	-33	-23	-13	-23	-13	-3
120	-39	-29	-19	-36	-26	-16	-27	-17	-7
110	-41	-31	-21	-38	-28	-18	-31	-21	-11
100	-43	-33	-23	-40	-30	-20	-35	-25	-15
90	-44	-34	-24	-43	-33	-23	-39	-29	-19

1. **Obtain V1, VR and V2 for the actual weight using the Dry Runway Takeoff Speeds table.**
2. **If V1(MCG) limited, set V1 = V1(MCG). If not V1(MCG) limited, enter V1 Adjustment table with the actual weight to obtain V1 speed adjustment. If adjusted V1 is less than V1(MCG), set V1 = V1(MCG). V1 not to exceed VR.**

ADVISORY INFORMATION

Slippery Runway Takeoff

Maximum Reverse Thrust

Weight Adjustment (1000 LB)

DRY FIELD/OBSTACLE LIMIT WEIGHT (1000 LB)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
190	-1.2	-2.8	-4.3	-12.3	-13.8	-15.4	-22.1	-23.6	-25.2
180	-1.9	-3.4	-5.0	-12.4	-13.9	-15.5	-21.5	-23.0	-24.6
170	-2.3	-3.9	-5.4	-12.3	-13.8	-15.3	-20.6	-22.2	-23.7
160	-2.6	-4.1	-5.7	-11.9	-13.5	-15.0	-19.6	-21.1	-22.7
150	-2.6	-4.2	-5.7	-11.4	-12.9	-14.4	-18.4	-19.9	-21.5
140	-2.4	-4.0	-5.5	-10.6	-12.1	-13.7	-17.0	-18.5	-20.0
130	-2.1	-3.6	-5.2	-9.6	-11.1	-12.7	-15.3	-16.9	-18.4
120	-1.5	-3.1	-4.6	-8.4	-9.9	-11.5	-13.5	-15.1	-16.6
110	-0.7	-2.3	-3.8	-6.9	-8.5	-10.0	-11.5	-13.1	-14.6
100	0.0	-1.3	-2.8	-5.3	-6.8	-8.4	-9.3	-10.8	-12.4
90	0.0	-0.1	-1.7	-3.4	-5.0	-6.5	-6.9	-8.4	-10.0

V1(MCG) Limit Weight (1000 LB)

ADJUSTED FIELD LENGTH (FT)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
3400	97.0								
3800	139.7	87.1							
4200	181.8	129.9	77.2	74.3					
4600		172.2	120.1	102.3					
5000			162.5	131.6	84.3				
5400			204.4	163.0	112.6		72.9		
5800				196.9	142.7	94.4	89.9		
6200					174.9	123.2	107.3	72.1	
6600					209.4	154.0	125.8	89.1	
7000						187.2	145.5	106.4	71.3
7400							166.8	124.8	88.2
7800							190.1	144.5	105.5
8200								165.7	123.9
8600								188.9	143.5
9000									164.6
9400									187.7

1. **Enter Weight Adjustment table with reported braking action and dry field/obstacle limit weight to obtain slippery runway weight adjustment.**
2. **Adjust "Good" field length available by -70 ft/+70 ft for every 5°C above/below 4°C.**
   Adjust "Medium" field length available by -70 ft/+70 ft for every 5°C above/below 4°C.
   Adjust "Poor" field length available by -120 ft/+120 ft for every 5°C above/below 4°C.
3. **Find V1(MCG) limit weight for adjusted field length and pressure altitude.**
4. **Max allowable slippery runway limited weight is lesser of weights from 1 and 3.**

ADVISORY INFORMATION

Slippery Runway Takeoff
Maximum Reverse Thrust
V1 Adjustment (KIAS)

WEIGHT (1000 LB)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
190	-6	-1	0	-16	-11	-6	-29	-24	-19
180	-7	-2	0	-18	-13	-8	-30	-25	-20
170	-8	-3	0	-19	-14	-9	-32	-27	-22
160	-9	-4	0	-20	-15	-10	-34	-29	-24
150	-10	-5	0	-22	-17	-12	-36	-31	-26
140	-11	-6	-1	-23	-18	-13	-37	-32	-27
130	-12	-7	-2	-24	-19	-14	-39	-34	-29
120	-13	-8	-3	-26	-21	-16	-41	-36	-31
110	-14	-9	-4	-27	-22	-17	-42	-37	-32
100	-15	-10	-5	-29	-24	-19	-44	-39	-34
90	-16	-11	-6	-30	-25	-20	-46	-41	-36

1. **Obtain V1, VR and V2 for the actual weight using the Dry Runway Takeoff Speeds table.**
2. **If V1(MCG) limited, set V1 = V1(MCG). If not V1(MCG) limited, enter V1 Adjustment table with the actual weight to obtain V1 speed adjustment. If adjusted V1 is less than V1(MCG), set V1 = V1(MCG). V1 not to exceed VR.**

ADVISORY INFORMATION

Slippery Runway Takeoff

No Reverse Thrust

Weight Adjustments (1000 LB)

DRY FIELD/OBSTACLE LIMIT WEIGHT (1000 LB)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
190	-5.6	-6.7	-7.8	-19.7	-20.8	-21.9	-30.9	-32.0	-33.1
180	-5.5	-6.6	-7.7	-18.9	-20.0	-21.1	-29.7	-30.8	-31.9
170	-5.4	-6.5	-7.6	-18.1	-19.2	-20.3	-28.4	-29.5	-30.6
160	-5.4	-6.5	-7.6	-17.3	-18.4	-19.5	-27.1	-28.2	-29.3
150	-5.3	-6.4	-7.5	-16.5	-17.6	-18.7	-25.9	-27.0	-28.1
140	-5.2	-6.3	-7.4	-15.7	-16.8	-17.9	-24.6	-25.7	-26.8
130	-5.1	-6.2	-7.3	-14.9	-16.0	-17.1	-23.3	-24.4	-25.5
120	-5.1	-6.2	-7.3	-14.1	-15.2	-16.3	-22.1	-23.2	-24.3
110	-5.0	-6.1	-7.2	-13.3	-14.4	-15.5	-20.8	-21.9	-23.0
100	-4.9	-6.0	-7.1	-12.5	-13.6	-14.7	-19.6	-20.7	-21.8
90	-4.8	-5.9	-7.1	-11.7	-12.8	-13.9	-18.3	-19.4	-20.5

V1(MCG) Limit Weight (1000 LB)

ADJUSTED FIELD LENGTH (FT)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
4000	93.6								
4400	158.5	75.5							
4800	209.4	145.3							
5200		198.1	131.3						
5600			186.8						
6000				75.1					
6400				135.9					
6800				190.6	122.5				
7200					178.5	108.7			
7600						166.1			
9600							84.2		
10000							125.6		
10400							168.4	90.5	
10800								132.1	
11200								175.1	96.9
11600									138.7
12000									181.9

1. **Enter Weight Adjustment table with reported braking action and 27K Bump dry field/obstacle limit weight to obtain slippery runway weight adjustment.**
2. **Adjust “Good” field length available by -80 ft/+80 ft for every 5°C above/below 4°C.**
   Adjust “Medium” field length available by -80 ft/+80 ft for every 5°C above/below 4°C.
   Adjust “Poor” field length available by -160 ft/+160 ft for every 5°C above/below 4°C.
3. **Find V1(MCG) limit weight for adjusted field length and pressure altitude.**
4. **Max allowable slippery runway limited weight is lesser of weights from 1 and 3.**

ADVISORY INFORMATION

Slippery Runway Takeoff
No Reverse Thrust
V1 Adjustment (KIAS)

WEIGHT (1000 LB)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
190	-9	0	0	-23	-13	-3	-44	-34	-24
180	-10	0	0	-25	-15	-5	-47	-37	-27
170	-11	-1	0	-27	-17	-7	-50	-40	-30
160	-12	-2	0	-29	-19	-9	-53	-43	-33
150	-14	-4	0	-31	-21	-11	-56	-46	-36
140	-15	-5	0	-34	-24	-14	-60	-50	-40
130	-17	-7	0	-37	-27	-17	-63	-53	-43
120	-19	-9	0	-40	-30	-20	-67	-57	-47
110	-21	-11	-1	-43	-33	-23	-71	-61	-51
100	-23	-13	-3	-46	-36	-26	-75	-65	-55
90	-25	-15	-5	-50	-40	-30	-79	-69	-59

1. **Obtain V1, VR and V2 for the actual weight using the Dry Runway Takeoff Speeds table.**
2. **If V1(MCG) limited, set V1 = V1(MCG). If not V1(MCG) limited, enter V1 Adjustment table with the actual weight to obtain V1 speed adjustment. If adjusted V1 is less than V1(MCG), set V1 = V1(MCG). V1 not to exceed VR**

Takeoff %N1

Based on engine bleed for packs on, engine and wing anti-ice on or off

OAT (°C)	AIRPORT PRESSURE ALTITUDE (FT)												
	-2000	-1000	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
60	95.7	96.2	96.7	96.9	96.7	97.0	97.2	97.3	96.9	96.3	96.0	95.9	95.9
55	96.8	97.2	97.4	97.6	97.5	97.7	98.0	98.1	97.8	97.2	96.7	96.0	95.3
50	97.6	98.2	98.7	98.6	98.3	98.5	98.7	99.0	98.7	98.2	97.6	97.0	96.3
45	98.3	98.9	99.4	99.6	99.6	99.6	99.6	99.8	99.5	99.0	98.5	97.9	97.3
40	99.0	99.7	100.2	100.4	100.3	100.4	100.5	100.5	100.3	99.9	99.4	98.8	98.2
35	99.7	100.5	101.2	101.4	101.3	101.4	101.5	101.5	101.2	100.7	100.2	99.7	99.1
30	99.3	100.8	102.6	102.3	102.3	102.2	102.3	102.4	102.1	101.8	101.4	100.6	100.0
25	98.5	100.1	101.9	102.2	102.5	102.6	102.6	102.6	102.5	102.5	102.4	101.4	100.9
20	97.8	99.3	101.2	101.5	101.8	102.0	102.3	102.6	102.6	102.6	102.5	101.8	101.0
15	97.0	98.5	100.5	100.8	101.1	101.3	101.6	101.8	102.1	102.4	102.5	102.0	101.3
10	96.2	97.8	99.7	100.1	100.3	100.6	100.8	101.1	101.4	101.6	101.9	101.8	101.7
5	95.4	97.0	99.0	99.3	99.6	99.8	100.1	100.3	100.6	100.9	101.2	101.0	100.9
0	94.6	96.2	98.2	98.6	98.8	99.1	99.3	99.6	99.8	100.1	100.4	100.3	100.1
-5	93.8	95.4	97.5	97.8	98.1	98.3	98.6	98.8	99.1	99.4	99.6	99.5	99.4
-10	93.0	94.6	96.7	97.0	97.3	97.5	97.8	98.0	98.3	98.6	98.8	98.7	98.6
-15	92.2	93.8	95.9	96.3	96.5	96.8	97.0	97.3	97.5	97.8	98.1	97.9	97.8
-20	91.4	93.0	95.2	95.5	95.7	96.0	96.2	96.5	96.7	97.0	97.3	97.1	97.0
-25	90.5	92.2	94.4	94.7	94.9	95.2	95.4	95.7	95.9	96.2	96.5	96.3	96.2
-30	89.7	91.3	93.6	93.9	94.1	94.4	94.6	94.9	95.1	95.4	95.6	95.5	95.4
-35	88.8	90.5	92.8	93.1	93.3	93.6	93.8	94.0	94.3	94.6	94.8	94.7	94.6
-40	88.0	89.6	91.9	92.3	92.5	92.7	93.0	93.2	93.5	93.7	94.0	93.9	93.7
-45	87.1	88.8	91.1	91.4	91.7	91.9	92.1	92.4	92.6	92.9	93.1	93.0	92.9
-50	86.2	87.9	90.3	90.6	90.8	91.1	91.3	91.5	91.8	92.0	92.3	92.2	92.0

%N1 Adjustments for Engine Bleeds

BLEED CONFIGURATION	AIRPORT PRESSURE ALTITUDE (FT)												
	-2000	-1000	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
PACKS OFF	0.7	0.8	0.8	0.9	0.9	0.9	1.0	1.0	1.0	1.0	1.0	1.0	1.0

Assumed Temperature Reduced Thrust

Maximum Assumed Temperature (Table 1 of 3)

Based on 25% Takeoff Thrust Reduction

OAT (°C)	AIRPORT PRESSURE ALTITUDE (FT)											
	-1000	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
55	73	71	69	67								
50	73	71	69	67	65	63						
45	73	71	69	67	65	63	61	59	57			
40	73	71	69	67	65	63	61	59	57	55		
35	70	69	69	67	65	63	61	59	57	55	53	
30	67	65	66	65	65	63	61	59	57	55	53	51
25	67	65	65	63	64	63	61	59	57	55	53	51
20	67	65	65	63	64	63	61	59	57	55	53	51
15	67	65	65	63	64	63	61	59	57	55	53	51
10 & BELOW	67	65	65	63	64	63	61	59	57	55	53	51

Takeoff %N1 (Table 2 of 3)

Based on engine bleed for packs on, engine and wing anti-ice on or off

ASSUMED TEMP (°C)	AIRPORT PRESSURE ALTITUDE (FT)											
	-1000	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
75	94.1	94.4	95.2	95.4	96.3	97.2	97.7	97.9	98.0	98.0	98.0	98.0
70	94.8	95.2	95.4	95.0	95.6	96.5	97.1	97.3	97.3	97.3	97.3	97.3
65	95.6	96.0	96.1	95.9	96.2	96.4	96.4	96.6	96.6	96.6	96.6	96.6
60	96.2	96.7	96.9	96.7	97.0	97.2	97.3	96.9	96.3	96.0	95.9	95.9
55	97.2	97.4	97.6	97.5	97.7	98.0	98.1	97.8	97.2	96.7	96.0	95.3
50	98.2	98.7	98.6	98.3	98.5	98.7	99.0	98.7	98.2	97.6	97.0	96.3
45	98.9	99.4	99.6	99.6	99.6	99.6	99.8	99.5	99.0	98.5	97.9	97.3
40	99.7	100.2	100.4	100.3	100.4	100.5	100.5	100.3	99.9	99.4	98.8	98.2
35	100.5	101.2	101.4	101.3	101.4	101.5	101.5	101.2	100.7	100.2	99.7	99.1
30	100.8	102.6	102.3	102.3	102.2	102.3	102.4	102.1	101.8	101.4	100.6	100.0
25	100.1	101.9	102.2	102.5	102.6	102.6	102.6	102.5	102.5	102.4	101.4	100.9
20	99.3	101.2	101.5	101.8	102.0	102.3	102.6	102.6	102.6	102.5	101.8	101.0
15	98.5	100.5	100.8	101.1	101.3	101.6	101.8	102.1	102.4	102.5	102.0	101.3
10	97.8	99.7	100.1	100.3	100.6	100.8	101.1	101.4	101.6	101.9	101.8	101.7
MINIMUM ASSUMED TEMP (°C)	32	30	28	26	24	22	20	18	16	15	12	10

With engine bleed for packs off, increase %N1 by 1.0.

Assumed Temperature Reduced Thrust

%N1 Adjustment for Temperature Difference (Table 3 of 3)

ASSUMED TEMP MINUS OAT (°C)	OUTSIDE AIR TEMPERATURE (°C)													
	-40	-20	0	5	10	15	20	25	30	35	40	45	50	55
110	14.7													
100	15.0	10.3												
90	14.0	11.5												
80	12.8	11.7	7.2											
70	10.7	10.7	8.3	7.2	5.6									
60	9.2	9.4	8.6	8.4	6.8	5.7	4.1							
50	7.8	7.5	7.5	7.2	7.0	6.9	5.3	4.2	2.7					
40		6.0	6.1	6.1	5.9	5.8	5.8	5.4	4.2	4.0	4.6			
30		4.6	4.4	4.5	4.6	4.5	4.4	4.3	4.3	4.2	4.1	4.0	4.0	
20			2.9	2.9	2.9	3.0	3.0	3.0	2.9	2.9	2.8	2.8	2.7	2.7
10			1.5	1.5	1.5	1.4	1.4	1.5	1.5	1.5	1.4	1.4	1.4	1.4
0			0	0	0	0	0	0	0	0	0	0	0	0

1. **Determine Maximum Assumed Temperature allowed from Table 1.**
2. **Find Maximum %N1 from Table 2 using the desired assumed temperature (no greater than temperature from Table 1).**
3. **Use the difference between assumed temperature and OAT to determine the %N1 adjustment from Table 3.**
4. **Subtract %N1 adjustment from Maximum %N1 in Table 2.**

Takeoff Speeds - Dry Runway (26K Derate)

V1, VR, V2

WEIGHT	FLAPS 1			FLAPS 5			FLAPS 10			FLAPS 15			FLAPS 25		
(1000 LB)	V1	VR	V2	V1	VR	V2	V1	VR	V2	V1	VR	V2	V1	VR	V2
190	169	172	178	161	164	170									
180	164	167	173	157	159	166	148	150	157	146	148	155			
170	159	162	169	152	154	162	144	146	153	142	144	151	139	140	147
160	154	156	165	147	149	158	139	141	149	137	139	147	134	135	143
150	149	150	160	142	143	153	134	135	145	132	134	143	129	130	139
140	143	145	155	136	138	149	129	130	141	127	128	139	124	125	135
130	137	138	150	130	131	144	123	124	136	121	123	134	119	119	131
120	131	131	145	124	125	139	117	118	131	116	117	129	113	113	126
110	124	124	139	118	118	133	111	112	126	110	110	124	107	107	121
100	117	117	133	111	111	128	105	105	121	104	104	119	101	101	116
90	109	109	127	104	104	122	99	99	115	97	97	114	94	94	111

Check V1(MCG).

V1, VR, V2 Adjustments*

TEMP		V1							VR							V2						
		PRESS ALT (1000 FT)							PRESS ALT (1000 FT)							PRESS ALT (1000 FT)						
°C	°F	-2	0	2	4	6	8	10	-2	0	2	4	6	8	10	-2	0	2	4	6	8	10
70	158	5	5						4	5						-2	-2					
60	140	4	4	5	6				3	4	5	6				-2	-2	-2	-3			
50	122	2	3	4	5	6	7	8	2	3	4	5	6	7	8	-1	-1	-2	-2	-2	-3	-4
40	104	1	1	2	3	4	5	7	1	1	2	3	4	6	7	0	-1	-1	-1	-2	-2	-3
30	86	0	0	1	2	3	5	6	0	0	1	2	4	5	6	0	0	-1	-1	-1	-2	-2
20	68	0	0	1	2	3	4	5	0	0	1	2	3	4	5	0	0	0	-1	-1	-2	-2
-60	-76	0	0	1	2	3	4	5	0	0	1	2	3	4	5	0	0	0	-1	-1	-1	-2

Slope and Wind V1 Adjustments*

WEIGHT	SLOPE (%)					WIND (KTS)							
(1000 LB)	-2	-1	0	1	2	-15	-10	-5	0	10	20	30	40
190	-4	-2	0	1	2	-2	-1	-1	0	0	0	1	1
170	-3	-1	0	1	2	-2	-1	-1	0	0	1	1	1
150	-2	-1	0	1	1	-2	-1	0	0	0	1	1	1
130	-1	0	0	1	1	-2	-1	0	0	0	1	1	1
110	-1	0	0	0	0	-1	-1	0	0	0	0	0	0
90	0	0	0	0	0	-1	-1	0	0	0	0	0	0

***V1 not to exceed VR.**

V1(MCG)

TEMP		PRESSURE ALTITUDE (FT)						
°C	°F	-2000	0	2000	4000	6000	8000	10000
70	158	93	91					
60	140	93	91	89	88			
50	122	95	93	90	88	86	83	81
40	104	99	97	94	90	87	83	81
30	86	102	101	98	94	90	86	83
20	68	102	102	99	95	92	88	85
-60	-76	104	103	100	96	93	90	87

Takeoff Speeds - Wet Runway (26K Derate)

V1, VR, V2

WEIGHT (1000 LB)	FLAPS 1			FLAPS 5			FLAPS 10			FLAPS 15			FLAPS 25		
	V1	VR	V2	V1	VR	V2	V1	VR	V2	V1	VR	V2	V1	VR	V2
190	165	172	178	156	164	170									
180	159	167	173	150	159	166	142	150	157	140	148	155			
170	153	162	169	145	154	162	137	146	153	135	144	151	131	140	147
160	147	156	165	139	149	158	132	141	149	130	139	147	126	135	143
150	141	150	160	134	143	153	126	135	145	125	134	143	121	130	139
140	135	145	155	128	138	149	121	130	141	119	128	139	116	125	135
130	128	138	150	122	131	144	115	124	136	114	123	134	110	119	131
120	122	131	145	115	125	139	109	118	131	108	117	129	104	113	126
110	115	124	139	109	118	133	103	112	126	101	110	124	98	107	121
100	107	117	133	102	111	128	96	105	121	95	104	119	92	101	116
90	100	109	127	95	104	122	89	99	115	88	97	114	85	94	111

Check V1(MCG).

V1, VR, V2 Adjustment*

TEMP		V1							VR							V2						
		PRESS ALT (1000 FT)							PRESS ALT (1000 FT)							PRESS ALT (1000 FT)						
°C	°F	-2	0	2	4	6	8	10	-2	0	2	4	6	8	10	-2	0	2	4	6	8	10
70	158	7	8						4	5						-2	-2					
60	140	5	6	7	9				3	4	5	6				-2	-2	-2	-3			
50	122	3	4	5	6	7	9	12	2	3	4	5	6	7	8	-1	-1	-2	-2	-2	-3	-4
40	104	1	2	3	4	5	7	9	1	1	2	3	5	6	7	0	-1	-1	-1	-2	-2	-3
30	86	0	0	1	3	4	5	7	0	0	1	2	4	5	6	0	0	-1	-1	-1	-2	-2
20	68	0	0	1	2	4	5	6	0	0	1	2	3	4	5	0	0	0	-1	-1	-2	-2
-60	-76	0	0	1	2	4	5	6	0	0	1	2	3	4	5	0	0	0	-1	-1	-1	-2

Slope and Wind V1 Adjustment*

WEIGHT (1000 LB)	SLOPE (%)					WIND (KTS)							
	-2	-1	0	1	2	-15	-10	-5	0	10	20	30	40
190	-5	-2	0	3	6	-4	-2	-1	0	1	1	2	3
170	-4	-2	0	2	5	-4	-2	-1	0	1	1	2	3
150	-3	-2	0	2	4	-4	-2	-1	0	1	2	2	3
130	-3	-1	0	2	3	-4	-3	-1	0	1	2	2	3
110	-2	-1	0	1	2	-5	-3	-1	0	1	2	3	4
90	-2	-1	0	1	1	-5	-3	-2	0	1	2	3	4

***V1 not to exceed VR.**

V1(MCG)

TEMP		PRESSURE ALTITUDE (FT)						
°C	°F	-2000	0	2000	4000	6000	8000	10000
70	158	93	91					
60	140	93	91	89	88			
50	122	95	93	90	88	86	83	81
40	104	99	97	94	90	87	83	81
30	86	102	101	98	94	90	86	83
20	68	102	102	99	95	92	88	85
-60	-76	104	103	100	96	93	90	87

Stab Trim Setting (26K Derate)

Flaps 1 and 5

WEIGHT (1000 LB)	C.G. (%MAC)										
	6	8	9	20	25	26	28	30	32	34	36
190	8 1/2	8 1/4	8 1/4	6 1/2	5 3/4	5 3/4	5 1/4	5	4 3/4	4 1/2	4 1/4
180	8 1/2	8 1/4	8	6 1/2	5 3/4	5 1/2	5 1/4	5	4 1/2	4 1/4	4
160	8	7 3/4	7 1/2	6	5 1/4	5	4 3/4	4 1/2	4 1/4	4	3 1/2
140	7 1/2	7	7	5 1/2	4 3/4	4 1/2	4 1/4	4	3 3/4	3 1/2	3 1/4
120	6 3/4	6 1/2	6 1/2	5	4 1/4	4 1/4	4	3 3/4	3 1/2	3	2 3/4
90-100	6	5 3/4	5 3/4	4 1/4	3 3/4	3 1/2	3 1/4	3	2 3/4	2 3/4	2 3/4

Flaps 10, 15 and 25

WEIGHT (1000 LB)	C.G. (%MAC)										
	6	8	9	20	25	26	28	30	32	34	36
190	8 1/2	8 1/2	8 1/4	5 3/4	4 3/4	4 3/4	4 1/4	4	3 1/2	3 1/4	2 3/4
180	8 1/2	8 1/4	8	5 1/2	4 3/4	4 1/2	4	3 3/4	3 1/4	3	2 3/4
160	8	7 3/4	7 1/2	5 1/4	4 1/4	4	3 3/4	3 1/4	3	2 3/4	2 3/4
140	7 1/2	7	6 3/4	4 3/4	3 3/4	3 3/4	3 1/4	3	2 3/4	2 3/4	2 3/4
120	7	6 1/2	6 1/4	4 1/4	3 1/4	3 1/4	2 3/4	2 3/4	2 3/4	2 3/4	2 3/4
90-100	6 1/4	5 3/4	5 1/2	3 3/4	3	2 3/4	2 3/4	2 3/4	2 3/4	2 3/4	2 3/4

ADVISORY INFORMATION

Slush/Standing Water Takeoff (26K Derate)

Maximum Reverse Thrust

Weight Adjustments (1000 LB)

26K DERATE DRY FIELD/OBSTACLE LIMIT WEIGHT (1000 LB)	SLUSH/STANDING WATER DEPTH								
	0.12 INCHES (3 mm)			0.25 INCHES (6 mm)			0.50 INCHES (13 mm)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
190	-21.8	-26.3	-30.8	-26.6	-31.1	-35.6	-37.2	-43.7	-50.2
180	-20.5	-25.0	-29.5	-24.7	-29.2	-33.7	-33.5	-40.0	-46.5
170	-19.1	-23.6	-28.1	-22.5	-27.0	-31.5	-29.8	-36.3	-42.8
160	-17.4	-21.9	-26.4	-20.2	-24.7	-29.2	-26.3	-32.8	-39.3
150	-15.6	-20.1	-24.6	-17.9	-22.4	-26.9	-22.8	-29.3	-35.8
140	-13.7	-18.2	-22.7	-15.5	-20.0	-24.5	-19.5	-26.0	-32.5
130	-11.7	-16.2	-20.7	-13.1	-17.6	-22.1	-16.3	-22.8	-29.3
120	-9.8	-14.3	-18.8	-10.8	-15.3	-19.8	-13.3	-19.8	-26.3
110	-7.9	-12.4	-16.9	-8.7	-13.2	-17.7	-10.5	-17.0	-23.5
100	-6.1	-10.6	-15.1	-6.7	-11.2	-15.7	-8.0	-14.5	-21.0
90	-4.4	-8.9	-13.4	-4.9	-9.4	-13.9	-5.7	-12.2	-18.7

V1(MCG) Limit Weight (1000 LB)

ADJUSTED FIELD LENGTH (FT)	SLUSH/STANDING WATER DEPTH								
	0.12 INCHES (3 mm)			0.25 INCHES (6 mm)			0.50 INCHES (13 mm)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
3800							72.3		
4200	77.0			83.8			95.5		
4600	101.8			108.6	74.6		120.3	86.8	
5000	128.0	92.4		135.0	99.1		146.6	110.8	78.1
5400	156.2	118.0	83.2	163.0	124.9	89.9	172.1	136.7	101.5
5800	186.1	145.4	108.2	192.5	152.3	115.0	195.2	162.7	126.9
6200		174.7	134.9		181.3	141.8		186.8	153.1
6600		205.3	163.5			170.3		209.1	178.1
7000			193.8			200.0			200.8

1. **Enter Weight Adjustment table with slush/standing water depth and 26K Derate dry field/obstacle limit weight to obtain slush/standing water weight adjustment.**
2. **Adjust field length available by -80 ft/+80 ft for every 5°C above/below 4°C.**
3. **Find V1(MCG) limit weight for adjusted field length and pressure altitude.**
4. **Max allowable slush/standing water limited weight is lesser of weights from 1 and 3.**

ADVISORY INFORMATION

Slush/Standing Water Takeoff (26K Derate)
Maximum Reverse Thrust
V1 Adjustment (KIAS)

WEIGHT (1000 LB)	SLUSH/STANDING WATER DEPTH								
	0.12 INCHES (3 mm)			0.25 INCHES (6 mm)			0.50 INCHES (13 mm)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
190	-16	-11	-6	-8	-3	0	0	0	0
180	-17	-12	-7	-11	-6	-1	0	0	0
170	-19	-14	-9	-13	-8	-3	0	0	0
160	-20	-15	-10	-15	-10	-5	-3	0	0
150	-21	-16	-11	-17	-12	-7	-6	-1	0
140	-22	-17	-12	-19	-14	-9	-9	-4	0
130	-23	-18	-13	-20	-15	-10	-12	-7	-2
120	-24	-19	-14	-22	-17	-12	-15	-10	-5
110	-25	-20	-15	-23	-18	-13	-18	-13	-8
100	-26	-21	-16	-24	-19	-14	-20	-15	-10
90	-27	-22	-17	-26	-21	-16	-23	-18	-13

1. **Obtain V1, VR and V2 for the actual weight using the 26K Derate Dry Runway Takeoff Speeds table.**
2. **If V1(MCG) limited, set V1 = V1(MCG). If not V1(MCG) limited, enter V1 Adjustment table with the actual weight to obtain V1 speed adjustment. If adjusted V1 is less than V1(MCG), set V1 = V1(MCG). V1 not to exceed VR.**

ADVISORY INFORMATION

Slush/Standing Water Takeoff (26K Derate)

No Reverse Thrust

Weight Adjustments (1000 LB)

26K DERATE DRY FIELD/OBSTACLE LIMIT WEIGHT (1000 LB)	SLUSH/STANDING WATER DEPTH								
	0.12 INCHES (3 mm)			0.25 INCHES (6 mm)			0.50 INCHES (13 mm)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
190	-28.9	-34.4	-39.9	-34.0	-39.5	-45.0	-44.6	-53.6	-62.6
180	-27.4	-32.9	-38.4	-31.6	-37.1	-42.6	-40.3	-49.3	-58.3
170	-25.6	-31.1	-36.6	-29.0	-34.5	-40.0	-36.3	-45.3	-54.3
160	-23.6	-29.1	-34.6	-26.4	-31.9	-37.4	-32.4	-41.4	-50.4
150	-21.4	-26.9	-32.4	-23.7	-29.2	-34.7	-28.7	-37.7	-46.7
140	-19.2	-24.7	-30.2	-21.1	-26.6	-32.1	-25.1	-34.1	-43.1
130	-17.0	-22.5	-28.0	-18.4	-23.9	-29.4	-21.7	-30.7	-39.7
120	-14.8	-20.3	-25.8	-15.9	-21.4	-26.9	-18.4	-27.4	-36.4
110	-12.7	-18.2	-23.7	-13.5	-19.0	-24.5	-15.3	-24.3	-33.3
100	-10.7	-16.2	-21.7	-11.3	-16.8	-22.3	-12.3	-21.3	-30.3
90	-9.0	-14.5	-20.0	-9.3	-14.8	-20.3	-9.4	-18.4	-27.4

V1(MCG) Limit Weight (1000 LB)

ADJUSTED FIELD LENGTH (FT)	SLUSH/STANDING WATER DEPTH								
	0.12 INCHES (3 mm)			0.25 INCHES (6 mm)			0.50 INCHES (13 mm)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
5400							75.7		
5800							106.0		
6200				94.0			139.5	94.3	
6600	101.0			133.4	80.3		172.1	126.7	83.1
7000	145.5	86.3		174.0	118.1		200.7	160.3	114.1
7400	194.1	128.0	71.8		159.0	103.4		190.3	147.9
7800		176.0	111.4		197.4	143.7			179.6
8200			157.6			183.6			207.6
8600			206.1						

1. **Enter Weight Adjustment table with slush/standing water depth and 26K Derate dry field/obstacle limit weight to obtain slush/standing water weight adjustment.**
2. **Adjust field length available by -140 ft/+140 ft for every 5°C above/below 4°C.**
3. **Find V1(MCG) limit weight for adjusted field length and pressure altitude.**
4. **Max allowable slush/standing water limited weight is lesser of weights from 1 and 3.**

ADVISORY INFORMATION

Slush/Standing Water Takeoff (26K Derate)
No Reverse Thrust
V1 Adjustment (KIAS)

WEIGHT (1000 LB)	SLUSH/STANDING WATER DEPTH								
	0.12 INCHES (3 mm)			0.25 INCHES (6 mm)			0.50 INCHES (13 mm)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
190	-24	-14	-4	-14	-4	0	0	0	0
180	-26	-16	-6	-17	-7	0	0	0	0
170	-28	-18	-8	-20	-10	0	0	0	0
160	-30	-20	-10	-23	-13	-3	-5	0	0
150	-32	-22	-12	-26	-16	-6	-11	-1	0
140	-34	-24	-14	-29	-19	-9	-15	-5	0
130	-36	-26	-16	-32	-22	-12	-20	-10	0
120	-38	-28	-18	-34	-24	-14	-25	-15	-5
110	-39	-29	-19	-37	-27	-17	-29	-19	-9
100	-41	-31	-21	-39	-29	-19	-33	-23	-13
90	-43	-33	-23	-41	-31	-21	-37	-27	-17

1. **Obtain V1, VR and V2 for the actual weight using the 26K Derate Dry Runway Takeoff Speeds table.**
2. **If V1(MCG) limited, set V1 = V1(MCG). If not V1(MCG) limited, enter V1 Adjustment table with the actual weight to obtain V1 speed adjustment. If adjusted V1 is less than V1(MCG), set V1 = V1(MCG).V1 not to exceed VR.**

ADVISORY INFORMATION

Slippery Runway Takeoff (26K Derate)
Maximum Reverse Thrust
Weight Adjustment (1000 LB)

26K DERATE DRY FIELD/OBSTACLE LIMIT WEIGHT (1000 LB)	SLUSH/STANDING WATER DEPTH								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
190	-1.1	-2.7	-4.2	-12.1	-13.6	-15.2	-22.3	-23.9	-25.4
180	-1.8	-3.4	-4.9	-12.3	-13.8	-15.4	-21.7	-23.3	-24.8
170	-2.3	-3.9	-5.4	-12.2	-13.8	-15.3	-20.9	-22.4	-24.0
160	-2.6	-4.2	-5.7	-11.9	-13.5	-15.0	-19.8	-21.4	-22.9
150	-2.7	-4.3	-5.8	-11.4	-13.0	-14.5	-18.6	-20.2	-21.7
140	-2.6	-4.1	-5.7	-10.7	-12.2	-13.8	-17.2	-18.8	-20.3
130	-2.2	-3.8	-5.3	-9.7	-11.3	-12.8	-15.6	-17.1	-18.7
120	-1.7	-3.2	-4.8	-8.6	-10.1	-11.7	-13.8	-15.3	-16.9
110	-0.9	-2.5	-4.0	-7.1	-8.7	-10.2	-11.8	-13.3	-14.9
100	0.0	-1.5	-3.0	-5.5	-7.1	-8.6	-9.6	-11.1	-12.7
90	0.0	-0.3	-1.9	-3.7	-5.2	-6.8	-7.2	-8.7	-10.3

V1(MCG) Limit Weight (1000 LB)

ADJUSTED FIELD LENGTH (FT)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
3400	104.9								
3800	147.7	93.9							
4200	188.8	137.1	82.8	80.6					
4600		178.7	126.5	109.3					
5000			168.4	139.7	94.9				
5400			208.8	172.2	124.3	80.6	77.6		
5800				206.6	155.7	109.3	95.0		
6200					189.4	139.7	113.0	75.4	
6600						172.2	132.3	92.8	
7000						206.6	153.0	110.7	73.2
7400							175.5	129.8	90.6
7800							200.2	150.3	108.4
8200								172.6	127.4
8600								197.1	147.7
9000									169.7
9400									193.9

1. **Enter Weight Adjustment table with reported braking action and 26K Derate dry field/obstacle limit weight to obtain slippery runway weight adjustment.**
2. **Adjust “Good” field length available by -70 ft/+70 ft for every 5°C above/below 4°C.
   Adjust “Medium” field length available by -70 ft/+70 ft for every 5°C above/below 4°C.
   Adjust “Poor” field length available by -120 ft/+120 ft for every 5°C above/below 4°C.**
3. **Find V1(MCG) limit weight for adjusted field length and pressure altitude.**
4. **Max allowable slippery runway limited weight is lesser of weights from 1 and 3.**

ADVISORY INFORMATION

Slippery Runway Takeoff (26K Derate)
Maximum Reverse Thrust
V1 Adjustment (KIAS)

WEIGHT (1000 LB)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
190	-6	-1	0	-15	-10	-5	-27	-22	-17
180	-7	-2	0	-17	-12	-7	-29	-24	-19
170	-7	-2	0	-18	-13	-8	-31	-26	-21
160	-8	-3	0	-19	-14	-9	-33	-28	-23
150	-9	-4	0	-21	-16	-11	-34	-29	-24
140	-10	-5	0	-22	-17	-12	-36	-31	-26
130	-11	-6	-1	-24	-19	-14	-38	-33	-28
120	-12	-7	-2	-25	-20	-15	-40	-35	-30
110	-13	-8	-3	-27	-22	-17	-41	-36	-31
100	-14	-9	-4	-28	-23	-18	-43	-38	-33
90	-16	-11	-6	-29	-24	-19	-44	-39	-34

1. **Obtain V1, VR and V2 for the actual weight using the 26K Derate Dry Runway Takeoff Speeds table.**
2. **If V1(MCG) limited, set V1 = V1(MCG). If not V1(MCG) limited, enter V1 Adjustment table with the actual weight to obtain V1 speed adjustment. If adjusted V1 is less than V1(MCG), set V1 = V1(MCG).V1 not to exceed VR.**

ADVISORY INFORMATION

Slippery Runway Takeoff (26K Derate)

No Reverse Thrust

Weight Adjustments (1000 LB)

26K DERATE DRY FIELD/OBSTACLE LIMIT WEIGHT (1000 LB)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
190	-4.1	-5.8	-7.5	-18.2	-19.9	-21.6	-30.2	-31.9	-33.6
180	-4.9	-6.6	-8.3	-18.3	-20.0	-21.7	-29.6	-31.3	-33.0
170	-5.5	-7.2	-8.9	-18.2	-19.9	-21.6	-28.7	-30.4	-32.1
160	-5.9	-7.6	-9.3	-17.8	-19.5	-21.2	-27.4	-29.1	-30.8
150	-6.0	-7.7	-9.4	-17.2	-18.9	-20.6	-25.8	-27.5	-29.2
140	-6.0	-7.7	-9.4	-16.3	-18.0	-19.7	-23.9	-25.6	-27.3
130	-5.7	-7.4	-9.1	-15.2	-16.9	-18.6	-21.7	-23.4	-25.1
120	-5.1	-6.8	-8.5	-13.8	-15.5	-17.2	-19.2	-20.9	-22.6
110	-4.4	-6.1	-7.8	-12.2	-13.9	-15.6	-16.3	-18.0	-19.7
100	-3.4	-5.1	-6.8	-10.3	-12.0	-13.7	-13.1	-14.8	-16.5
90	-2.2	-3.9	-5.6	-8.2	-9.9	-11.6	-9.6	-11.3	-13.0

V1(MCG) Limit Weight (1000 LB)

ADJUSTED FIELD LENGTH (FT)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
3800	72.7								
4200	144.3								
4600	192.9	129.4							
5000		181.9	112.9						
5400			170.2						
6200				131.0					
6600				186.2	100.6				
7000					159.4				
7400						131.0			
7800						186.2			
9400							91.0		
9800							133.4		
10200							177.2	80.6	
10600								122.7	
11000								166.1	70.2
11400									112.0
11800									155.1
12200									199.6

1. **Enter Weight Adjustment table with reported braking action and 26K Derate dry field/obstacle limit weight to obtain slippery runway weight adjustment.**
2. **Adjust "Good" field length available by -80 ft/+80 ft for every 5°C above/below 4°C.**
   Adjust "Medium" field length available by -80 ft/+80 ft for every 5°C above/below 4°C.
   Adjust "Poor" field length available by -160 ft/+160 ft for every 5°C above/below 4°C.
3. **Find V1(MCG) limit weight for adjusted field length and pressure altitude.**
4. **Max allowable slippery runway limited weight is lesser of weights from 1 and 3.**

ADVISORY INFORMATION

Slippery Runway Takeoff (26K Derate)
No Reverse Thrust
V1 Adjustment (KIAS)

WEIGHT (1000 LB)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
190	-8	-3	0	-21	-16	-11	-41	-36	-31
180	-9	-4	0	-23	-18	-13	-44	-39	-34
170	-10	-5	0	-25	-20	-15	-47	-42	-37
160	-12	-7	-2	-27	-22	-17	-51	-46	-41
150	-13	-8	-3	-30	-25	-20	-54	-49	-44
140	-15	-10	-5	-32	-27	-22	-57	-52	-47
130	-16	-11	-6	-35	-30	-25	-61	-56	-51
120	-18	-13	-8	-38	-33	-28	-65	-60	-55
110	-20	-15	-10	-41	-36	-31	-68	-63	-58
100	-22	-17	-12	-44	-39	-34	-72	-67	-62
90	-24	-19	-14	-48	-43	-38	-76	-71	-66

1. **Obtain V1, VR and V2 for the actual weight using the 26K Derate Dry Runway Takeoff Speeds table.**
2. **If V1(MCG) limited, set V1 = V1(MCG). If not V1(MCG) limited, enter V1 Adjustment table with the actual weight to obtain V1 speed adjustment. If adjusted V1 is less than V1(MCG), set V1 = V1(MCG). V1 not to exceed VR.**

Takeoff %N1 - (26K Derate)

Based on engine bleeds for packs on, engine and wing anti-ice on or off

OAT (°C)	AIRPORT PRESSURE ALTITUDE (FT)												
	-2000	-1000	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
60	94.8	95.4	95.8	95.9	96.0	96.1	96.2	96.3	96.2	95.9	95.8	95.7	95.7
55	95.4	96.0	96.5	96.6	96.7	96.8	96.9	97.1	96.9	96.6	96.3	95.7	95.0
50	96.0	96.6	97.1	97.3	97.4	97.6	97.7	97.8	97.7	97.4	97.1	96.6	96.1
45	96.8	97.4	97.8	98.0	98.1	98.3	98.4	98.5	98.4	98.1	97.8	97.5	97.1
40	97.4	98.1	98.6	98.7	98.8	98.9	99.0	99.2	99.1	98.8	98.5	98.4	98.1
35	98.0	98.7	99.4	99.5	99.6	99.7	99.8	99.9	99.8	99.5	99.2	99.1	99.0
30	97.6	98.8	100.3	100.3	100.4	100.4	100.5	100.5	100.4	100.3	100.0	99.9	99.9
25	96.8	98.1	99.5	100.1	100.7	100.8	100.7	100.7	100.7	100.7	100.6	100.6	100.7
20	96.0	97.3	98.8	99.3	99.9	100.2	100.5	100.8	100.8	100.9	100.8	100.8	100.8
15	95.2	96.5	98.0	98.6	99.2	99.5	99.8	100.1	100.5	100.9	101.1	101.1	101.1
10	94.5	95.8	97.2	97.8	98.4	98.7	99.0	99.4	99.7	100.1	100.5	101.0	101.5
5	93.7	95.0	96.4	97.0	97.6	98.0	98.3	98.6	99.0	99.4	99.8	100.3	100.7
0	92.9	94.2	95.6	96.3	96.9	97.2	97.5	97.9	98.2	98.6	99.0	99.5	100.0
-5	92.0	93.4	94.8	95.5	96.1	96.4	96.7	97.1	97.5	97.9	98.3	98.7	99.2
-10	91.2	92.6	94.0	94.7	95.3	95.6	96.0	96.3	96.7	97.1	97.5	98.0	98.4
-15	90.4	91.7	93.2	93.9	94.5	94.8	95.2	95.6	95.9	96.3	96.7	97.2	97.6
-20	89.6	90.9	92.4	93.0	93.7	94.0	94.4	94.8	95.2	95.6	95.9	96.4	96.8
-25	88.7	90.1	91.6	92.2	92.9	93.2	93.6	94.0	94.4	94.8	95.2	95.6	96.0
-30	87.9	89.2	90.7	91.4	92.0	92.4	92.8	93.2	93.6	94.0	94.3	94.8	95.2
-35	87.0	88.4	89.9	90.5	91.2	91.6	91.9	92.4	92.8	93.1	93.5	94.0	94.4
-40	86.1	87.5	89.0	89.7	90.3	90.7	91.1	91.5	91.9	92.3	92.7	93.1	93.6
-45	85.3	86.6	88.2	88.8	89.5	89.9	90.3	90.7	91.1	91.5	91.9	92.3	92.7
-50	84.4	85.7	87.3	87.9	88.6	89.0	89.4	89.9	90.3	90.6	91.0	91.5	91.9

%N1 Adjustments for Engine Bleeds

BLEED CONFIGURATION	AIRPORT PRESSURE ALTITUDE (FT)												
	-2000	-1000	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
PACKS OFF	0.7	0.7	0.7	0.7	0.7	0.7	0.8	0.8	0.8	0.8	0.8	0.9	1.0

Assumed Temperature Reduced Thrust - (26K Derate)

Maximum Assumed Temperature (Table 1 of 3)

Based on 25% Takeoff Thrust Reduction

OAT (°C)	AIRPORT PRESSURE ALTITUDE (FT)											
	-1000	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
55	73	71	69	67								
50	73	71	69	67	65	63						
45	73	71	69	67	65	63	61	59	57			
40	73	71	69	67	65	63	61	59	57	55		
35	71	71	69	67	65	63	61	59	57	55	53	
30	69	67	67	67	65	63	61	59	57	55	53	51
25	69	67	66	64	65	63	61	59	57	55	53	51
20	69	67	66	64	64	63	61	59	57	55	53	51
15	69	67	66	64	64	63	61	59	57	55	53	51
10 & BELOW	69	67	66	64	64	63	61	59	57	55	53	51

Takeoff %N1 (Table 2 of 3)

Based on engine bleed for packs on, engine and wing anti-ice on or off

ASSUMED TEMP (°C)	AIRPORT PRESSURE ALTITUDE (FT)											
	-1000	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
75	93.4	93.7	94.2	94.7	95.4	96.1	96.9	97.3	97.6	97.8	97.8	97.7
70	94.1	94.4	94.4	94.4	94.7	95.4	96.2	96.6	96.9	97.1	97.1	97.1
65	94.8	95.1	95.2	95.2	95.3	95.4	95.5	96.0	96.2	96.5	96.4	96.4
60	95.4	95.8	95.9	96.0	96.1	96.2	96.3	96.2	95.9	95.8	95.7	95.7
55	96.0	96.5	96.6	96.7	96.8	96.9	97.1	96.9	96.6	96.3	95.7	95.0
50	96.6	97.1	97.3	97.4	97.6	97.7	97.8	97.7	97.4	97.1	96.6	96.1
45	97.4	97.8	98.0	98.1	98.3	98.4	98.5	98.4	98.1	97.8	97.5	97.1
40	98.1	98.6	98.7	98.8	98.9	99.0	99.2	99.1	98.8	98.5	98.4	98.1
35	98.7	99.4	99.5	99.6	99.7	99.8	99.9	99.8	99.5	99.2	99.1	99.0
30	98.8	100.3	100.3	100.4	100.4	100.5	100.5	100.4	100.3	100.0	99.9	99.9
25	98.1	99.5	100.1	100.7	100.8	100.7	100.7	100.7	100.7	100.6	100.6	100.7
20	97.3	98.8	99.3	99.9	100.2	100.5	100.8	100.8	100.9	100.8	100.8	100.8
15	96.5	98.0	98.6	99.2	99.5	99.8	100.1	100.5	100.9	101.1	101.1	101.1
10	95.8	97.2	97.8	98.4	98.7	99.0	99.4	99.7	100.1	100.5	101.0	101.5
MINIMUM ASSUMED TEMP (°C)	32	30	28	26	24	22	20	18	16	15	12	10

With engine bleed for packs off, increase %N1 by 1.0.

Assumed Temperature Reduced Thrust - (26K Derate)
%N1 Adjustment for Temperature Difference (Table 3 of 3)

ASSUMED TEMP MINUS OAT (°C)	OUTSIDE AIR TEMPERATURE (°C)													
	-40	-20	0	5	10	15	20	25	30	35	40	45	50	55
110	14.9													
100	14.9	10.9												
90	14.0	11.7												
80	12.9	11.6	7.8											
70	11.2	10.7	8.6	7.8	6.3									
60	9.2	9.5	8.5	8.4	7.1	6.3	4.9							
50	7.8	7.8	7.5	7.1	6.9	7.0	5.6	4.9	3.4					
40		6.0	6.2	6.1	5.9	5.8	5.7	5.6	4.7	4.4	5.3			
30		4.6	4.6	4.6	4.6	4.5	4.4	4.3	4.3	4.2	4.1	4.0	3.9	
20			2.9	3.0	3.0	3.0	3.0	3.0	2.9	2.9	2.8	2.8	2.7	2.6
10			1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.4	1.4	1.4	1.4
0			0	0	0	0	0	0	0	0	0	0	0	0

1. **Determine Maximum Assumed Temperature allowed from Table 1.**
2. **Find Maximum %N1 from Table 2 using the desired assumed temperature (no greater than temperature from Table 1).**
3. **Use the difference between assumed temperature and OAT to determine the %N1 adjustment from Table 3.**
4. **Subtract %N1 adjustment from Maximum %N1 in Table 2.**

Takeoff Speeds - Dry Runway (24K Derate)
V1, VR, V2

WEIGHT (1000 LB)	FLAPS 1			FLAPS 5			FLAPS 10			FLAPS 15			FLAPS 25		
	V1	VR	V2	V1	VR	V2	V1	VR	V2	V1	VR	V2	V1	VR	V2
190	172	173	177												
180	167	168	173	159	160	165									
170	162	163	168	154	155	161	146	147	153	144	145	151			
160	156	157	164	149	150	157	141	142	149	139	140	147	136	136	142
150	151	152	160	144	145	153	136	137	144	134	135	143	131	131	139
140	145	146	155	138	139	148	130	131	140	129	130	138	126	126	134
130	139	140	150	132	133	143	125	126	135	123	124	134	121	121	130
120	132	133	144	126	127	138	119	120	130	117	118	129	115	115	125
110	125	126	138	119	120	133	113	113	125	111	112	124	109	109	120
100	118	119	133	113	113	127	107	107	120	105	105	119	102	103	115
90	111	111	127	106	106	121	100	100	114	98	99	113	95	96	110

Check V1(MCG).

V1, VR, V2 Adjustments*

TEMP		V1							VR							V2						
		PRESS ALT (1000 FT)							PRESS ALT (1000 FT)							PRESS ALT (1000 FT)						
°C	°F	-2	0	2	4	6	8	10	-2	0	2	4	6	8	10	-2	0	2	4	6	8	10
70	158	4	5						4	5						-2	-2					
60	140	3	4	5	6				3	4	5	6				-2	-2	-2	-3			
50	122	2	3	4	5	6	6	8	2	3	4	5	6	7	8	-1	-1	-2	-2	-2	-3	-3
40	104	1	1	2	3	4	5	6	1	1	3	4	5	6	7	0	-1	-1	-2	-2	-2	-3
30	86	0	0	1	2	3	4	5	0	0	1	2	3	5	6	0	0	-1	-1	-1	-2	-2
20	68	0	0	0	1	2	3	4	0	0	1	1	2	3	4	0	0	0	0	-1	-1	-2
-60	-76	0	0	0	1	2	2	3	0	0	1	1	2	3	3	0	0	0	0	-1	-1	-1

Slope and Wind V1 Adjustments*

WEIGHT (1000 LB)	SLOPE (%)					WIND (KTS)							
	-2	-1	0	1	2	-15	-10	-5	0	10	20	30	40
190	-4	-2	0	1	1	-1	-1	-1	0	0	0	0	1
170	-3	-2	0	1	1	-1	-1	-1	0	0	0	1	1
150	-2	-1	0	1	1	-1	-1	0	0	0	1	1	1
130	-1	0	0	1	1	-1	-1	0	0	0	1	1	1
110	0	0	0	0	0	-1	-1	0	0	0	0	0	0
90	0	0	0	0	0	-1	0	0	0	0	0	0	0

***V1 not to exceed VR.**

V1(MCG)

TEMP		PRESSURE ALTITUDE (FT)						
°C	°F	-2000	0	2000	4000	6000	8000	10000
70	158	88	86					
60	140	88	86	84	83			
50	122	90	88	84	83	81	79	77
40	104	94	92	89	85	82	79	77
30	86	97	97	93	89	86	82	79
20	68	98	97	95	93	90	86	82
-60	-76	99	99	96	94	91	89	86

Takeoff Speeds - Wet Runway (24K Derate)

V1, VR, V2

WEIGHT (1000 LB)	FLAPS1			FLAPS5			FLAPS 10			FLAPS 15			FLAPS 25		
	V1	VR	V2	V1	VR	V2	V1	VR	V2	V1	VR	V2	V1	VR	V2
190	168	173	177												
180	162	168	173	154	160	165									
170	156	163	168	148	155	161	140	147	153	139	145	151			
160	150	157	164	142	150	157	134	142	149	133	140	147	129	136	142
150	144	152	160	137	145	153	129	137	144	127	135	143	124	131	139
140	138	146	155	131	139	148	124	131	140	122	130	138	119	126	134
130	131	140	150	125	133	143	118	126	135	116	124	134	113	121	130
120	124	133	144	118	127	138	112	120	130	110	118	129	107	115	125
110	117	126	138	111	120	133	105	113	125	104	112	124	101	109	120
100	110	119	133	104	113	127	99	107	120	97	105	119	94	103	115
90	103	111	127	97	106	121	92	100	114	90	99	113	88	96	110

Check V1(MCG).

V1, VR, V2 Adjustment*

TEMP		V1							VR							V2						
		PRESS ALT (1000 FT)							PRESS ALT (1000 FT)							PRESS ALT (1000 FT)						
°C	°F	-2	0	2	4	6	8	10	-2	0	2	4	6	8	10	-2	0	2	4	6	8	10
70	158	7	8						4	5						-2	-2					
60	140	5	6	7	9				3	4	5	6				-2	-2	-2	-3			
50	122	3	4	5	6	8	9	12	2	3	4	5	6	7	8	-1	-1	-2	-2	-2	-3	-3
40	104	1	2	3	4	6	7	9	1	1	3	4	5	6	7	0	-1	-1	-2	-2	-2	-3
30	86	0	0	1	3	4	5	7	0	0	1	2	3	5	6	0	0	-1	-1	-1	-2	-2
20	68	0	0	1	1	2	4	5	0	0	1	1	2	3	4	0	0	0	0	-1	-1	-2
-60	-76	0	0	1	1	2	3	4	0	0	1	1	2	3	3	0	0	0	0	-1	-1	-1

Slope and Wind V1 Adjustment*

WEIGHT (1000 LB)	SLOPE (%)					WIND (KTS)							
	-2	-1	0	1	2	-15	-10	-5	0	10	20	30	40
190	-5	-3	0	3	6	-3	-2	-1	0	1	1	2	2
170	-4	-2	0	3	5	-3	-2	-1	0	1	1	2	3
150	-4	-2	0	2	4	-3	-2	-1	0	1	1	2	3
130	-3	-1	0	2	3	-4	-2	-1	0	1	2	2	3
110	-2	-1	0	1	2	-4	-3	-1	0	1	2	3	3
90	-2	-1	0	1	2	-5	-3	-1	0	1	2	3	4

***V1 not to exceed VR.**

V1(MCG)

TEMP		PRESSURE ALTITUDE (FT)						
°C	°F	-2000	0	2000	4000	6000	8000	10000
70	158	88	86					
60	140	88	86	84	83			
50	122	90	88	84	83	81	79	77
40	104	94	92	89	85	82	79	77
30	86	97	97	93	89	86	82	79
20	68	98	97	95	93	90	86	82
-60	-76	99	99	96	94	91	89	86

Stab Trim Setting (24K Derate)

Flaps 1 and 5

WEIGHT (1000 LB)	C.G. (%MAC)										
	6	8	9	20	25	26	28	30	32	34	36
190	8 1/2	8 1/2	8 1/4	6 1/2	5 3/4	5 3/4	5 1/4	5	4 3/4	4 1/4	4
180	8 1/2	8 1/2	8 1/4	6 1/2	5 3/4	5 1/2	5 1/4	4 3/4	4 1/2	4 1/4	4
160	8 1/4	8	7 3/4	6	5 1/4	5 1/4	5	4 1/2	4 1/4	4	3 3/4
140	7 3/4	7 1/2	7 1/4	5 3/4	5	4 3/4	4 1/2	4 1/4	4	3 3/4	3 1/2
120	7	6 3/4	6 3/4	5 1/4	4 1/2	4 1/2	4 1/4	4	3 3/4	3 1/4	3
90-100	6 1/2	6 1/4	6	4 3/4	4	3 3/4	3 1/2	3 1/4	3	2 3/4	2 3/4

Flaps 10, 15 and 25

WEIGHT (1000 LB)	C.G. (%MAC)										
	6	8	9	20	25	26	28	30	32	34	36
190	8 1/2	8 1/4	8	6	5	5	4 1/2	4 1/4	3 3/4	3 1/2	3 1/4
180	8 1/2	8 1/4	8	5 3/4	5	4 3/4	4 1/2	4	3 3/4	3 1/4	3
160	8	7 3/4	7 1/2	5 1/2	4 1/2	4 1/4	4	3 3/4	3 1/4	3	2 3/4
140	7 1/2	7	7	5	4	4	3 1/2	3 1/4	3	2 3/4	2 3/4
120	7	6 1/2	6 1/4	4 1/2	3 1/2	3 1/2	3 1/4	2 3/4	2 3/4	2 3/4	2 3/4
90-100	6 1/4	6	5 3/4	4	3 1/4	3	2 3/4	2 3/4	2 3/4	2 3/4	2 3/4

ADVISORY INFORMATION

Slush/Standing Water Takeoff (24K Derate)

Maximum Reverse Thrust

Weight Adjustments (1000 LB)

24K DERATE DRY FIELD/OBSTACLE LIMIT WEIGHT (1000 LB)	SLUSH/STANDING WATER DEPTH								
	0.12 INCHES (3 mm)			0.25 INCHES (6 mm)			0.50 INCHES (13 mm)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
190	-23.3	-26.8	-30.3	-29.3	-32.8	-36.3	-37.2	-42.2	-47.2
180	-21.4	-24.9	-28.4	-26.3	-29.8	-33.3	-34.1	-39.1	-44.1
170	-19.5	-23.0	-26.5	-23.5	-27.0	-30.5	-30.9	-35.9	-40.9
160	-17.7	-21.2	-24.7	-21.0	-24.5	-28.0	-27.6	-32.6	-37.6
150	-16.0	-19.5	-23.0	-18.6	-22.1	-25.6	-24.2	-29.2	-34.2
140	-14.2	-17.7	-21.2	-16.3	-19.8	-23.3	-20.9	-25.9	-30.9
130	-12.3	-15.8	-19.3	-14.0	-17.5	-21.0	-17.7	-22.7	-27.7
120	-10.5	-14.0	-17.5	-11.7	-15.2	-18.7	-14.5	-19.5	-24.5
110	-8.5	-12.0	-15.5	-9.4	-12.9	-16.4	-11.4	-16.4	-21.4
100	-6.4	-9.9	-13.4	-7.0	-10.5	-14.0	-8.5	-13.5	-18.5
90	-4.1	-7.6	-11.1	-4.5	-8.0	-11.5	-5.9	-10.9	-15.9

V1(MCG) Limit Weight (1000 LB)

ADJUSTED FIELD LENGTH (FT)	SLUSH/STANDING WATER DEPTH								
	0.12 INCHES (3 mm)			0.25 INCHES (6 mm)			0.50 INCHES (13 mm)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
3800				72.8			83.5		
4200	92.8			98.9			109.6		
4600	120.2	76.4		126.3	82.5		136.0	93.2	
5000	149.5	102.9		155.3	109.0		162.8	119.5	77.0
5400	181.0	130.9	86.3	186.4	136.9	92.3	190.0	146.0	103.0
5800		161.0	113.2		166.7	119.3		173.0	129.4
6200		193.6	141.9		198.7	147.9		200.3	156.1
6600			172.9			178.4			183.2
7000			206.5						

1. **Enter Weight Adjustment table with slush/standing water depth and 24K Derate dry field/obstacle limit weight to obtain slush/standing water weight adjustment.**
2. **Adjust field length available by -80 ft/+80 ft for every 5°C above/below 4°C.**
3. **Find V1(MCG) limit weight for adjusted field length and pressure altitude.**
4. **Max allowable slush/standing water limited weight is lesser of weights from 1 and 3.**

ADVISORY INFORMATION

Slush/Standing Water Takeoff (24K Derate)
Maximum Reverse Thrust
V1 Adjustment (KIAS)

WEIGHT (1000 LB)	SLUSH/STANDING WATER DEPTH								
	0.12 INCHES (3 mm)			0.25 INCHES (6 mm)			0.50 INCHES (13 mm)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
190	-12	-7	-2	-5	0	0	0	0	0
180	-14	-9	-4	-7	-2	0	0	0	0
170	-16	-11	-6	-10	-5	0	0	0	0
160	-17	-12	-7	-12	-7	-2	-1	0	0
150	-19	-14	-9	-14	-9	-4	-4	0	0
140	-20	-15	-10	-16	-11	-6	-7	-2	0
130	-21	-16	-11	-18	-13	-8	-10	-5	0
120	-22	-17	-12	-19	-14	-9	-13	-8	-3
110	-23	-18	-13	-21	-16	-11	-15	-10	-5
100	-24	-19	-14	-22	-17	-12	-18	-13	-8
90	-25	-20	-15	-24	-19	-14	-21	-16	-11

1. **Obtain V1, VR and V2 for the actual weight using the 24K Derate Dry Runway Takeoff Speeds table.**
2. **If V1(MCG) limited, set V1 = V1(MCG). If not V1(MCG) limited, enter V1 Adjustment table with the actual weight to obtain V1 speed adjustment. If adjusted V1 is less than V1(MCG), set V1 = V1(MCG). V1 not to exceed VR.**

ADVISORY INFORMATION

Slush/Standing Water Takeoff (24K Derate)

No Reverse Thrust

Weight Adjustments (1000 LB)

24K DERATE DRY FIELD/OBSTACLE LIMIT WEIGHT (1000 LB)	SLUSH/STANDING WATER DEPTH								
	0.12 INCHES (3 mm)			0.25 INCHES (6 mm)			0.50 INCHES (13 mm)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
190	-30.8	-35.8	-40.8	-37.1	-42.1	-47.1	-47.5	-54.0	-60.5
180	-28.3	-33.3	-38.3	-33.3	-38.3	-43.3	-42.5	-49.0	-55.5
170	-26.0	-31.0	-36.0	-30.0	-35.0	-40.0	-38.0	-44.5	-51.0
160	-23.8	-28.8	-33.8	-27.1	-32.1	-37.1	-33.8	-40.3	-46.8
150	-21.8	-26.8	-31.8	-24.4	-29.4	-34.4	-30.0	-36.5	-43.0
140	-19.7	-24.7	-29.7	-21.8	-26.8	-31.8	-26.4	-32.9	-39.4
130	-17.6	-22.6	-27.6	-19.3	-24.3	-29.3	-23.0	-29.5	-36.0
120	-15.5	-20.5	-25.5	-16.8	-21.8	-26.8	-19.6	-26.1	-32.6
110	-13.1	-18.1	-23.1	-14.1	-19.1	-24.1	-16.2	-22.7	-29.2
100	-10.5	-15.5	-20.5	-11.3	-16.3	-21.3	-12.7	-19.2	-25.7
90	-7.7	-12.7	-17.7	-8.1	-13.1	-18.1	-9.0	-15.5	-22.0

V1(MCG) Limit Weight (1000 LB)

ADJUSTED FIELD LENGTH (FT)	SLUSH/STANDING WATER DEPTH								
	0.12 INCHES (3 mm)			0.25 INCHES (6 mm)			0.50 INCHES (13 mm)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
5000							71.1		
5400							104.1		
5800				99.6			139.3	75.2	
6200	114.8			141.9			171.5	108.4	
6600	164.0	71.7		186.1	104.9		198.3	143.6	79.3
7000		121.0			147.3			175.1	112.8
7400		170.0	77.8		192.0	110.2		201.4	147.8
7800			127.2			152.6			178.6
8200			175.9			197.9			204.6

1. **Enter Weight Adjustment table with slush/standing water depth and 24K Derate dry field/obstacle limit weight to obtain slush/standing water weight adjustment.**
2. **Adjust field length available by -120 ft/+120 ft for every 5°C above/below 4°C.**
3. **Find V1(MCG) limit weight for adjusted field length and pressure altitude.**
4. **Max allowable slush/standing water limited weight is lesser of weights from 1 and 3.**

ADVISORY INFORMATION

Slush/Standing Water Takeoff (24K Derate)

No Reverse Thrust

V1 Adjustment (KIAS)

WEIGHT (1000 LB)	SLUSH/STANDING WATER DEPTH								
	0.12 INCHES (3 mm)			0.25 INCHES (6 mm)			0.50 INCHES (13 mm)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
190	-20	-10	0	-8	0	0	0	0	0
180	-22	-12	-2	-11	-1	0	0	0	0
170	-24	-14	-4	-15	-5	0	0	0	0
160	-26	-16	-6	-18	-8	0	-1	0	0
150	-28	-18	-8	-21	-11	-1	-6	0	0
140	-30	-20	-10	-25	-15	-5	-11	-1	0
130	-32	-22	-12	-28	-18	-8	-15	-5	0
120	-34	-24	-14	-30	-20	-10	-20	-10	0
110	-36	-26	-16	-33	-23	-13	-25	-15	-5
100	-38	-28	-18	-36	-26	-16	-29	-19	-9
90	-40	-30	-20	-38	-28	-18	-34	-24	-14

1. **Obtain V1, VR and V2 for the actual weight using the 24K Derate Dry Runway Takeoff Speeds table.**
2. **If V1(MCG) limited, set V1 = V1(MCG). If not V1(MCG) limited, enter V1 Adjustment table with the actual weight to obtain V1 speed adjustment. If adjusted V1 is less than V1(MCG), set V1 = V1(MCG). V1 not to exceed VR.**

ADVISORY INFORMATION

Slippery Runway Takeoff (24K Derate)

Maximum Reverse Thrust

Weight Adjustment (1000 LB)

24K DERATE DRY FIELD/OBSTACLE LIMIT WEIGHT (1000 LB)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
190	-1.0	-2.6	-4.3	-11.5	-13.2	-14.8	-21.3	-23.0	-24.6
180	-1.7	-3.4	-5.0	-11.7	-13.3	-15.0	-21.0	-22.6	-24.3
170	-2.3	-3.9	-5.6	-11.9	-13.5	-15.2	-20.4	-22.1	-23.7
160	-2.6	-4.3	-5.9	-11.7	-13.4	-15.0	-19.6	-21.3	-22.9
150	-2.7	-4.4	-6.0	-11.3	-13.0	-14.6	-18.6	-20.2	-21.9
140	-2.7	-4.3	-6.0	-10.7	-12.4	-14.0	-17.3	-19.0	-20.6
130	-2.4	-4.0	-5.7	-9.9	-11.5	-13.2	-15.8	-17.5	-19.1
120	-1.9	-3.5	-5.2	-8.8	-10.4	-12.1	-14.1	-15.8	-17.4
110	-1.2	-2.9	-4.5	-7.5	-9.1	-10.8	-12.2	-13.8	-15.5
100	-0.3	-2.0	-3.6	-5.9	-7.6	-9.2	-10.0	-11.7	-13.3
90	0.0	-0.9	-2.5	-4.1	-5.8	-7.4	-7.6	-9.2	-10.9

V1(MCG) Limit Weight (1000 LB)

ADJUSTED FIELD LENGTH (FT)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
3000	77.0								
3400	121.4								
3800	164.1	99.3							
4200	205.2	143.0	77.0	94.9					
4600		184.8	121.4	125.5					
5000			164.1	157.9	98.7				
5400			205.2	192.4	129.5	72.5	88.0		
5800					162.1	102.4	106.7		
6200					196.9	133.5	126.5	78.9	
6600						166.4	147.7	97.2	
7000						201.3	170.7	116.5	
7400							195.8	137.0	88.0
7800								159.0	106.7
8200								183.0	126.5
8600								208.6	147.7
9000									170.7
9400									195.8

1. **Enter Weight Adjustment table with reported braking action and 24K Derate dry field/obstacle limit weight to obtain slippery runway weight adjustment.**
2. **Adjust "Good" field length available by -70 ft/+70 ft for every 5°C above/below 4°C.**
   Adjust "Medium" field length available by -70 ft/+70 ft for every 5°C above/below 4°C.
   Adjust "Poor" field length available by -110 ft/+110 ft for every 5°C above/below 4°C.
3. **Find V1(MCG) limit weight for adjusted field length and pressure altitude.**
4. **Max allowable slippery runway limited weight is lesser of weights from 1 and 3.**

ADVISORY INFORMATION

Slippery Runway Takeoff (24K Derate)
Maximum Reverse Thrust
V1 Adjustment (KIAS)

WEIGHT (1000 LB)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
190	-5	0	0	-13	-8	-3	-23	-18	-13
180	-6	-1	0	-14	-9	-4	-25	-20	-15
170	-7	-2	0	-16	-11	-6	-27	-22	-17
160	-8	-3	0	-17	-12	-7	-29	-24	-19
150	-8	-3	0	-19	-14	-9	-31	-26	-21
140	-9	-4	0	-20	-15	-10	-33	-28	-23
130	-10	-5	0	-22	-17	-12	-35	-30	-25
120	-11	-6	-1	-23	-18	-13	-37	-32	-27
110	-12	-7	-2	-25	-20	-15	-39	-34	-29
100	-13	-8	-3	-26	-21	-16	-40	-35	-30
90	-14	-9	-4	-27	-22	-17	-42	-37	-32

1. **Obtain V1, VR and V2 for the actual weight using the 24K Derate Dry Runway Takeoff Speeds table.**
2. **If V1(MCG) limited, set V1 = V1(MCG). If not V1(MCG) limited, enter V1 Adjustment table with the actual weight to obtain V1 speed adjustment. If adjusted V1 is less than V1(MCG), set V1 = V1(MCG). V1 not to exceed VR.**

ADVISORY INFORMATION

Slippery Runway Takeoff (24K Derate)
No Reverse Thrust
Weight Adjustments (1000 LB)

24K DERATE DRY FIELD/OBSTACLE LIMIT WEIGHT (1000 LB)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
190	-3.4	-4.9	-6.4	-17.0	-18.5	-20.0	-29.8	-31.3	-32.8
180	-4.3	-5.8	-7.3	-17.4	-18.9	-20.4	-29.2	-30.7	-32.2
170	-5.0	-6.5	-8.0	-17.5	-19.0	-20.5	-28.3	-29.8	-31.3
160	-5.5	-7.0	-8.5	-17.3	-18.8	-20.3	-27.1	-28.6	-30.1
150	-5.8	-7.3	-8.8	-16.9	-18.4	-19.9	-25.7	-27.2	-28.7
140	-5.8	-7.3	-8.8	-16.1	-17.6	-19.1	-24.1	-25.6	-27.1
130	-5.6	-7.1	-8.6	-15.1	-16.6	-18.1	-22.2	-23.7	-25.2
120	-5.1	-6.6	-8.1	-13.8	-15.3	-16.8	-20.0	-21.5	-23.0
110	-4.5	-6.0	-7.5	-12.3	-13.8	-15.3	-17.6	-19.1	-20.6
100	-3.6	-5.1	-6.6	-10.5	-12.0	-13.5	-15.0	-16.5	-18.0
90	-2.4	-3.9	-5.4	-8.3	-9.8	-11.3	-12.1	-13.6	-15.1

V1(MCG) Limit Weight (1000 LB)

ADJUSTED FIELD LENGTH (FT)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
3800	114.5								
4200	171.0	85.6							
4600		152.0							
5000		199.0	130.6						
5400			182.6						
5800				123.5					
6200				178.8	73.8				
6600					138.3				
7000					191.4	91.0			
7400						152.4			
7800						203.9			
9000							109.3		
9400							153.5		
9800							196.1		
10200								115.0	
10600								158.8	
11000								201.4	75.3
11400									120.6
11800									164.2
12200									206.7

1. **Enter Weight Adjustment table with reported braking action and 24K Derate dry field/obstacle limit weight to obtain slippery runway weight adjustment.**
2. **Adjust “Good” field length available by -70 ft/+70 ft for every 5°C above/below 4°C.**
   Adjust “Medium” field length available by -70 ft/+70 ft for every 5°C above/below 4°C.
   Adjust “Poor” field length available by -140 ft/+140 ft for every 5°C above/below 4°C.
3. **Find V1(MCG) limit weight for adjusted field length and pressure altitude.**
4. **Max allowable slippery runway limited weight is lesser of weights from 1 and 3.**

ADVISORY INFORMATION

Slippery Runway Takeoff (24K Derate)
No Reverse Thrust
V1 Adjustment (KIAS)

WEIGHT (1000 LB)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
190	-7	-2	0	-18	-13	-8	-35	-30	-25
180	-8	-3	0	-20	-15	-10	-38	-33	-28
170	-9	-4	0	-22	-17	-12	-42	-37	-32
160	-10	-5	0	-24	-19	-14	-45	-40	-35
150	-12	-7	-2	-27	-22	-17	-49	-44	-39
140	-13	-8	-3	-29	-24	-19	-52	-47	-42
130	-15	-10	-5	-32	-27	-22	-56	-51	-46
120	-16	-11	-6	-35	-30	-25	-60	-55	-50
110	-18	-13	-8	-37	-32	-27	-63	-58	-53
100	-20	-15	-10	-40	-35	-30	-67	-62	-57
90	-22	-17	-12	-44	-39	-34	-71	-66	-61

1. **Obtain V1, VR and V2 for the actual weight using the 24K Derate Dry Runway Takeoff Speeds table.**
2. **If V1(MCG) limited, set V1 = V1(MCG). If not V1(MCG) limited, enter V1 Adjustment table with the actual weight to obtain V1 speed adjustment. If adjusted V1 is less than V1(MCG), set V1 = V1(MCG). V1 not to exceed VR.**

Takeoff %N1 - (24K Derate)

Based on engine bleeds for packs on, engine and wing anti-ice on or off

OAT (°C)	AIRPORT PRESSURE ALTITUDE (FT)												
	-2000	-1000	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
60	90.3	90.8	91.2	91.2	91.1	91.1	91.0	91.1	91.2	91.0	91.2	91.3	91.4
55	91.0	91.6	92.0	92.0	92.0	91.9	91.9	91.9	92.0	91.9	91.7	91.3	90.8
50	91.8	92.4	92.8	92.8	92.8	92.7	92.7	92.7	92.7	92.6	92.6	92.2	91.8
45	92.6	93.2	93.6	93.6	93.6	93.6	93.5	93.5	93.5	93.4	93.3	93.1	92.8
40	93.4	94.0	94.4	94.4	94.4	94.3	94.3	94.2	94.2	94.1	94.1	94.0	93.8
35	94.2	94.8	95.2	95.2	95.2	95.1	95.1	95.0	95.0	94.9	94.8	94.8	94.7
30	93.8	95.0	96.1	96.0	96.0	96.0	95.9	95.8	95.8	95.7	95.7	95.6	95.6
25	93.1	94.3	95.4	95.9	96.4	96.7	96.7	96.6	96.6	96.5	96.4	96.4	96.3
20	92.3	93.5	94.6	95.1	95.7	96.3	96.9	97.6	97.5	97.5	97.4	97.3	97.2
15	91.6	92.7	93.8	94.3	94.9	95.5	96.1	96.8	97.5	98.2	98.6	98.6	98.5
10	90.8	92.0	93.0	93.6	94.1	94.7	95.3	96.0	96.7	97.5	98.2	99.1	100.0
5	90.0	91.2	92.2	92.8	93.3	93.9	94.5	95.2	95.9	96.7	97.4	98.4	99.3
0	89.2	90.4	91.4	92.0	92.5	93.1	93.7	94.4	95.1	95.9	96.7	97.6	98.5
-5	88.4	89.6	90.6	91.2	91.7	92.3	92.9	93.6	94.3	95.1	95.9	96.8	97.7
-10	87.6	88.8	89.8	90.4	90.9	91.5	92.1	92.8	93.5	94.3	95.1	96.1	97.0
-15	86.8	88.0	89.0	89.5	90.0	90.6	91.3	92.0	92.7	93.5	94.3	95.3	96.2
-20	86.0	87.1	88.2	88.7	89.2	89.8	90.5	91.2	91.9	92.6	93.5	94.5	95.4
-25	85.2	86.3	87.3	87.9	88.4	89.0	89.6	90.3	91.0	91.8	92.6	93.7	94.6
-30	84.4	85.5	86.5	87.0	87.5	88.1	88.8	89.5	90.2	91.0	91.8	92.9	93.8
-35	83.5	84.6	85.6	86.2	86.6	87.3	87.9	88.6	89.3	90.1	91.0	92.1	93.0
-40	82.7	83.8	84.8	85.3	85.8	86.4	87.0	87.8	88.5	89.3	90.1	91.2	92.2
-45	81.8	82.9	83.9	84.4	84.9	85.5	86.2	86.9	87.6	88.4	89.3	90.4	91.4
-50	81.0	82.0	83.0	83.5	84.0	84.6	85.3	86.0	86.7	87.5	88.4	89.5	90.5

%N1 Adjustments for Engine Bleeds

BLEED CONFIGURATION	AIRPORT PRESSURE ALTITUDE (FT)												
	-2000	-1000	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
PACKS OFF	0.7	0.7	0.7	0.7	0.7	0.7	0.8	0.8	0.8	0.8	0.8	0.9	1.0

Assumed Temperature Reduced Thrust (24K Derate)

Maximum Assumed Temperature (Table 1 of 3)

Based on 25% Takeoff Thrust Reduction

OAT (°C)	AIRPORT PRESSURE ALTITUDE (FT)											
	-1000	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
55	73	71	69	67								
50	73	71	69	67	65	63						
45	73	71	69	67	65	63	61	59	57			
40	73	71	69	67	65	63	61	59	57	55		
35	67	67	67	67	65	63	61	59	57	55	53	
30	64	61	62	61	61	61	61	59	57	55	53	51
25	64	61	59	57	56	56	57	57	57	55	53	51
20	64	61	59	57	56	54	53	53	53	53	52	51
15	64	61	59	57	56	54	53	52	50	49	48	47
10 & BELOW	64	61	59	57	56	54	53	52	50	48	45	43

Takeoff %N1 (Table 2 of 3)

Based on engine bleed for packs on, engine and wing anti-ice on or off

ASSUMED TEMP (°C)	AIRPORT PRESSURE ALTITUDE (FT)											
	-1000	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
75	88.3	88.6	89.1	89.6	90.2	90.8	91.5	92.2	92.7	93.1	93.3	93.4
70	89.1	89.5	89.4	89.3	89.6	90.1	90.8	91.6	92.0	92.5	92.6	92.7
65	90.0	90.4	90.3	90.2	90.2	90.1	90.2	90.9	91.4	91.8	91.9	92.1
60	90.8	91.2	91.2	91.1	91.1	91.0	91.1	91.2	91.0	91.2	91.3	91.4
55	91.6	92.0	92.0	92.0	91.9	91.9	91.9	92.0	91.9	91.7	91.3	90.8
50	92.4	92.8	92.8	92.8	92.7	92.7	92.7	92.7	92.6	92.6	92.2	91.8
45	93.2	93.6	93.6	93.6	93.6	93.5	93.5	93.5	93.4	93.3	93.1	92.8
40	94.0	94.4	94.4	94.4	94.3	94.3	94.2	94.2	94.1	94.1	94.0	93.8
35	94.8	95.2	95.2	95.2	95.1	95.1	95.0	95.0	94.9	94.8	94.8	94.7
30	95.0	96.1	96.0	96.0	96.0	95.9	95.8	95.8	95.7	95.7	95.6	95.6
25	94.3	95.4	95.9	96.4	96.7	96.7	96.6	96.6	96.5	96.4	96.4	96.3
20	93.5	94.6	95.1	95.7	96.3	96.9	97.6	97.5	97.5	97.4	97.3	97.2
15	92.7	93.8	94.3	94.9	95.5	96.1	96.8	97.5	98.2	98.6	98.6	98.5
10	92.0	93.0	93.6	94.1	94.7	95.3	96.0	96.7	97.5	98.2	99.1	100.0
MINIMUM ASSUMED TEMP (°C)	32	30	28	26	24	22	20	18	16	15	12	10

With engine bleed for packs off, increase %N1 by 1.0

Assumed Temperature Reduced Thrust (24K Derate)
%N1 Adjustment for Temperature Difference (Table 3 of 3)

ASSUMED TEMP MINUS OAT (°C)	OUTSIDE AIR TEMPERATURE (°C)													
	-40	-20	0	5	10	15	20	25	30	35	40	45	50	55
110	12.1													
100	11.3	8.5												
90	11.7	8.9												
80	12.5	8.0	5.5											
70	11.3	8.4	5.9	5.6	4.0									
60	9.7	9.2	4.8	4.7	4.4	4.2	2.6							
50	7.8	7.9	5.3	3.5	3.3	3.6	3.0	2.7	1.2					
40		6.4	6.0	5.5	3.7	3.2	3.7	3.0	2.8	3.0	3.7			
30		4.6	4.6	4.6	4.5	4.3	4.2	4.0	4.1	4.0	3.9	3.8	3.7	
20			3.1	3.1	3.1	3.0	2.9	2.9	2.8	2.7	2.7	2.6	2.6	2.5
10			1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.4	1.4	1.4	1.3	1.3
0			0	0	0	0	0	0	0	0	0	0	0	0

1. **Determine Maximum Assumed Temperature allowed from Table 1.**
2. **Find Maximum %N1 from Table 2 using the desired assumed temperature (no greater than temperature from Table 1).**
3. **Use the difference between assumed temperature and OAT to determine the %N1 adjustment from Table 3.**
4. **Subtract %N1 adjustment from Maximum %N1 in Table 2.**

Max Climb %N1

Based on engine bleed for packs on or off and anti-ice off

TAT (°C)	PRESSURE ALTITUDE (FT)/SPEED (KIAS/MACH)									
	0	5000	10000	15000	20000	25000	30000	35000	37000	41000
	280	280	280	280	280	280	280	.78	.78	.78
60	90.2	90.5	90.4	90.6	90.4	92.1	93.8	95.1	95.2	93.5
55	91.0	91.2	91.3	91.4	90.8	91.5	93.1	94.4	94.5	92.8
50	91.7	92.0	92.1	92.2	91.7	91.5	92.4	93.7	93.8	92.1
45	92.4	92.6	92.8	93.0	92.6	92.4	92.4	93.0	93.1	91.4
40	93.1	93.3	93.6	93.8	93.4	93.2	93.2	92.3	92.4	90.7
35	93.6	94.0	94.3	94.5	94.3	94.0	94.0	93.0	92.4	90.8
30	92.9	94.8	95.0	95.2	95.1	94.8	94.7	93.9	93.3	91.8
25	92.2	94.8	95.7	95.9	95.9	95.5	95.4	94.7	94.1	92.8
20	91.4	94.0	96.5	96.7	96.6	96.2	96.1	95.4	94.9	93.7
15	90.6	93.2	95.9	97.5	97.4	96.9	96.7	96.2	95.7	94.6
10	89.9	92.5	95.1	97.8	98.3	97.7	97.4	96.9	96.5	95.6
5	89.1	91.7	94.3	97.0	99.2	98.6	98.1	97.7	97.3	96.5
0	88.3	90.9	93.5	96.2	98.6	99.6	99.1	98.5	98.2	97.5
-5	87.6	90.1	92.7	95.4	97.8	99.6	100.0	99.2	99.0	98.4
-10	86.8	89.3	91.9	94.6	97.1	98.8	100.3	100.2	99.8	99.4
-15	86.0	88.5	91.0	93.8	96.3	98.0	99.6	101.1	100.8	100.4
-20	85.2	87.6	90.2	93.0	95.5	97.2	98.7	100.8	101.3	101.0
-25	84.3	86.8	89.4	92.2	94.7	96.4	97.9	100.0	100.5	100.1
-30	83.5	86.0	88.5	91.3	93.9	95.6	97.1	99.1	99.6	99.3
-35	82.7	85.1	87.7	90.5	93.1	94.8	96.3	98.3	98.8	98.4
-40	81.8	84.3	86.8	89.6	92.3	93.9	95.4	97.4	97.9	97.6

%N1 Adjustments for Engine Bleeds

BLEED CONFIGURATION	PRESSURE ALTITUDE (1000 FT)					
	0	10	20	30	35	41
ENGINE ANTI-ICE	-0.6	-0.8	-0.9	-0.9	-0.8	-0.8
ENGINE & WING ANTI-ICE*	-1.8	-2.1	-2.5	-2.7	-3.0	-3.0

***Dual bleed sources**

Go-around %N1

Based on engine bleed for packs on, engine and wing anti-ice on or off

AIRPORT OAT		TAT (°C)	AIRPORT PRESSURE ALTITUDE (FT)											
°C	°F		-2000	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
57	134	60	95.0	96.2	96.8									
52	125	55	95.9	96.7	96.6	96.8	97.5							
47	116	50	96.6	97.6	97.8	97.8	97.7	97.5	98.2	98.8				
42	108	45	97.4	98.4	98.5	98.6	98.7	98.8	98.7	98.5	98.5	99.0		
37	99	40	98.0	99.1	99.2	99.3	99.4	99.5	99.6	99.5	99.1	98.9	98.8	99.1
32	90	35	98.1	99.9	100.0	100.1	100.1	100.3	100.3	100.2	99.9	99.6	99.6	99.5
27	81	30	97.3	99.8	100.4	100.7	100.7	100.7	100.7	100.7	100.6	100.4	100.4	100.3
22	72	25	96.6	99.1	99.7	100.2	100.6	100.9	100.9	100.9	100.9	100.9	100.9	100.8
17	63	20	95.8	98.3	98.9	99.5	99.8	100.2	100.5	100.9	101.0	101.1	101.0	101.0
12	54	15	95.0	97.5	98.1	98.7	99.1	99.4	99.8	100.1	100.5	100.9	101.3	101.2
7	45	10	94.2	96.8	97.4	98.0	98.3	98.7	99.0	99.4	99.8	100.2	100.5	100.9
2	36	5	93.4	96.0	96.6	97.2	97.6	97.9	98.3	98.7	99.0	99.4	99.8	100.2
-3	27	0	92.6	95.2	95.8	96.4	96.8	97.2	97.5	97.9	98.3	98.7	99.0	99.4
-8	18	-5	91.8	94.4	95.0	95.6	96.0	96.4	96.8	97.2	97.5	97.9	98.3	98.6
-13	9	-10	91.0	93.6	94.2	94.8	95.2	95.6	96.0	96.4	96.8	97.1	97.5	97.9
-17	1	-15	90.2	92.8	93.4	94.0	94.4	94.8	95.2	95.6	96.0	96.4	96.7	97.1
-22	-8	-20	89.3	92.0	92.6	93.2	93.6	94.0	94.4	94.8	95.2	95.6	95.9	96.3
-27	-17	-25	88.5	91.1	91.8	92.4	92.8	93.2	93.6	94.0	94.4	94.8	95.1	95.5
-32	-26	-30	87.6	90.3	90.9	91.6	92.0	92.4	92.8	93.3	93.6	94.0	94.3	94.7
-37	-35	-35	86.8	89.4	90.1	90.7	91.1	91.6	92.0	92.4	92.8	93.2	93.5	93.9
-42	-44	-40	85.9	88.6	89.2	89.9	90.3	90.7	91.2	91.6	92.0	92.4	92.7	93.0
-47	-53	-45	85.0	87.7	88.4	89.0	89.4	89.9	90.3	90.8	91.2	91.5	91.9	92.2
-52	-62	-50	84.1	86.8	87.5	88.2	88.6	89.0	89.5	90.0	90.3	90.7	91.0	91.4

%N1 Adjustments for Engine Bleeds

BLEED CONFIGURATION	PRESSURE ALTITUDE (FT)											
	-2000	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
PACKS OFF	0.7	0.8	0.8	0.8	0.8	0.9	0.9	0.9	0.9	0.9	0.9	0.9
A/C HIGH	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1

Flight With Unreliable Airspeed/ Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

CLIMB (280/.76)

Flaps Up, Set Max Climb Thrust

PRESSURE ALTITUDE (FT)		WEIGHT (1000 LB)					
		80	100	120	140	160	180
40000	**PITCH ATT**	**4.0**	**4.0**	**4.0**			
	V/S (FT/MIN)	2000	1300	800			
30000	**PITCH ATT**	**4.5**	**4.0**	**4.0**	**4.0**	**4.0**	**4.0**
	V/S (FT/MIN)	2800	2100	1700	1300	1000	700
20000	**PITCH ATT**	**7.5**	**6.5**	**6.5**	**6.0**	**6.0**	**6.0**
	V/S (FT/MIN)	4600	3600	2900	2400	2000	1600
10000	**PITCH ATT**	**11.5**	**10.0**	**9.0**	**8.5**	**8.0**	**8.0**
	V/S (FT/MIN)	6200	4900	4000	3300	2800	2400
SEA LEVEL	**PITCH ATT**	**15.5**	**13.0**	**11.5**	**10.5**	**10.0**	**9.5**
	V/S (FT/MIN)	7400	5900	4800	4100	3500	3000

CRUISE (.76/280)

Flaps Up, %N1 for Level Flight

PRESSURE ALTITUDE (FT)		WEIGHT (1000 LB)					
		80	100	120	140	160	180
40000	**PITCH ATT**	**1.5**	**2.5**	**3.0**	**4.0**		
	%N1	**82.6**	**84.6**	**87.5**	**93.1**		
35000	**PITCH ATT**	**1.0**	**1.5**	**2.0**	**2.5**	**3.5**	**4.0**
	%N1	**81.0**	**82.3**	**83.9**	**85.8**	**88.4**	**93.5**
30000	**PITCH ATT**	**0.5**	**1.0**	**1.5**	**2.0**	**2.5**	**3.0**
	%N1	**80.6**	**81.4**	**82.4**	**83.6**	**85.2**	**87.2**
25000	**PITCH ATT**	**0.5**	**1.5**	**2.0**	**2.5**	**3.0**	**3.5**
	%N1	**77.2**	**77.8**	**78.8**	**79.9**	**81.4**	**83.2**
20000	**PITCH ATT**	**1.0**	**1.5**	**2.0**	**2.5**	**3.0**	**3.5**
	%N1	**73.7**	**74.2**	**75.0**	**76.2**	**77.5**	**79.2**
15000	**PITCH ATT**	**1.0**	**1.5**	**2.0**	**2.5**	**3.0**	**3.5**
	%N1	**70.1**	**70.5**	**71.3**	**72.5**	**73.8**	**75.2**

Flight With Unreliable Airspeed/ Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

DESCENT (.76/280)

Flaps Up, Set Idle Thrust

PRESSURE ALTITUDE (FT)		WEIGHT (1000 LB)					
		80	100	120	140	160	180
40000	**PITCH ATT**	**-2.0**	**-1.0**	**0.0**	**0.5**	**1.0**	**1.5**
	V/S (FT/MIN)	-2900	-2600	-2400	-2500	-2700	-3000
30000	**PITCH ATT**	**-4.0**	**-2.5**	**-1.5**	**-0.5**	**0.0**	**0.5**
	V/S (FT/MIN)	-3400	-2800	-2500	-2200	-2100	-2000
20000	**PITCH ATT**	**-4.0**	**-2.5**	**-1.5**	**-0.5**	**0.0**	**1.0**
	V/S (FT/MIN)	-3100	-2500	-2200	-2000	-1900	-1800
10000	**PITCH ATT**	**-4.0**	**-2.5**	**-1.5**	**-0.5**	**0.0**	**1.0**
	V/S (FT/MIN)	-2800	-2300	-2000	-1800	-1700	-1600
SEA LEVEL	**PITCH ATT**	**-4.5**	**-3.0**	**-2.0**	**-1.0**	**0.0**	**0.5**
	V/S (FT/MIN)	-2600	-2100	-1800	-1600	-1500	-1400

HOLDING (VREF40 + 70)

Flaps Up, %N1 for Level Flight

PRESSURE ALTITUDE (FT)		WEIGHT (1000 LB)					
		90	100	120	140	160	180
15000	**PITCH ATT**	**5.0**	**5.5**	**5.0**	**5.0**	**5.0**	**5.0**
	%N1	**56.6**	**59.2**	**63.8**	**67.3**	**70.8**	**73.8**
	KIAS	176	184	202	218	234	248
10000	**PITCH ATT**	**5.0**	**5.5**	**5.5**	**5.0**	**5.0**	**5.0**
	%N1	**53.1**	**55.4**	**59.6**	**63.7**	**66.8**	**69.6**
	KIAS	176	183	201	217	232	247
5000	**PITCH ATT**	**5.0**	**5.5**	**5.5**	**5.5**	**5.0**	**5.0**
	%N1	**49.6**	**51.8**	**56.0**	**59.5**	**63.0**	**66.1**
	KIAS	176	182	200	216	232	246

Flight With Unreliable Airspeed/ Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

TERMINAL AREA (5000 FT)

%N1 for Level Flight

Airport Altitude = -2000 FT

FLAP POSITION (VREF+INCREMENT)		WEIGHT (1000 LB) 90	100	120	140	160	180
FLAPS UP (GEAR UP) VREF40+70	**PITCH ATT**	**5.0**	**5.0**	**5.5**	**6.0**	**6.0**	**6.5**
	%N1	**47.7**	**50.0**	**53.8**	**57.4**	**60.7**	**64.0**
	KIAS	176	182	193	204	213	223
FLAPS 1 (GEAR UP) VREF40+50	**PITCH ATT**	**5.0**	**5.0**	**5.5**	**6.0**	**6.0**	**6.5**
	%N1	**50.1**	**52.3**	**56.4**	**60.1**	**63.6**	**66.6**
	KIAS	156	162	173	184	193	203
FLAPS 5 (GEAR UP) VREF40+30	**PITCH ATT**	**6.0**	**6.0**	**6.5**	**6.5**	**7.0**	**7.0**
	%N1	**49.9**	**52.4**	**56.8**	**60.8**	**64.5**	**67.8**
	KIAS	136	142	153	164	173	183
FLAPS 10 (GEAR UP) VREF40+30	**PITCH ATT**	**4.0**	**4.0**	**4.5**	**4.5**	**5.0**	**5.0**
	%N1	**52.5**	**54.8**	**59.3**	**63.4**	**67.0**	**70.2**
	KIAS	136	142	153	164	173	183
FLAPS 15 (GEAR UP) VREF40+20	**PITCH ATT**	**4.5**	**5.0**	**5.0**	**5.0**	**5.5**	**5.5**
	%N1	**52.6**	**55.1**	**59.8**	**64.0**	**67.7**	**71.0**
	KIAS	126	132	143	154	163	173
FLAPS 25 (GEAR UP) VREF40+10	**PITCH ATT**	**5.5**	**5.5**	**5.5**	**5.5**	**6.0**	**5.5**
	%N1	**53.9**	**56.6**	**61.5**	**65.7**	**69.4**	**72.8**
	KIAS	116	122	133	144	153	163
FLAPS 15 (GEAR DOWN) VREF40+20	**PITCH ATT**	**5.0**	**5.0**	**5.0**	**5.5**	**5.5**	**5.5**
	%N1	**57.0**	**59.6**	**64.5**	**68.6**	**72.4**	**75.9**
	KIAS	126	132	143	154	163	173

Flight With Unreliable Airspeed/ Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

TERMINAL AREA (5000 FT)

%N1 for Level Flight

Airport Altitude = -1000 FT

FLAP POSITION (VREF+INCREMENT)		WEIGHT (1000 LB) 90	100	120	140	160	180
FLAPS UP (GEAR UP) VREF40+70	**PITCH ATT**	**5.0**	**5.0**	**5.5**	**6.0**	**6.0**	**6.5**
	%N1	**48.4**	**50.6**	**54.5**	**58.2**	**61.5**	**64.8**
	KIAS	176	182	193	204	214	223
FLAPS 1 (GEAR UP) VREF40+50	**PITCH ATT**	**5.0**	**5.0**	**5.5**	**6.0**	**6.0**	**6.5**
	%N1	**50.8**	**53.0**	**57.1**	**60.9**	**64.4**	**67.4**
	KIAS	156	162	173	184	194	203
FLAPS 5 (GEAR UP) VREF40+30	**PITCH ATT**	**6.0**	**6.0**	**6.5**	**6.5**	**7.0**	**7.0**
	%N1	**50.6**	**53.1**	**57.5**	**61.6**	**65.3**	**68.5**
	KIAS	136	142	153	164	174	183
FLAPS 10 (GEAR UP) VREF40+30	**PITCH ATT**	**4.0**	**4.0**	**4.5**	**4.5**	**5.0**	**5.0**
	%N1	**53.2**	**55.6**	**60.1**	**64.2**	**67.8**	**71.1**
	KIAS	136	142	153	164	174	183
FLAPS 15 (GEAR UP) VREF40+20	**PITCH ATT**	**4.5**	**5.0**	**5.0**	**5.0**	**5.5**	**5.5**
	%N1	**53.3**	**55.9**	**60.6**	**64.8**	**68.4**	**71.9**
	KIAS	126	132	143	154	164	173
FLAPS 25 (GEAR UP) VREF40+10	**PITCH ATT**	**5.5**	**5.5**	**5.5**	**5.5**	**6.0**	**5.5**
	%N1	**54.7**	**57.4**	**62.3**	**66.5**	**70.2**	**73.7**
	KIAS	116	122	133	144	154	163
FLAPS 15 (GEAR DOWN) VREF40+20	**PITCH ATT**	**5.0**	**5.0**	**5.0**	**5.5**	**5.5**	**5.5**
	%N1	**57.7**	**60.4**	**65.4**	**69.5**	**73.3**	**76.7**
	KIAS	126	132	143	154	164	173

Flight With Unreliable Airspeed/ Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

TERMINAL AREA (5000 FT)
%N1 for Level Flight
Airport Altitude = SEA LEVEL

FLAP POSITION (VREF+INCREMENT)		WEIGHT (1000 LB)					
		90	100	120	140	160	180
FLAPS UP (GEAR UP) VREF40+70	**PITCH ATT**	**5.0**	**5.0**	**5.5**	**6.0**	**6.0**	**6.5**
	%N1	**49.1**	**51.3**	**55.3**	**58.9**	**62.4**	**65.6**
	KIAS	176	182	193	204	214	224
FLAPS 1 (GEAR UP) VREF40+50	**PITCH ATT**	**5.0**	**5.0**	**5.5**	**6.0**	**6.0**	**6.5**
	%N1	**51.5**	**53.8**	**57.9**	**61.7**	**65.2**	**68.2**
	KIAS	156	162	173	184	194	204
FLAPS 5 (GEAR UP) VREF40+30	**PITCH ATT**	**6.0**	**6.0**	**6.5**	**6.5**	**6.5**	**7.0**
	%N1	**51.3**	**53.8**	**58.3**	**62.5**	**66.1**	**69.3**
	KIAS	136	142	153	164	174	184
FLAPS 10 (GEAR UP) VREF40+30	**PITCH ATT**	**4.0**	**4.0**	**4.5**	**4.5**	**5.0**	**5.0**
	%N1	**53.9**	**56.3**	**60.9**	**65.0**	**68.6**	**71.9**
	KIAS	136	142	153	164	174	184
FLAPS 15 (GEAR UP) VREF40+20	**PITCH ATT**	**4.5**	**5.0**	**5.0**	**5.0**	**5.5**	**5.5**
	%N1	**54.0**	**56.6**	**61.4**	**65.6**	**69.3**	**72.8**
	KIAS	126	132	143	154	164	174
FLAPS 25 (GEAR UP) VREF40+10	**PITCH ATT**	**5.5**	**5.5**	**5.5**	**5.5**	**5.5**	**5.5**
	%N1	**55.4**	**58.2**	**63.1**	**67.3**	**71.0**	**74.5**
	KIAS	116	122	133	144	154	164
FLAPS 15 (GEAR DOWN) VREF40+20	**PITCH ATT**	**5.0**	**5.0**	**5.0**	**5.5**	**5.5**	**5.5**
	%N1	**58.5**	**61.3**	**66.1**	**70.3**	**74.1**	**77.5**
	KIAS	126	132	143	154	164	174

Flight With Unreliable Airspeed/ Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

TERMINAL AREA (5000 FT)
%N1 for Level Flight
Airport Altitude = 1000 FT

FLAP POSITION (VREF+INCREMENT)		WEIGHT (1000 LB)					
		90	100	120	140	160	180
FLAPS UP (GEAR UP) VREF40+70	**PITCH ATT**	**5.0**	**5.0**	**5.5**	**6.0**	**6.0**	**6.5**
	%N1	**49.9**	**52.0**	**56.0**	**59.7**	**63.2**	**66.3**
	KIAS	176	182	194	205	214	224
FLAPS 1 (GEAR UP) VREF40+50	**PITCH ATT**	**5.0**	**5.0**	**5.5**	**6.0**	**6.0**	**6.5**
	%N1	**52.2**	**54.5**	**58.7**	**62.6**	**65.9**	**69.0**
	KIAS	156	162	174	185	194	204
FLAPS 5 (GEAR UP) VREF40+30	**PITCH ATT**	**6.0**	**6.0**	**6.5**	**6.5**	**6.5**	**7.0**
	%N1	**52.1**	**54.5**	**59.1**	**63.3**	**66.9**	**70.1**
	KIAS	136	142	154	165	174	184
FLAPS 10 (GEAR UP) VREF40+30	**PITCH ATT**	**4.0**	**4.0**	**4.5**	**4.5**	**5.0**	**5.0**
	%N1	**54.6**	**57.1**	**61.8**	**65.9**	**69.4**	**72.8**
	KIAS	136	142	154	165	174	184
FLAPS 15 (GEAR UP) VREF40+20	**PITCH ATT**	**4.5**	**5.0**	**5.0**	**5.0**	**5.5**	**5.5**
	%N1	**54.8**	**57.4**	**62.2**	**66.4**	**70.1**	**73.6**
	KIAS	126	132	144	155	164	174
FLAPS 25 (GEAR UP) VREF40+10	**PITCH ATT**	**5.5**	**5.5**	**5.5**	**5.5**	**5.5**	**5.5**
	%N1	**56.2**	**58.9**	**63.9**	**68.1**	**71.9**	**75.4**
	KIAS	116	122	134	145	154	164
FLAPS 15 (GEAR DOWN) VREF40+20	**PITCH ATT**	**5.0**	**5.0**	**5.0**	**5.5**	**5.5**	**5.5**
	%N1	**59.3**	**62.1**	**66.9**	**71.2**	**75.0**	**78.4**
	KIAS	126	132	144	155	164	174

Flight With Unreliable Airspeed/ Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

TERMINAL AREA (5000 FT)

%N1 for Level Flight

Airport Altitude = 2000 FT

FLAP POSITION (VREF+INCREMENT)		WEIGHT (1000 LB) 90	100	120	140	160	180
FLAPS UP (GEAR UP) VREF40+70	**PITCH ATT**	**5.0**	**5.0**	**5.5**	**6.0**	**6.0**	**6.5**
	%N1	**50.5**	**52.6**	**56.7**	**60.5**	**64.1**	**67.0**
	KIAS	176	182	194	205	214	224
FLAPS 1 (GEAR UP) VREF40+50	**PITCH ATT**	**5.0**	**5.0**	**5.5**	**6.0**	**6.0**	**6.5**
	%N1	**53.0**	**55.3**	**59.5**	**63.4**	**66.7**	**69.8**
	KIAS	156	162	174	185	194	204
FLAPS 5 (GEAR UP) VREF40+30	**PITCH ATT**	**6.0**	**6.0**	**6.5**	**6.5**	**6.5**	**7.0**
	%N1	**52.8**	**55.3**	**59.9**	**64.1**	**67.7**	**71.0**
	KIAS	136	142	154	165	174	184
FLAPS 10 (GEAR UP) VREF40+30	**PITCH ATT**	**4.0**	**4.0**	**4.5**	**4.5**	**5.0**	**5.0**
	%N1	**55.3**	**57.8**	**62.6**	**66.7**	**70.3**	**73.6**
	KIAS	136	142	154	165	174	184
FLAPS 15 (GEAR UP) VREF40+20	**PITCH ATT**	**4.5**	**5.0**	**5.0**	**5.0**	**5.5**	**5.5**
	%N1	**55.5**	**58.1**	**63.0**	**67.2**	**71.0**	**74.5**
	KIAS	126	132	144	155	164	174
FLAPS 25 (GEAR UP) VREF40+10	**PITCH ATT**	**5.5**	**5.5**	**5.5**	**5.5**	**5.5**	**5.5**
	%N1	**57.0**	**59.7**	**64.7**	**68.9**	**72.8**	**76.2**
	KIAS	116	122	134	145	154	164
FLAPS 15 (GEAR DOWN) VREF40+20	**PITCH ATT**	**5.0**	**5.0**	**5.0**	**5.0**	**5.5**	**5.5**
	%N1	**60.1**	**62.9**	**67.7**	**72.1**	**75.8**	**79.2**
	KIAS	126	132	144	155	164	174

Flight With Unreliable Airspeed/ Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

TERMINAL AREA (5000 FT)

%N1 for Level Flight

Airport Altitude = 3000 FT

FLAP POSITION (VREF+INCREMENT)		WEIGHT (1000 LB)					
		90	100	120	140	160	180
FLAPS UP (GEAR UP) VREF40+70	**PITCH ATT**	**5.0**	**5.0**	**5.5**	**6.0**	**6.0**	**6.5**
	%N1	**51.2**	**53.3**	**57.4**	**61.3**	**64.8**	**67.8**
	KIAS	176	182	194	205	215	224
FLAPS 1 (GEAR UP) VREF40+50	**PITCH ATT**	**5.0**	**5.0**	**5.5**	**5.5**	**6.0**	**6.0**
	%N1	**53.7**	**56.0**	**60.3**	**64.2**	**67.5**	**70.6**
	KIAS	156	162	174	185	195	204
FLAPS 5 (GEAR UP) VREF40+30	**PITCH ATT**	**6.0**	**6.0**	**6.0**	**6.5**	**6.5**	**7.0**
	%N1	**53.5**	**56.0**	**60.7**	**64.9**	**68.5**	**71.8**
	KIAS	136	142	154	165	175	184
FLAPS 10 (GEAR UP) VREF40+30	**PITCH ATT**	**4.0**	**4.0**	**4.5**	**4.5**	**5.0**	**5.0**
	%N1	**56.1**	**58.6**	**63.4**	**67.5**	**71.1**	**74.4**
	KIAS	136	142	154	165	175	184
FLAPS 15 (GEAR UP) VREF40+20	**PITCH ATT**	**4.5**	**5.0**	**5.0**	**5.0**	**5.5**	**5.5**
	%N1	**56.2**	**59.0**	**63.8**	**68.0**	**71.9**	**75.3**
	KIAS	126	132	144	155	165	174
FLAPS 25 (GEAR UP) VREF40+10	**PITCH ATT**	**5.5**	**5.5**	**5.5**	**5.5**	**5.5**	**5.5**
	%N1	**57.8**	**60.6**	**65.5**	**69.7**	**73.6**	**77.0**
	KIAS	116	122	134	145	155	164
FLAPS 15 (GEAR DOWN) VREF40+20	**PITCH ATT**	**5.0**	**5.0**	**5.0**	**5.0**	**5.5**	**5.5**
	%N1	**60.9**	**63.7**	**68.5**	**73.0**	**76.7**	**80.1**
	KIAS	126	132	144	155	165	174

Flight With Unreliable Airspeed/ Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

TERMINAL AREA (5000 FT)

%N1 for Level Flight

Airport Altitude = 4000 FT

FLAP POSITION (VREF+INCREMENT)		WEIGHT (1000 LB) 90	100	120	140	160	180
FLAPS UP (GEAR UP) VREF40+70	**PITCH ATT**	**5.0**	**5.0**	**5.5**	**6.0**	**6.0**	**6.5**
	%N1	**51.9**	**54.1**	**58.2**	**62.1**	**65.6**	**68.6**
	KIAS	176	182	194	205	215	224
FLAPS 1 (GEAR UP) VREF40+50	**PITCH ATT**	**5.0**	**5.0**	**5.5**	**5.5**	**6.0**	**6.0**
	%N1	**54.5**	**56.8**	**61.1**	**64.9**	**68.3**	**71.5**
	KIAS	156	162	174	185	195	204
FLAPS 5 (GEAR UP) VREF40+30	**PITCH ATT**	**6.0**	**6.0**	**6.0**	**6.5**	**6.5**	**7.0**
	%N1	**54.3**	**56.8**	**61.6**	**65.7**	**69.3**	**72.7**
	KIAS	136	142	154	165	175	184
FLAPS 10 (GEAR UP) VREF40+30	**PITCH ATT**	**4.0**	**4.0**	**4.5**	**4.5**	**5.0**	**5.0**
	%N1	**56.9**	**59.5**	**64.2**	**68.3**	**72.0**	**75.3**
	KIAS	136	142	154	165	175	184
FLAPS 15 (GEAR UP) VREF40+20	**PITCH ATT**	**4.5**	**5.0**	**5.0**	**5.0**	**5.0**	**5.5**
	%N1	**57.0**	**59.8**	**64.7**	**68.9**	**72.8**	**76.0**
	KIAS	126	132	144	155	165	174
FLAPS 25 (GEAR UP) VREF40+10	**PITCH ATT**	**5.5**	**5.5**	**5.5**	**5.5**	**5.5**	**5.5**
	%N1	**58.5**	**61.4**	**66.3**	**70.6**	**74.5**	**77.8**
	KIAS	116	122	134	145	155	164
FLAPS 15 (GEAR DOWN) VREF40+20	**PITCH ATT**	**5.0**	**5.0**	**5.0**	**5.0**	**5.5**	**5.5**
	%N1	**61.7**	**64.6**	**69.4**	**73.9**	**77.5**	**81.0**
	KIAS	126	132	144	155	165	174

Flight With Unreliable Airspeed/ Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

TERMINAL AREA (5000 FT)

%N1 for Level Flight

Airport Altitude = 5000 FT

FLAP POSITION (VREF+INCREMENT)		WEIGHT (1000 LB)					
		90	100	120	140	160	180
FLAPS UP (GEAR UP) VREF40+70	**PITCH ATT**	**5.0**	**5.0**	**5.5**	**6.0**	**6.0**	**6.5**
	%N1	**52.6**	**54.8**	**59.0**	**63.0**	**66.3**	**69.3**
	KIAS	176	183	194	206	215	225
FLAPS 1 (GEAR UP) VREF40+50	**PITCH ATT**	**5.0**	**5.0**	**5.5**	**5.5**	**6.0**	**6.0**
	%N1	**55.2**	**57.5**	**62.0**	**65.7**	**69.1**	**72.3**
	KIAS	156	163	174	186	195	205
FLAPS 5 (GEAR UP) VREF40+30	**PITCH ATT**	**6.0**	**6.0**	**6.0**	**6.5**	**6.5**	**7.0**
	%N1	**55.0**	**57.6**	**62.4**	**66.5**	**70.1**	**73.5**
	KIAS	136	143	154	166	175	185
FLAPS 10 (GEAR UP) VREF40+30	**PITCH ATT**	**4.0**	**4.0**	**4.5**	**4.5**	**4.5**	**5.0**
	%N1	**57.6**	**60.3**	**65.0**	**69.2**	**72.9**	**76.1**
	KIAS	136	143	154	166	175	185
FLAPS 15 (GEAR UP) VREF40+20	**PITCH ATT**	**4.5**	**5.0**	**5.0**	**5.0**	**5.0**	**5.5**
	%N1	**57.8**	**60.6**	**65.5**	**69.7**	**73.6**	**76.8**
	KIAS	126	133	144	156	165	175
FLAPS 25 (GEAR UP) VREF40+10	**PITCH ATT**	**5.5**	**5.5**	**5.5**	**5.5**	**5.5**	**5.5**
	%N1	**59.4**	**62.2**	**67.1**	**71.5**	**75.3**	**78.7**
	KIAS	116	123	134	146	155	165
FLAPS 15 (GEAR DOWN) VREF40+20	**PITCH ATT**	**5.0**	**5.0**	**5.0**	**5.0**	**5.5**	**5.5**
	%N1	**62.6**	**65.3**	**70.3**	**74.7**	**78.4**	**81.9**
	KIAS	126	133	144	156	165	175

Flight With Unreliable Airspeed/ Turbulent Air Penetration
Altitude and/or vertical speed indications may also be unreliable.

TERMINAL AREA (5000 FT)
%N1 for Level Flight
Airport Altitude = 6000 FT

FLAP POSITION (VREF+INCREMENT)		WEIGHT (1000 LB)					
		90	100	120	140	160	180
FLAPS UP (GEAR UP) VREF40+70	**PITCH ATT**	**5.0**	**5.0**	**5.5**	**6.0**	**6.0**	**6.5**
	%N1	**53.3**	**55.6**	**59.8**	**63.8**	**67.1**	**70.1**
	KIAS	176	183	195	206	216	225
FLAPS 1 (GEAR UP) VREF40+50	**PITCH ATT**	**5.0**	**5.0**	**5.5**	**5.5**	**6.0**	**6.0**
	%N1	**56.0**	**58.3**	**62.8**	**66.5**	**70.0**	**73.2**
	KIAS	156	163	175	186	196	205
FLAPS 5 (GEAR UP) VREF40+30	**PITCH ATT**	**5.5**	**6.0**	**6.0**	**6.5**	**6.5**	**6.5**
	%N1	**55.8**	**58.4**	**63.2**	**67.3**	**71.0**	**74.3**
	KIAS	136	143	155	166	176	185
FLAPS 10 (GEAR UP) VREF40+30	**PITCH ATT**	**4.0**	**4.0**	**4.5**	**4.5**	**4.5**	**5.0**
	%N1	**58.5**	**61.2**	**65.9**	**70.0**	**73.7**	**76.9**
	KIAS	136	143	155	166	176	185
FLAPS 15 (GEAR UP) VREF40+20	**PITCH ATT**	**4.5**	**4.5**	**5.0**	**5.0**	**5.0**	**5.5**
	%N1	**58.6**	**61.4**	**66.3**	**70.6**	**74.4**	**77.7**
	KIAS	126	133	145	156	166	175
FLAPS 25 (GEAR UP) VREF40+10	**PITCH ATT**	**5.5**	**5.5**	**5.5**	**5.5**	**5.5**	**5.5**
	%N1	**60.2**	**63.0**	**67.9**	**72.3**	**76.1**	**79.6**
	KIAS	116	123	135	146	156	165
FLAPS 15 (GEAR DOWN) VREF40+20	**PITCH ATT**	**4.5**	**5.0**	**5.0**	**5.0**	**5.5**	**5.5**
	%N1	**63.4**	**66.1**	**71.2**	**75.5**	**79.3**	**82.8**
	KIAS	126	133	145	156	166	175

Flight With Unreliable Airspeed/ Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

TERMINAL AREA (5000 FT)
%N1 for Level Flight
Airport Altitude = 7000 FT

FLAP POSITION (VREF+INCREMENT)		WEIGHT (1000 LB) 90	100	120	140	160	180
FLAPS UP (GEAR UP) VREF40+70	**PITCH ATT**	**5.0**	**5.0**	**5.5**	**6.0**	**6.0**	**6.5**
	%N1	**54.0**	**56.3**	**60.6**	**64.6**	**67.8**	**71.0**
	KIAS	177	183	195	206	216	226
FLAPS 1 (GEAR UP) VREF40+50	**PITCH ATT**	**5.0**	**5.0**	**5.5**	**5.5**	**6.0**	**6.0**
	%N1	**56.7**	**59.2**	**63.6**	**67.3**	**70.9**	**74.1**
	KIAS	157	163	175	186	196	206
FLAPS 5 (GEAR UP) VREF40+30	**PITCH ATT**	**5.5**	**6.0**	**6.0**	**6.5**	**6.5**	**6.5**
	%N1	**56.5**	**59.2**	**64.0**	**68.1**	**71.9**	**75.1**
	KIAS	137	143	155	166	176	186
FLAPS 10 (GEAR UP) VREF40+30	**PITCH ATT**	**4.0**	**4.0**	**4.5**	**4.5**	**4.5**	**5.0**
	%N1	**59.3**	**62.0**	**66.7**	**70.9**	**74.5**	**77.7**
	KIAS	137	143	155	166	176	186
FLAPS 15 (GEAR UP) VREF40+20	**PITCH ATT**	**4.5**	**4.5**	**5.0**	**5.0**	**5.0**	**5.0**
	%N1	**59.5**	**62.3**	**67.1**	**71.6**	**75.2**	**78.5**
	KIAS	127	133	145	156	166	176
FLAPS 25 (GEAR UP) VREF40+10	**PITCH ATT**	**5.5**	**5.5**	**5.5**	**5.5**	**5.5**	**5.5**
	%N1	**61.0**	**63.9**	**68.8**	**73.2**	**77.0**	**80.5**
	KIAS	117	123	135	146	156	166
FLAPS 15 (GEAR DOWN) VREF40+20	**PITCH ATT**	**4.5**	**5.0**	**5.0**	**5.0**	**5.0**	**5.5**
	%N1	**64.3**	**67.0**	**72.1**	**76.4**	**80.2**	**83.7**
	KIAS	127	133	145	156	166	176

Flight With Unreliable Airspeed/ Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

TERMINAL AREA (5000 FT)

%N1 for Level Flight

Airport Altitude = 8000 FT

FLAP POSITION (VREF+INCREMENT)		WEIGHT (1000 LB) 90	100	120	140	160	180
FLAPS UP (GEAR UP) VREF40+70	**PITCH ATT**	**5.0**	**5.0**	**5.5**	**6.0**	**6.0**	**6.5**
	%N1	**54.8**	**57.1**	**61.5**	**65.4**	**68.6**	**71.8**
	KIAS	177	183	195	207	217	226
FLAPS 1 (GEAR UP) VREF40+50	**PITCH ATT**	**5.0**	**5.0**	**5.5**	**5.5**	**6.0**	**6.0**
	%N1	**57.5**	**60.0**	**64.4**	**68.2**	**71.7**	**74.9**
	KIAS	157	163	175	187	197	206
FLAPS 5 (GEAR UP) VREF40+30	**PITCH ATT**	**5.5**	**6.0**	**6.0**	**6.5**	**6.5**	**6.5**
	%N1	**57.3**	**60.1**	**64.9**	**68.9**	**72.7**	**75.9**
	KIAS	137	143	155	167	177	186
FLAPS 10 (GEAR UP) VREF40+30	**PITCH ATT**	**4.0**	**4.0**	**4.5**	**4.5**	**4.5**	**5.0**
	%N1	**60.2**	**62.8**	**67.5**	**71.8**	**75.4**	**78.6**
	KIAS	137	143	155	167	177	186
FLAPS 15 (GEAR UP) VREF40+20	**PITCH ATT**	**4.5**	**4.5**	**5.0**	**5.0**	**5.0**	**5.0**
	%N1	**60.3**	**63.1**	**68.0**	**72.4**	**76.0**	**79.4**
	KIAS	127	133	145	157	167	176
FLAPS 25 (GEAR UP) VREF40+10	**PITCH ATT**	**5.5**	**5.5**	**5.5**	**5.5**	**5.5**	**5.5**
	%N1	**61.8**	**64.6**	**69.7**	**74.1**	**77.9**	**81.4**
	KIAS	117	123	135	147	157	166
FLAPS 15 (GEAR DOWN) VREF40+20	**PITCH ATT**	**4.5**	**5.0**	**5.0**	**5.0**	**5.0**	**5.5**
	%N1	**65.0**	**67.8**	**73.0**	**77.3**	**81.2**	**84.6**
	KIAS	127	133	145	157	167	176

Flight With Unreliable Airspeed/ Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

TERMINAL AREA (5000 FT)

%N1 for Level Flight

Airport Altitude = 9000 FT

FLAP POSITION (VREF+INCREMENT)		WEIGHT (1000 LB) 90	100	120	140	160	180
FLAPS UP (GEAR UP) VREF40+70	**PITCH ATT**	**5.0**	**5.0**	**5.5**	**5.5**	**6.0**	**6.5**
	%N1	**55.5**	**57.8**	**62.4**	**66.1**	**69.4**	**72.6**
	KIAS	177	183	195	207	217	227
FLAPS 1 (GEAR UP) VREF40+50	**PITCH ATT**	**5.0**	**5.0**	**5.5**	**5.5**	**6.0**	**6.0**
	%N1	**58.3**	**60.9**	**65.2**	**69.0**	**72.6**	**75.7**
	KIAS	157	163	175	187	197	207
FLAPS 5 (GEAR UP) VREF40+30	**PITCH ATT**	**5.5**	**6.0**	**6.0**	**6.5**	**6.5**	**6.5**
	%N1	**58.2**	**61.0**	**65.7**	**69.8**	**73.5**	**76.8**
	KIAS	137	143	155	167	177	187
FLAPS 10 (GEAR UP) VREF40+30	**PITCH ATT**	**4.0**	**4.0**	**4.5**	**4.5**	**4.5**	**5.0**
	%N1	**61.1**	**63.7**	**68.4**	**72.6**	**76.2**	**79.6**
	KIAS	137	143	155	167	177	187
FLAPS 15 (GEAR UP) VREF40+20	**PITCH ATT**	**4.5**	**4.5**	**5.0**	**5.0**	**5.0**	**5.0**
	%N1	**61.1**	**64.0**	**68.9**	**73.2**	**76.9**	**80.3**
	KIAS	127	133	145	157	167	177
FLAPS 25 (GEAR UP) VREF40+10	**PITCH ATT**	**5.5**	**5.5**	**5.5**	**5.5**	**5.5**	**5.5**
	%N1	**62.7**	**65.4**	**70.6**	**74.9**	**78.8**	**82.2**
	KIAS	117	123	135	147	157	167
FLAPS 15 (GEAR DOWN) VREF40+20	**PITCH ATT**	**4.5**	**5.0**	**5.0**	**5.0**	**5.0**	**5.5**
	%N1	**65.9**	**68.7**	**73.9**	**78.2**	**82.1**	**85.6**
	KIAS	127	133	145	157	167	177

Flight With Unreliable Airspeed/ Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

TERMINAL AREA (5000 FT)

%N1 for Level Flight

Airport Altitude = 10000 FT

FLAP POSITION (VREF+INCREMENT)		WEIGHT (1000 LB) 90	100	120	140	160	180
FLAPS UP (GEAR UP) VREF40+70	**PITCH ATT**	**5.0**	**5.0**	**5.5**	**5.5**	**6.0**	**6.5**
	%N1	**56.3**	**58.7**	**63.2**	**66.8**	**70.3**	**73.4**
	KIAS	177	184	196	207	217	227
FLAPS 1 (GEAR UP) VREF40+50	**PITCH ATT**	**5.0**	**5.0**	**5.5**	**5.5**	**6.0**	**6.0**
	%N1	**59.2**	**61.7**	**66.0**	**70.0**	**73.5**	**76.5**
	KIAS	157	164	176	187	197	207
FLAPS 5 (GEAR UP) VREF40+30	**PITCH ATT**	**5.5**	**6.0**	**6.0**	**6.0**	**6.5**	**6.5**
	%N1	**59.1**	**61.8**	**66.5**	**70.7**	**74.4**	**77.7**
	KIAS	137	144	156	167	177	187
FLAPS 10 (GEAR UP) VREF40+30	**PITCH ATT**	**4.0**	**4.0**	**4.0**	**4.5**	**4.5**	**4.5**
	%N1	**61.9**	**64.6**	**69.3**	**73.5**	**77.1**	**80.5**
	KIAS	137	144	156	167	177	187
FLAPS 15 (GEAR UP) VREF40+20	**PITCH ATT**	**4.5**	**4.5**	**5.0**	**5.0**	**5.0**	**5.0**
	%N1	**62.0**	**64.7**	**69.8**	**74.1**	**77.8**	**81.3**
	KIAS	127	134	146	157	167	177
FLAPS 25 (GEAR UP) VREF40+10	**PITCH ATT**	**5.5**	**5.5**	**5.0**	**5.0**	**5.5**	**5.5**
	%N1	**63.5**	**66.3**	**71.4**	**75.7**	**79.7**	**83.1**
	KIAS	117	124	136	147	157	167
FLAPS 15 (GEAR DOWN) VREF40+20	**PITCH ATT**	**4.5**	**5.0**	**5.0**	**5.0**	**5.0**	**5.0**
	%N1	**66.7**	**69.7**	**74.7**	**79.1**	**83.0**	**86.5**
	KIAS	127	134	146	157	167	177

Flight With Unreliable Airspeed/ Turbulent Air Penetration
Altitude and/or vertical speed indications may also be unreliable.

TERMINAL AREA (5000 FT)
%N1 for Level Flight
Airport Altitude = 11000 FT

FLAP POSITION (VREF+INCREMENT)		WEIGHT (1000 LB)					
		90	100	120	140	160	180
FLAPS UP (GEAR UP) VREF40+70	**PITCH ATT**	**5.0**	**5.0**	**5.5**	**5.5**	**6.0**	**6.5**
	%N1	**57.1**	**59.6**	**64.0**	**67.6**	**71.1**	**74.2**
	KIAS	177	184	196	208	218	228
FLAPS 1 (GEAR UP) VREF40+50	**PITCH ATT**	**5.0**	**5.0**	**5.5**	**5.5**	**6.0**	**6.0**
	%N1	**60.2**	**62.7**	**66.9**	**70.9**	**74.3**	**77.4**
	KIAS	157	164	176	188	198	208
FLAPS 5 (GEAR UP) VREF40+30	**PITCH ATT**	**5.5**	**6.0**	**6.0**	**6.0**	**6.5**	**6.5**
	%N1	**60.2**	**62.8**	**67.4**	**71.7**	**75.2**	**78.6**
	KIAS	137	144	156	168	178	188
FLAPS 10 (GEAR UP) VREF40+30	**PITCH ATT**	**4.0**	**4.0**	**4.0**	**4.5**	**4.5**	**4.5**
	%N1	**62.9**	**65.5**	**70.3**	**74.4**	**78.1**	**81.5**
	KIAS	137	144	156	168	178	188
FLAPS 15 (GEAR UP) VREF40+20	**PITCH ATT**	**4.5**	**4.5**	**4.5**	**5.0**	**5.0**	**5.0**
	%N1	**63.0**	**65.8**	**70.9**	**75.0**	**78.8**	**82.2**
	KIAS	127	134	146	158	168	178
FLAPS 25 (GEAR UP) VREF40+10	**PITCH ATT**	**5.0**	**5.0**	**5.0**	**5.0**	**5.0**	**5.0**
	%N1	**64.6**	**67.4**	**72.5**	**76.8**	**80.7**	**84.1**
	KIAS	117	124	136	148	158	168
FLAPS 15 (GEAR DOWN) VREF40+20	**PITCH ATT**	**4.5**	**4.5**	**5.0**	**5.0**	**5.0**	**5.0**
	%N1	**67.9**	**70.8**	**75.7**	**80.2**	**84.0**	**87.6**
	KIAS	127	134	146	158	168	178

Flight With Unreliable Airspeed/ Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

TERMINAL AREA (5000 FT)
%N1 for Level Flight
Airport Altitude = 12000 FT

FLAP POSITION (VREF+INCREMENT)		WEIGHT (1000 LB) 90	100	120	140	160	180
FLAPS UP (GEAR UP) VREF40+70	**PITCH ATT**	**5.0**	**5.0**	**5.5**	**5.5**	**6.0**	**6.5**
	%N1	**57.9**	**60.5**	**64.7**	**68.4**	**71.9**	**75.0**
	KIAS	178	184	196	208	218	228
FLAPS 1 (GEAR UP) VREF40+50	**PITCH ATT**	**5.0**	**5.0**	**5.5**	**5.5**	**6.0**	**6.0**
	%N1	**61.2**	**63.5**	**67.8**	**71.8**	**75.1**	**78.3**
	KIAS	158	164	176	188	198	208
FLAPS 5 (GEAR UP) VREF40+30	**PITCH ATT**	**5.5**	**6.0**	**6.0**	**6.0**	**6.5**	**6.5**
	%N1	**61.3**	**63.7**	**68.4**	**72.5**	**76.1**	**79.6**
	KIAS	138	144	156	168	178	188
FLAPS 10 (GEAR UP) VREF40+30	**PITCH ATT**	**4.0**	**4.0**	**4.0**	**4.5**	**4.5**	**4.5**
	%N1	**63.9**	**66.5**	**71.4**	**75.3**	**79.1**	**82.4**
	KIAS	138	144	156	168	178	188
FLAPS 15 (GEAR UP) VREF40+20	**PITCH ATT**	**4.5**	**4.5**	**4.5**	**5.0**	**5.0**	**5.0**
	%N1	**64.1**	**66.8**	**71.8**	**75.9**	**79.8**	**83.2**
	KIAS	128	134	146	158	168	178
FLAPS 25 (GEAR UP) VREF40+10	**PITCH ATT**	**5.0**	**5.0**	**5.0**	**5.0**	**5.0**	**5.0**
	%N1	**65.7**	**68.6**	**73.5**	**77.8**	**81.7**	**85.1**
	KIAS	118	124	136	148	158	168
FLAPS 15 (GEAR DOWN) VREF40+20	**PITCH ATT**	**4.5**	**4.5**	**5.0**	**5.0**	**5.0**	**5.0**
	%N1	**69.1**	**71.9**	**76.8**	**81.2**	**85.0**	**88.7**
	KIAS	128	134	146	158	168	178

Flight With Unreliable Airspeed/ Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

TERMINAL AREA (5000 FT)

%N1 for Level Flight

Airport Altitude = 13000 FT

FLAP POSITION (VREF+INCREMENT)		WEIGHT (1000 LB)					
		90	100	120	140	160	180
FLAPS UP (GEAR UP) VREF40+70	**PITCH ATT**	**5.0**	**5.0**	**5.5**	**5.5**	**6.0**	**6.0**
	%N1	**58.8**	**61.4**	**65.4**	**69.3**	**72.8**	**75.8**
	KIAS	178	184	197	208	219	229
FLAPS 1 (GEAR UP) VREF40+50	**PITCH ATT**	**5.0**	**5.0**	**5.5**	**5.5**	**6.0**	**6.0**
	%N1	**62.1**	**64.3**	**68.8**	**72.7**	**75.9**	**79.1**
	KIAS	158	164	177	188	199	209
FLAPS 5 (GEAR UP) VREF40+30	**PITCH ATT**	**5.5**	**6.0**	**6.0**	**6.0**	**6.5**	**6.5**
	%N1	**62.2**	**64.6**	**69.4**	**73.4**	**77.0**	**80.5**
	KIAS	138	144	157	168	179	189
FLAPS 10 (GEAR UP) VREF40+30	**PITCH ATT**	**4.0**	**4.0**	**4.0**	**4.5**	**4.5**	**4.5**
	%N1	**64.9**	**67.5**	**72.2**	**76.2**	**80.0**	**83.3**
	KIAS	138	144	157	168	179	189
FLAPS 15 (GEAR UP) VREF40+20	**PITCH ATT**	**4.5**	**4.5**	**4.5**	**4.5**	**5.0**	**5.0**
	%N1	**65.1**	**67.9**	**72.7**	**76.9**	**80.7**	**84.1**
	KIAS	128	134	147	158	169	179
FLAPS 25 (GEAR UP) VREF40+10	**PITCH ATT**	**5.0**	**5.0**	**5.0**	**5.0**	**5.0**	**5.0**
	%N1	**66.8**	**69.8**	**74.4**	**78.8**	**82.7**	**86.1**
	KIAS	118	124	137	148	159	169
FLAPS 15 (GEAR DOWN) VREF40+20	**PITCH ATT**	**4.5**	**4.5**	**5.0**	**5.0**	**5.0**	**5.0**
	%N1	**70.2**	**72.9**	**77.9**	**82.2**	**86.1**	**89.8**
	KIAS	128	134	147	158	169	179

Flight With Unreliable Airspeed/ Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

TERMINAL AREA (5000 FT)
%N1 for Level Flight
Airport Altitude = 14000 FT

FLAP POSITION (VREF+INCREMENT)		WEIGHT (1000 LB) 90	100	120	140	160	180
FLAPS UP (GEAR UP) VREF40+70	**PITCH ATT**	**5.0**	**5.0**	**5.5**	**5.5**	**6.0**	**6.5**
	%N1	**59.7**	**62.2**	**66.2**	**70.2**	**73.6**	**76.7**
	KIAS	178	184	197	208	219	228
FLAPS 1 (GEAR UP) VREF40+50	**PITCH ATT**	**5.0**	**5.0**	**5.5**	**5.5**	**6.0**	**6.0**
	%N1	**62.9**	**65.2**	**69.6**	**73.4**	**76.8**	**80.0**
	KIAS	158	164	177	188	199	208
FLAPS 5 (GEAR UP) VREF40+30	**PITCH ATT**	**5.5**	**6.0**	**6.0**	**6.0**	**6.5**	**6.5**
	%N1	**63.0**	**65.5**	**70.3**	**74.3**	**78.0**	**81.3**
	KIAS	138	144	157	168	179	188
FLAPS 10 (GEAR UP) VREF40+30	**PITCH ATT**	**4.0**	**4.0**	**4.0**	**4.5**	**4.5**	**4.5**
	%N1	**65.8**	**68.5**	**73.1**	**77.2**	**80.9**	**84.2**
	KIAS	138	144	157	168	179	188
FLAPS 15 (GEAR UP) VREF40+20	**PITCH ATT**	**4.5**	**4.5**	**4.5**	**5.0**	**5.0**	**5.0**
	%N1	**66.1**	**69.0**	**73.6**	**77.9**	**81.7**	**85.0**
	KIAS	128	134	147	158	169	178
FLAPS 25 (GEAR UP) VREF40+10	**PITCH ATT**	**5.0**	**5.0**	**5.0**	**5.0**	**5.0**	**5.0**
	%N1	**68.0**	**70.8**	**75.5**	**79.8**	**83.6**	**87.2**
	KIAS	118	124	137	148	159	168
FLAPS 15 (GEAR DOWN) VREF40+20	**PITCH ATT**	**4.5**	**4.5**	**5.0**	**5.0**	**5.0**	**5.0**
	%N1	**71.2**	**73.8**	**78.8**	**83.2**	**87.1**	**91.0**
	KIAS	128	134	147	158	169	178

Flight With Unreliable Airspeed/ Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

TERMINAL AREA (5000 FT)
%N1 for Level Flight
Airport Altitude = 14500 FT

FLAP POSITION (VREF+INCREMENT)		WEIGHT (1000 LB)					
		90	100	120	140	160	180
FLAPS UP (GEAR UP) VREF40+70	**PITCH ATT**	**5.0**	**5.0**	**5.5**	**5.5**	**6.0**	**6.5**
	%N1	**60.1**	**62.6**	**66.6**	**70.6**	**74.0**	**77.1**
	KIAS	178	184	197	208	219	229
FLAPS 1 (GEAR UP) VREF40+50	**PITCH ATT**	**5.0**	**5.0**	**5.5**	**5.5**	**6.0**	**6.0**
	%N1	**63.3**	**65.6**	**70.1**	**73.8**	**77.3**	**80.5**
	KIAS	158	164	177	188	199	209
FLAPS 5 (GEAR UP) VREF40+30	**PITCH ATT**	**5.5**	**6.0**	**6.0**	**6.0**	**6.5**	**6.5**
	%N1	**63.5**	**66.0**	**70.8**	**74.7**	**78.5**	**81.8**
	KIAS	138	144	157	168	179	189
FLAPS 10 (GEAR UP) VREF40+30	**PITCH ATT**	**4.0**	**4.0**	**4.0**	**4.5**	**4.5**	**4.5**
	%N1	**66.3**	**69.0**	**73.5**	**77.7**	**81.3**	**84.7**
	KIAS	138	144	157	168	179	189
FLAPS 15 (GEAR UP) VREF40+20	**PITCH ATT**	**4.5**	**4.5**	**4.5**	**4.5**	**5.0**	**5.0**
	%N1	**66.6**	**69.5**	**74.1**	**78.4**	**82.1**	**85.5**
	KIAS	128	134	147	158	169	179
FLAPS 25 (GEAR UP) VREF40+10	**PITCH ATT**	**5.0**	**5.0**	**5.0**	**5.0**	**5.0**	**5.0**
	%N1	**68.6**	**71.2**	**76.0**	**80.3**	**84.1**	**87.7**
	KIAS	118	124	137	148	159	169
FLAPS 15 (GEAR DOWN) VREF40+20	**PITCH ATT**	**4.5**	**4.5**	**5.0**	**5.0**	**5.0**	**5.0**
	%N1	**71.7**	**74.2**	**79.3**	**83.6**	**87.6**	**91.7**
	KIAS	128	134	147	158	169	179

Flight With Unreliable Airspeed/ Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

FINAL APPROACH (1500 FT)

Gear Down, %N1 for 3° Glideslope

Airport Altitude = -2000 FT

FLAP POSITION (VREF+INCREMENT)		WEIGHT (1000 LB)					
		90	100	120	140	160	180
FLAPS 15 (VREF15 + 10)	**PITCH ATT**	**1.5**	**1.5**	**2.0**	**2.0**	**2.0**	**2.5**
	%N1	**40.9**	**42.7**	**46.4**	**49.7**	**52.5**	**55.3**
	KIAS	127	134	146	157	166	175
FLAPS 30 (VREF30 + 10)	**PITCH ATT**	**1.0**	**1.0**	**1.0**	**1.0**	**1.5**	**1.5**
	%N1	**46.6**	**48.7**	**52.8**	**56.3**	**59.4**	**62.4**
	KIAS	122	128	139	150	159	168
FLAPS 40 (VREF40 + 10)	**PITCH ATT**	**0.0**	**0.5**	**0.5**	**0.5**	**1.0**	**0.5**
	%N1	**49.9**	**52.3**	**56.6**	**60.5**	**64.0**	**67.5**
	KIAS	116	122	133	143	152	163

Airport Altitude = -1000 FT

FLAP POSITION (VREF+INCREMENT)		WEIGHT (1000 LB)					
		90	100	120	140	160	180
FLAPS 15 (VREF15 + 10)	**PITCH ATT**	**1.5**	**1.5**	**2.0**	**2.0**	**2.0**	**2.5**
	%N1	**41.4**	**43.3**	**47.0**	**50.3**	**53.2**	**55.9**
	KIAS	127	134	146	157	166	175
FLAPS 30 (VREF30 + 10)	**PITCH ATT**	**1.0**	**1.0**	**1.0**	**1.0**	**1.5**	**1.5**
	%N1	**47.1**	**49.3**	**53.4**	**57.0**	**60.2**	**63.2**
	KIAS	122	128	139	150	159	168
FLAPS 40 (VREF40 + 10)	**PITCH ATT**	**0.0**	**0.5**	**0.5**	**0.5**	**1.0**	**0.5**
	%N1	**50.6**	**53.0**	**57.4**	**61.3**	**64.8**	**68.2**
	KIAS	116	122	133	143	152	163

Airport Altitude = SEA LEVEL

FLAP POSITION (VREF+INCREMENT)		WEIGHT (1000 LB)					
		90	100	120	140	160	180
FLAPS 15 (VREF15 + 10)	**PITCH ATT**	**1.5**	**2.0**	**2.0**	**2.0**	**2.0**	**2.5**
	%N1	**41.9**	**43.9**	**47.7**	**50.9**	**53.9**	**56.6**
	KIAS	127	134	146	157	166	175
FLAPS 30 (VREF30 + 10)	**PITCH ATT**	**1.0**	**1.0**	**1.0**	**1.0**	**1.5**	**1.5**
	%N1	**47.8**	**50.0**	**54.1**	**57.7**	**61.0**	**63.9**
	KIAS	122	128	139	150	159	168
FLAPS 40 (VREF40 + 10)	**PITCH ATT**	**0.0**	**0.5**	**0.5**	**0.5**	**0.5**	**0.5**
	%N1	**51.4**	**53.7**	**58.1**	**62.1**	**65.7**	**69.0**
	KIAS	116	122	133	143	153	163

Flight With Unreliable Airspeed/ Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

FINAL APPROACH (1500 FT)

Gear Down, %N1 for 3° Glideslope

Airport Altitude = 1000 FT

FLAP POSITION (VREF+INCREMENT)		WEIGHT (1000 LB) 90	100	120	140	160	180
FLAPS 15 (VREF15 + 10)	**PITCH ATT**	**1.5**	**2.0**	**2.0**	**2.0**	**2.0**	**2.5**
	%N1	**42.4**	**44.5**	**48.3**	**51.6**	**54.7**	**57.3**
	KIAS	127	134	146	157	166	175
FLAPS 30 (VREF30 + 10)	**PITCH ATT**	**1.0**	**1.0**	**1.0**	**1.0**	**1.5**	**1.5**
	%N1	**48.4**	**50.7**	**54.8**	**58.5**	**61.8**	**64.7**
	KIAS	122	128	139	150	159	168
FLAPS 40 (VREF40 + 10)	**PITCH ATT**	**0.0**	**0.5**	**0.5**	**0.5**	**0.5**	**0.5**
	%N1	**52.0**	**54.5**	**58.9**	**63.0**	**66.5**	**69.8**
	KIAS	116	122	133	143	153	163

Airport Altitude = 2000 FT

FLAP POSITION (VREF+INCREMENT)		WEIGHT (1000 LB) 90	100	120	140	160	180
FLAPS 15 (VREF15 + 10)	**PITCH ATT**	**1.5**	**2.0**	**2.0**	**2.0**	**2.0**	**2.5**
	%N1	**43.0**	**45.1**	**48.9**	**52.3**	**55.3**	**58.0**
	KIAS	127	134	146	157	166	176
FLAPS 30 (VREF30 + 10)	**PITCH ATT**	**1.0**	**1.0**	**1.0**	**1.0**	**1.5**	**1.5**
	%N1	**49.0**	**51.4**	**55.5**	**59.2**	**62.6**	**65.5**
	KIAS	122	128	140	150	159	168
FLAPS 40 (VREF40 + 10)	**PITCH ATT**	**0.0**	**0.5**	**0.5**	**0.5**	**0.5**	**0.5**
	%N1	**52.7**	**55.2**	**59.7**	**63.8**	**67.3**	**70.6**
	KIAS	116	122	133	144	153	163

Airport Altitude = 3000 FT

FLAP POSITION (VREF+INCREMENT)		WEIGHT (1000 LB) 90	100	120	140	160	180
FLAPS 15 (VREF15 + 10)	**PITCH ATT**	**1.5**	**2.0**	**2.0**	**2.0**	**2.0**	**2.5**
	%N1	**43.6**	**45.7**	**49.5**	**53.0**	**56.0**	**58.8**
	KIAS	127	134	146	157	167	176
FLAPS 30 (VREF30 + 10)	**PITCH ATT**	**1.0**	**1.0**	**1.0**	**1.0**	**1.5**	**1.5**
	%N1	**49.7**	**52.1**	**56.2**	**60.0**	**63.3**	**66.3**
	KIAS	122	128	140	150	159	168
FLAPS 40 (VREF40 + 10)	**PITCH ATT**	**0.0**	**0.5**	**0.5**	**0.5**	**0.5**	**0.5**
	%N1	**53.5**	**55.9**	**60.5**	**64.6**	**68.1**	**71.4**
	KIAS	116	122	133	144	153	163

Flight With Unreliable Airspeed/ Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

FINAL APPROACH (1500 FT)

Gear Down, %N1 for 3° Glideslope

Airport Altitude = 4000 FT

FLAP POSITION (VREF+INCREMENT)		WEIGHT (1000 LB)					
		90	100	120	140	160	180
FLAPS 15 (VREF15 + 10)	**PITCH ATT**	**1.5**	**2.0**	**2.0**	**2.0**	**2.0**	**2.5**
	%N1	**44.2**	**46.4**	**50.2**	**53.7**	**56.8**	**59.5**
	KIAS	127	134	146	157	167	176
FLAPS 30 (VREF30 + 10)	**PITCH ATT**	**1.0**	**1.0**	**1.0**	**1.0**	**1.5**	**1.5**
	%N1	**50.4**	**52.8**	**57.0**	**60.8**	**64.1**	**67.0**
	KIAS	122	128	140	150	159	168
FLAPS 40 (VREF40 + 10)	**PITCH ATT**	**0.0**	**0.5**	**0.5**	**0.5**	**0.5**	**0.5**
	%N1	**54.2**	**56.7**	**61.3**	**65.5**	**68.9**	**72.3**
	KIAS	116	122	133	144	154	163

Airport Altitude = 5000 FT

FLAP POSITION (VREF+INCREMENT)		WEIGHT (1000 LB)					
		90	100	120	140	160	180
FLAPS 15 (VREF15 + 10)	**PITCH ATT**	**1.5**	**2.0**	**2.0**	**2.0**	**2.0**	**2.5**
	%N1	**44.8**	**47.1**	**50.9**	**54.4**	**57.4**	**60.3**
	KIAS	127	134	146	157	167	176
FLAPS 30 (VREF30 + 10)	**PITCH ATT**	**1.0**	**1.0**	**1.0**	**1.0**	**1.5**	**1.5**
	%N1	**51.1**	**53.5**	**57.7**	**61.6**	**64.9**	**67.8**
	KIAS	122	128	140	150	159	168
FLAPS 40 (VREF40 + 10)	**PITCH ATT**	**0.0**	**0.5**	**0.5**	**0.5**	**0.5**	**0.5**
	%N1	**54.9**	**57.4**	**62.1**	**66.3**	**69.8**	**73.2**
	KIAS	116	122	133	144	154	164

Airport Altitude = 6000 FT

FLAP POSITION (VREF+INCREMENT)		WEIGHT (1000 LB)					
		90	100	120	140	160	180
FLAPS 15 (VREF15 + 10)	**PITCH ATT**	**1.5**	**2.0**	**2.0**	**2.0**	**2.0**	**2.5**
	%N1	**45.5**	**47.7**	**51.6**	**55.1**	**58.2**	**61.1**
	KIAS	127	134	146	157	167	176
FLAPS 30 (VREF30 + 10)	**PITCH ATT**	**1.0**	**1.0**	**1.0**	**1.0**	**1.5**	**1.5**
	%N1	**51.9**	**54.2**	**58.5**	**62.4**	**65.7**	**68.5**
	KIAS	122	128	140	150	159	168
FLAPS 40 (VREF40 + 10)	**PITCH ATT**	**0.0**	**0.5**	**0.5**	**0.5**	**0.5**	**0.5**
	%N1	**55.7**	**58.2**	**63.0**	**67.1**	**70.6**	**74.0**
	KIAS	116	122	134	145	154	164

Flight With Unreliable Airspeed/ Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

FINAL APPROACH (1500 FT)

Gear Down, %N1 for 3° Glideslope

Airport Altitude = 7000 FT

FLAP POSITION (VREF+INCREMENT)		WEIGHT (1000 LB)					
		90	100	120	140	160	180
FLAPS 15 (VREF15 + 10)	**PITCH ATT**	**1.5**	**2.0**	**2.0**	**2.0**	**2.0**	**2.5**
	%N1	**46.2**	**48.3**	**52.3**	**55.8**	**58.9**	**61.9**
	KIAS	127	134	146	157	167	176
FLAPS 30 (VREF30 + 10)	**PITCH ATT**	**1.0**	**1.0**	**1.0**	**1.0**	**1.5**	**1.5**
	%N1	**52.5**	**54.9**	**59.3**	**63.2**	**66.4**	**69.4**
	KIAS	122	128	140	150	159	168
FLAPS 40 (VREF40 + 10)	**PITCH ATT**	**0.0**	**0.5**	**0.5**	**0.5**	**0.5**	**0.5**
	%N1	**56.4**	**59.0**	**63.8**	**67.9**	**71.6**	**74.9**
	KIAS	116	122	134	145	154	164

Airport Altitude = 8000 FT

FLAP POSITION (VREF+INCREMENT)		WEIGHT (1000 LB)					
		90	100	120	140	160	180
FLAPS 15 (VREF15 + 10)	**PITCH ATT**	**1.5**	**2.0**	**2.0**	**2.0**	**2.0**	**2.5**
	%N1	**46.9**	**49.0**	**53.0**	**56.5**	**59.7**	**62.7**
	KIAS	127	134	146	157	167	177
FLAPS 30 (VREF30 + 10)	**PITCH ATT**	**1.0**	**1.0**	**1.0**	**1.0**	**1.5**	**1.5**
	%N1	**53.2**	**55.6**	**60.1**	**64.0**	**67.2**	**70.2**
	KIAS	122	128	140	150	160	168
FLAPS 40 (VREF40 + 10)	**PITCH ATT**	**0.0**	**0.5**	**0.5**	**0.5**	**0.5**	**0.5**
	%N1	**57.2**	**59.9**	**64.7**	**68.8**	**72.5**	**75.7**
	KIAS	116	122	134	145	155	164

Airport Altitude = 9000 FT

FLAP POSITION (VREF+INCREMENT)		WEIGHT (1000 LB)					
		90	100	120	140	160	180
FLAPS 15 (VREF15 + 10)	**PITCH ATT**	**1.5**	**2.0**	**2.0**	**2.0**	**2.0**	**2.0**
	%N1	**47.5**	**49.6**	**53.7**	**57.3**	**60.5**	**63.5**
	KIAS	127	134	146	157	167	177
FLAPS 30 (VREF30 + 10)	**PITCH ATT**	**1.0**	**1.0**	**1.0**	**1.0**	**1.5**	**1.5**
	%N1	**54.0**	**56.4**	**60.9**	**64.8**	**68.0**	**71.0**
	KIAS	122	128	140	150	160	168
FLAPS 40 (VREF40 + 10)	**PITCH ATT**	**0.0**	**0.5**	**0.5**	**0.5**	**0.5**	**0.5**
	%N1	**58.0**	**60.7**	**65.5**	**69.7**	**73.3**	**76.5**
	KIAS	116	122	134	145	155	164

Flight With Unreliable Airspeed/ Turbulent Air Penetration
Altitude and/or vertical speed indications may also be unreliable.

FINAL APPROACH (1500 FT)
Gear Down, %N1 for 3° Glideslope
Airport Altitude = 10000 FT

FLAP POSITION (VREF+INCREMENT)		WEIGHT (1000 LB)					
		90	100	120	140	160	180
FLAPS 15 (VREF15 + 10)	**PITCH ATT**	**1.5**	**2.0**	**2.0**	**2.0**	**2.0**	**2.0**
	%N1	**48.1**	**50.3**	**54.4**	**58.0**	**61.3**	**64.2**
	KIAS	127	134	146	157	168	177
FLAPS 30 (VREF30 + 10)	**PITCH ATT**	**1.0**	**1.0**	**1.0**	**1.0**	**1.5**	**1.5**
	%N1	**54.7**	**57.1**	**61.7**	**65.5**	**68.8**	**71.8**
	KIAS	122	128	140	150	160	168
FLAPS 40 (VREF40 + 10)	**PITCH ATT**	**0.0**	**0.0**	**0.5**	**0.0**	**0.5**	**0.5**
	%N1	**58.8**	**61.5**	**66.3**	**70.6**	**74.2**	**77.4**
	KIAS	116	123	134	146	155	165

Airport Altitude = 11000 FT

FLAP POSITION (VREF+INCREMENT)		WEIGHT (1000 LB)					
		90	100	120	140	160	180
FLAPS 15 (VREF15 + 10)	**PITCH ATT**	**1.5**	**2.0**	**2.0**	**2.0**	**2.0**	**2.0**
	%N1	**48.7**	**51.0**	**55.1**	**58.8**	**62.1**	**64.9**
	KIAS	127	134	146	158	168	178
FLAPS 30 (VREF30 + 10)	**PITCH ATT**	**1.0**	**1.0**	**1.0**	**1.0**	**1.5**	**1.5**
	%N1	**55.4**	**57.9**	**62.5**	**66.3**	**69.6**	**72.6**
	KIAS	122	128	140	150	160	168
FLAPS 40 (VREF40 + 10)	**PITCH ATT**	**0.0**	**0.0**	**0.0**	**0.0**	**0.5**	**0.5**
	%N1	**59.7**	**62.4**	**67.1**	**71.5**	**75.1**	**78.3**
	KIAS	116	123	135	146	156	165

Airport Altitude = 12000 FT

FLAP POSITION (VREF+INCREMENT)		WEIGHT (1000 LB)					
		90	100	120	140	160	180
FLAPS 15 (VREF15 + 10)	**PITCH ATT**	**1.5**	**2.0**	**2.0**	**2.0**	**2.0**	**2.0**
	%N1	**49.4**	**51.8**	**55.9**	**59.6**	**62.9**	**65.6**
	KIAS	127	134	146	158	168	178
FLAPS 30 (VREF30 + 10)	**PITCH ATT**	**1.0**	**1.0**	**1.0**	**1.0**	**1.5**	**1.5**
	%N1	**56.2**	**58.8**	**63.3**	**67.1**	**70.5**	**73.4**
	KIAS	122	128	140	151	160	168
FLAPS 40 (VREF40 + 10)	**PITCH ATT**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.5**
	%N1	**60.5**	**63.3**	**68.0**	**72.4**	**75.9**	**79.2**
	KIAS	117	123	135	146	156	166

Flight With Unreliable Airspeed/ Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

FINAL APPROACH (1500 FT)

Gear Down, %N1 for 3° Glideslope

Airport Altitude = 13000 FT

FLAP POSITION (VREF+INCREMENT)		WEIGHT (1000 LB) 90	100	120	140	160	180
FLAPS 15 (VREF15 + 10)	**PITCH ATT**	**1.5**	**2.0**	**2.0**	**2.0**	**2.0**	**2.0**
	%N1	**50.1**	**52.5**	**56.6**	**60.4**	**63.6**	**66.4**
	KIAS	127	134	146	158	168	178
FLAPS 30 (VREF30 + 10)	**PITCH ATT**	**1.0**	**1.0**	**1.0**	**1.0**	**1.5**	**1.5**
	%N1	**57.0**	**59.6**	**64.1**	**67.9**	**71.3**	**74.2**
	KIAS	122	128	140	151	160	169
FLAPS 40 (VREF40 + 10)	**PITCH ATT**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**
	%N1	**61.4**	**64.1**	**68.9**	**73.3**	**76.8**	**80.1**
	KIAS	117	123	135	147	157	166

Airport Altitude = 14000 FT

FLAP POSITION (VREF+INCREMENT)		WEIGHT (1000 LB) 90	100	120	140	160	180
FLAPS 15 (VREF15 + 10)	**PITCH ATT**	**1.5**	**2.0**	**2.0**	**2.0**	**2.0**	**2.0**
	%N1	**51.0**	**53.3**	**57.4**	**61.3**	**64.4**	**67.2**
	KIAS	128	134	146	158	169	179
FLAPS 30 (VREF30 + 10)	**PITCH ATT**	**1.0**	**1.0**	**1.0**	**1.0**	**1.5**	**1.5**
	%N1	**58.0**	**60.6**	**65.0**	**68.8**	**72.1**	**75.0**
	KIAS	122	128	140	151	160	169
FLAPS 40 (VREF40 + 10)	**PITCH ATT**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**
	%N1	**62.4**	**65.0**	**70.0**	**74.2**	**77.8**	**81.1**
	KIAS	117	123	135	147	157	167

Airport Altitude = 14500 FT

FLAP POSITION (VREF+INCREMENT)		WEIGHT (1000 LB) 90	100	120	140	160	180
FLAPS 15 (VREF15 + 10)	**PITCH ATT**	**1.5**	**2.0**	**2.0**	**2.0**	**2.0**	**2.0**
	%N1	**51.4**	**53.7**	**57.9**	**61.8**	**64.8**	**67.6**
	KIAS	128	134	146	158	169	179
FLAPS 30 (VREF30 + 10)	**PITCH ATT**	**1.0**	**1.0**	**1.0**	**1.0**	**1.5**	**1.5**
	%N1	**58.6**	**61.1**	**65.4**	**69.3**	**72.6**	**75.4**
	KIAS	122	128	140	151	160	169
FLAPS 40 (VREF40 + 10)	**PITCH ATT**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**
	%N1	**62.9**	**65.6**	**70.6**	**74.7**	**78.3**	**81.6**
	KIAS	117	123	136	147	157	167

Flight With Unreliable Airspeed/ Turbulent Air Penetration
Altitude and/or vertical speed indications may also be unreliable.

GO-AROUND
Flaps 1, Gear Up, Set Go-Around Thrust

PRESSURE ALTITUDE (FT)		WEIGHT (1000 LB)					
		90	100	120	140	160	180
14000	**PITCH ATT**	**17.0**	**15.5**	**13.5**	**12.0**	**11.0**	**10.0**
	V/S (FT/MIN)	4200	3800	3100	2600	2100	1800
	KIAS	157	163	175	187	197	207
10000	**PITCH ATT**	**19.5**	**17.5**	**15.0**	**13.5**	**12.0**	**11.5**
	V/S (FT/MIN)	4700	4200	3500	2900	2500	2100
	KIAS	156	163	174	186	195	205
5000	**PITCH ATT**	**23.0**	**21.0**	**17.5**	**15.5**	**14.0**	**13.0**
	V/S (FT/MIN)	5400	4900	4100	3500	3000	2500
	KIAS	156	162	173	184	194	204
SEA LEVEL	**PITCH ATT**	**27.0**	**24.0**	**20.5**	**18.0**	**16.0**	**14.5**
	V/S (FT/MIN)	6100	5500	4600	3900	3400	3000
	KIAS	156	162	173	183	193	203
-2000	**PITCH ATT**	**27.0**	**24.5**	**20.5**	**18.0**	**16.0**	**14.5**
	V/S (FT/MIN)	6000	5400	4500	3900	3400	2900
	KIAS	156	162	173	183	192	203

Flaps 5, Gear Up, Set Go-Around Thrust

PRESSURE ALTITUDE (FT)		WEIGHT (1000 LB)					
		90	100	120	140	160	180
14000	**PITCH ATT**	**18.0**	**16.5**	**14.0**	**12.5**	**11.5**	**10.5**
	V/S (FT/MIN)	3800	3400	2800	2300	1900	1600
	KIAS	137	143	155	167	177	187
10000	**PITCH ATT**	**20.5**	**18.5**	**16.0**	**14.0**	**12.5**	**11.5**
	V/S (FT/MIN)	4200	3800	3100	2600	2200	1900
	KIAS	136	143	154	166	175	185
5000	**PITCH ATT**	**24.5**	**22.0**	**18.5**	**16.5**	**14.5**	**13.5**
	V/S (FT/MIN)	4900	4400	3700	3100	2700	2300
	KIAS	136	142	153	164	174	184
SEA LEVEL	**PITCH ATT**	**28.0**	**25.5**	**21.5**	**19.0**	**17.0**	**15.0**
	V/S (FT/MIN)	5500	5000	4200	3600	3100	2700
	KIAS	136	142	153	163	173	183
-2000	**PITCH ATT**	**28.5**	**25.5**	**21.5**	**19.0**	**17.0**	**15.0**
	V/S (FT/MIN)	5400	4900	4100	3500	3000	2700
	KIAS	136	142	153	163	172	183

Only authorized operators may use Flaps 5 for a Go-Around in conjunction with the Alternate Go-Around and Missed Approach Procedure.

Flight With Unreliable Airspeed/ Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

GO-AROUND

Flaps 15, Gear Up, Set Go-Around Thrust

PRESSURE ALTITUDE (FT)		WEIGHT (1000 LB)					
		90	100	120	140	160	180
14000	**PITCH ATT**	**16.5**	**15.0**	**12.5**	**10.5**	**9.5**	**8.5**
	V/S (FT/MIN)	3400	3000	2400	2000	1600	1300
	KIAS	127	133	145	157	167	177
10000	**PITCH ATT**	**19.0**	**17.0**	**14.0**	**12.0**	**10.5**	**9.5**
	V/S (FT/MIN)	3800	3400	2800	2300	1900	1600
	KIAS	126	133	144	156	165	175
5000	**PITCH ATT**	**23.0**	**20.5**	**17.0**	**14.5**	**13.0**	**11.5**
	V/S (FT/MIN)	4400	4000	3300	2800	2400	2000
	KIAS	126	132	143	154	164	174
SEA LEVEL	**PITCH ATT**	**27.0**	**24.0**	**20.0**	**17.0**	**15.0**	**13.0**
	V/S (FT/MIN)	5000	4600	3800	3200	2800	2400
	KIAS	126	132	143	153	163	173
-2000	**PITCH ATT**	**27.0**	**24.0**	**20.0**	**17.0**	**15.0**	**13.5**
	V/S (FT/MIN)	4900	4500	3700	3200	2700	2400
	KIAS	126	132	143	153	162	173

Performance Inflight
Chapter PI
All Engine
Section 81

Long Range Cruise Maximum Operating Altitude
Max Cruise Thrust
ISA + 10°C and Below

WEIGHT (1000 LB)	OPTIMUM ALT (FT)	TAT (°C)	MARGIN TO INITIAL BUFFET 'G' (BANK ANGLE)				
			1.20 (33°)	1.25 (36°)	1.30 (39°)	1.40 (44°)	1.50 (48°)
190	30900	-6	33000*	33000*	33000*	31500	30100
180	32100	-9	34500*	34500*	34300	32700	31300
170	33300	-12	35800*	35800*	35500	33900	32500
160	34600	-14	37100*	37100*	36800	35200	33800
150	35900	-18	38300*	38300*	38100	36500	35200
140	37400	-18	39600*	39600*	39500	38000	36600
130	38900	-18	41000	41000	41000	39500	38100
120	40600	-18	41000	41000	41000	41000	39800
110	41000	-18	41000	41000	41000	41000	41000
100	41000	-18	41000	41000	41000	41000	41000
90	41000	-18	41000	41000	41000	41000	41000

ISA + 15°C

WEIGHT (1000 LB)	OPTIMUM ALT (FT)	TAT (°C)	MARGIN TO INITIAL BUFFET 'G' (BANK ANGLE)				
			1.20 (33°)	1.25 (36°)	1.30 (39°)	1.40 (44°)	1.50 (48°)
190	30900	-1	30800*	30800*	30800*	30800*	30100
180	32100	-3	32900*	32900*	32900*	32700	31300
170	33300	-6	34700*	34700*	34700*	33900	32500
160	34600	-9	36100*	36100*	36100*	35200	33800
150	35900	-12	37400*	37400*	37400*	36500	35200
140	37400	-12	38600*	38600*	38600*	38000	36600
130	38900	-12	40000*	40000*	40000*	39500	38100
120	40600	-12	41000	41000	41000	41000	39800
110	41000	-12	41000	41000	41000	41000	41000
100	41000	-12	41000	41000	41000	41000	41000
90	41000	-12	41000	41000	41000	41000	41000

ISA + 20°C

WEIGHT (1000 LB)	OPTIMUM ALT (FT)	TAT (°C)	MARGIN TO INITIAL BUFFET 'G' (BANK ANGLE)				
			1.20 (33°)	1.25 (36°)	1.30 (39°)	1.40 (44°)	1.50 (48°)
190	30900	5	27400*	27400*	27400*	27400*	27400*
180	32100	2	29500*	29500*	29500*	29500*	29500*
170	33300	0	32100*	32100*	32100*	32100*	32100*
160	34600	-3	34300*	34300*	34300*	34300*	33800
150	35900	-6	36000*	36000*	36000*	36000*	35200
140	37400	-7	37300*	37300*	37300*	37300*	36600
130	38900	-7	38600*	38600*	38600*	38600*	38100
120	40600	-7	40000*	40000*	40000*	40000*	39800
110	41000	-7	41000	41000	41000	41000	41000
100	41000	-7	41000	41000	41000	41000	41000
90	41000	-7	41000	41000	41000	41000	41000

***Denotes altitude thrust limited in level flight, 100 fpm residual rate of climb.**

Long Range Cruise Control

WEIGHT (1000 LB)		PRESSURE ALTITUDE (1000 FT)								
		25	27	29	31	33	35	37	39	41
190	%N1	86.1	87.4	88.6	90.0	92.1				
	MACH	.746	.767	.784	.792	.793				
	KIAS	313	310	304	294	282				
	FF/ENG	3554	3542	3530	3506	3521				
180	%N1	85.0	86.3	87.5	88.8	90.4	93.9			
	MACH	.733	.755	.775	.789	.793	.791			
	KIAS	307	304	300	293	282	269			
	FF/ENG	3381	3367	3358	3333	3318	3421			
170	%N1	83.8	85.1	86.4	87.7	89.0	91.0			
	MACH	.720	.741	.762	.781	.792	.793			
	KIAS	301	298	295	290	281	269			
	FF/ENG	3214	3194	3182	3163	3141	3141			
160	%N1	82.4	83.8	85.1	86.5	87.7	89.2	92.5		
	MACH	.702	.726	.748	.769	.786	.793	.792		
	KIAS	293	292	288	285	279	269	257		
	FF/ENG	3028	3024	3009	2991	2967	2951	3011		
150	%N1	80.8	82.5	83.8	85.1	86.5	87.8	89.9		
	MACH	.678	.710	.732	.754	.775	.789	.793		
	KIAS	283	285	282	279	275	268	257		
	FF/ENG	2817	2850	2837	2820	2798	2777	2786		
140	%N1	79.2	80.8	82.4	83.7	85.1	86.4	88.1	91.0	
	MACH	.656	.686	.716	.737	.760	.780	.792	.793	
	KIAS	273	274	275	272	269	264	257	245	
	FF/ENG	2621	2646	2670	2647	2628	2606	2610	2643	
130	%N1	77.6	79.0	80.6	82.2	83.5	84.9	86.6	88.9	92.4
	MACH	.635	.660	.691	.720	.742	.764	.783	.792	.793
	KIAS	264	263	265	265	262	259	254	245	234
	FF/ENG	2439	2443	2471	2479	2456	2437	2440	2454	2504
120	%N1	76.0	77.3	78.7	80.4	81.9	83.3	85.0	87.1	89.6
	MACH	.618	.638	.663	.695	.723	.745	.768	.786	.793
	KIAS	256	254	253	255	255	252	248	243	234
	FF/ENG	2281	2258	2265	2289	2287	2267	2269	2281	2297
110	%N1	74.5	75.6	76.8	78.3	80.0	81.5	83.2	85.4	87.6
	MACH	.601	.618	.638	.664	.697	.725	.748	.770	.787
	KIAS	249	246	243	243	245	244	241	238	232
	FF/ENG	2144	2099	2081	2084	2103	2098	2094	2109	2120
100	%N1	72.5	73.9	75.0	76.2	77.7	79.5	81.3	83.5	85.7
	MACH	.579	.600	.617	.637	.663	.697	.725	.748	.771
	KIAS	239	238	235	232	232	234	233	230	227
	FF/ENG	1987	1960	1922	1901	1900	1916	1922	1932	1971
90	%N1	70.3	71.7	73.1	74.2	75.5	76.9	79.0	81.3	83.5
	MACH	.552	.574	.596	.614	.634	.660	.694	.723	.746
	KIAS	228	227	226	223	221	220	222	222	219
	FF/ENG	1821	1804	1783	1775	1747	1740	1761	1781	1790

Shaded area approximates optimum altitude.

Long Range Cruise Enroute Fuel and Time - Low Altitudes

Ground to Air Miles Conversions

AIR DISTANCE (NM)					GROUND DISTANCE (NM)	AIR DISTANCE (NM)				
HEADWIND COMPONENT (KTS)						TAILWIND COMPONENT (KTS)				
100	80	60	40	20		20	40	60	80	100
293	268	247	229	214	200	190	181	173	166	159
440	403	371	344	321	300	286	272	260	249	239
588	539	496	459	428	400	381	363	347	332	319
736	675	620	574	535	500	476	454	434	415	399
885	810	745	689	642	600	571	544	520	498	479
1034	946	869	804	749	700	667	636	607	582	558
1184	1083	994	920	856	800	762	727	694	665	638
1334	1220	1120	1036	964	900	857	817	781	748	718
1484	1357	1245	1152	1071	1000	952	908	867	831	798
1635	1494	1370	1267	1179	1100	1047	998	954	913	877
1787	1632	1496	1383	1286	1200	1142	1089	1040	996	956
1939	1771	1622	1499	1394	1300	1237	1180	1127	1079	1036
2092	1909	1749	1615	1501	1400	1332	1270	1213	1161	1115
2245	2048	1875	1732	1609	1500	1428	1361	1300	1244	1194
2399	2188	2002	1848	1717	1600	1523	1451	1386	1327	1273
2553	2327	2129	1965	1824	1700	1618	1542	1473	1409	1352
2708	2468	2256	2081	1932	1800	1713	1633	1559	1492	1431
2863	2608	2384	2198	2040	1900	1808	1723	1645	1574	1510
3019	2749	2512	2315	2148	2000	1903	1813	1731	1656	1589

Reference Fuel And Time Required at Check Point

AIR DIST (NM)	PRESSURE ALTITUDE (1000 FT)									
	10		14		20		24		28	
	FUEL (1000 LB)	TIME (HR:MIN)	FUEL (1000 LB)	TIME (HR:MIN)	FUEL (1000 LB)	TIME (HR:MIN)	FUEL (1000 LB)	TIME (HR:MIN)	FUEL (1000 LB)	TIME (HR:MIN)
200	3.2	0:42	2.9	0:40	2.4	0:38	2.1	0:37	1.9	0:35
300	4.9	1:01	4.5	0:58	3.8	0:54	3.4	0:53	3.1	0:51
400	6.6	1:21	6.0	1:16	5.2	1:11	4.7	1:09	4.4	1:06
500	8.3	1:40	7.6	1:35	6.6	1:28	6.0	1:25	5.6	1:21
600	10.0	2:00	9.2	1:54	8.0	1:45	7.3	1:41	6.8	1:36
700	11.7	2:20	10.7	2:12	9.4	2:02	8.5	1:57	7.9	1:52
800	13.4	2:40	12.3	2:31	10.8	2:19	9.8	2:13	9.1	2:07
900	15.0	3:00	13.8	2:50	12.2	2:36	11.0	2:29	10.3	2:22
1000	16.7	3:21	15.4	3:09	13.6	2:53	12.3	2:46	11.5	2:38
1100	18.3	3:41	16.9	3:29	14.9	3:11	13.5	3:02	12.6	2:54
1200	20.0	4:02	18.4	3:48	16.3	3:28	14.8	3:18	13.8	3:09
1300	21.6	4:23	19.9	4:07	17.6	3:46	16.0	3:35	15.0	3:25
1400	23.2	4:43	21.4	4:27	19.0	4:03	17.3	3:52	16.1	3:41
1500	24.8	5:05	22.9	4:47	20.3	4:21	18.5	4:08	17.2	3:57
1600	26.4	5:26	24.4	5:06	21.7	4:39	19.7	4:25	18.4	4:13
1700	28.0	5:47	25.9	5:27	23.0	4:57	20.9	4:42	19.5	4:29
1800	29.6	6:09	27.4	5:47	24.3	5:15	22.1	4:58	20.6	4:45
1900	31.2	6:30	28.8	6:07	25.6	5:33	23.3	5:15	21.7	5:01
2000	32.7	6:52	30.3	6:27	26.9	5:51	24.5	5:32	22.9	5:17

Long Range Cruise Enroute Fuel and Time - Low Altitudes
Fuel Required Adjustments (1000 LB)

REFERENCE FUEL REQUIRED (1000 LB)	WEIGHT AT CHECK POINT (1000 LB)					
	90	110	130	150	170	190
5	-0.5	-0.3	0.0	0.3	0.7	1.0
10	-1.2	-0.6	0.0	0.8	1.5	2.3
15	-1.8	-0.9	0.0	1.2	2.3	3.5
20	-2.3	-1.2	0.0	1.6	3.2	4.8
25	-2.9	-1.5	0.0	2.1	4.1	6.0
30	-3.4	-1.8	0.0	2.5	4.9	7.3
35	-4.0	-2.1	0.0	2.9	5.8	8.6

Long Range Cruise Enroute Fuel and Time - High Altitudes
Ground to Air Miles Conversions

AIR DISTANCE (NM)					GROUND DISTANCE (NM)	AIR DISTANCE (NM)				
HEADWIND COMPONENT (KTS)						TAIL WIND COMPONENT (KTS)				
100	80	60	40	20		20	40	60	80	100
537	503	472	445	422	400	382	365	350	337	325
802	752	707	667	632	600	574	550	527	507	489
1068	1002	942	889	843	800	766	734	704	677	653
1335	1252	1177	1112	1053	1000	957	918	881	848	817
1603	1504	1414	1335	1264	1200	1149	1102	1058	1018	981
1872	1756	1651	1558	1475	1400	1341	1286	1235	1188	1145
2142	2009	1888	1781	1686	1600	1533	1470	1411	1358	1309
2413	2262	2125	2005	1898	1800	1724	1653	1588	1528	1473
2684	2515	2362	2228	2109	2000	1916	1837	1764	1698	1637
2956	2769	2600	2452	2320	2200	2107	2021	1941	1867	1801
3229	3024	2839	2676	2532	2400	2299	2204	2117	2037	1964
3503	3280	3078	2901	2743	2600	2490	2388	2294	2207	2128
3778	3536	3317	3125	2955	2800	2682	2572	2470	2377	2292
4053	3792	3556	3350	3167	3000	2873	2756	2647	2546	2455
4329	4049	3796	3575	3379	3200	3065	2939	2823	2716	2618
4605	4306	4036	3800	3590	3400	3256	3122	2999	2885	2781
4883	4564	4276	4025	3802	3600	3448	3306	3175	3054	2944
5161	4823	4517	4251	4015	3800	3639	3489	3351	3223	3107
5440	5082	4758	4477	4227	4000	3830	3672	3526	3392	3270
5719	5341	5000	4702	4439	4200	4022	3856	3702	3561	3433
6000	5601	5242	4929	4652	4400	4213	4039	3878	3730	3595
6282	5863	5485	5155	4864	4600	4404	4222	4053	3898	3757
6566	6125	5728	5383	5077	4800	4595	4405	4229	4067	3919
6851	6388	5972	5610	5290	5000	4786	4588	4404	4235	4081

Long Range Cruise Enroute Fuel and Time - High Altitudes

Reference Fuel And Time Required at Check Point

AIR DIST (NM)	PRESSURE ALTITUDE (1000 FT)									
	31		33		35		37		39	
	FUEL (1000 LB)	TIME (HR:MIN)	FUEL (1000 LB)	TIME (HR:MIN)	FUEL (1000 LB)	TIME (HR:MIN)	FUEL (1000 LB)	TIME (HR:MIN)	FUEL (1000 LB)	TIME (HR:MIN)
400	4.1	1:03	4.0	1:02	3.8	1:01	3.7	1:00	3.7	1:00
600	6.4	1:32	6.2	1:30	6.0	1:29	5.8	1:27	5.7	1:26
800	8.7	2:01	8.4	1:59	8.1	1:57	7.9	1:54	7.8	1:53
1000	11.0	2:30	10.6	2:27	10.3	2:24	10.0	2:21	9.9	2:19
1200	13.2	3:00	12.8	2:56	12.4	2:52	12.1	2:49	11.9	2:46
1400	15.4	3:30	14.9	3:24	14.5	3:20	14.1	3:16	13.9	3:13
1600	17.6	4:00	17.0	3:53	16.5	3:49	16.1	3:43	15.9	3:39
1800	19.7	4:31	19.1	4:23	18.6	4:17	18.1	4:11	17.8	4:06
2000	21.9	5:01	21.2	4:52	20.6	4:46	20.1	4:39	19.8	4:33
2200	24.0	5:32	23.3	5:22	22.6	5:14	22.1	5:07	21.7	5:01
2400	26.1	6:04	25.3	5:52	24.6	5:43	24.0	5:35	23.6	5:28
2600	28.2	6:35	27.4	6:23	26.6	6:13	25.9	6:03	25.5	5:55
2800	30.2	7:07	29.3	6:53	28.5	6:42	27.8	6:32	27.3	6:23
3000	32.3	7:39	31.3	7:24	30.4	7:12	29.7	7:01	29.1	6:50
3200	34.3	8:12	33.3	7:56	32.3	7:42	31.5	7:30	31.0	7:18
3400	36.3	8:45	35.2	8:27	34.2	8:12	33.4	7:59	32.8	7:46
3600	38.3	9:17	37.2	8:59	36.1	8:43	35.2	8:28	34.6	8:15
3800	40.3	9:51	39.1	9:31	38.0	9:14	37.0	8:57	36.3	8:43
4000	42.2	10:24	41.0	10:04	39.8	9:45	38.8	9:27	38.1	9:12
4200	44.2	10:58	42.9	10:37	41.7	10:16	40.6	9:57	39.8	9:40
4400	46.1	11:31	44.8	11:10	43.5	10:48	42.4	10:27	41.6	10:09
4600	48.0	12:06	46.6	11:43	45.3	11:20	44.1	10:58	43.3	10:39
4800	49.9	12:40	48.4	12:16	47.0	11:53	45.8	11:29	44.9	11:08
5000	51.8	13:15	50.3	12:50	48.8	12:25	47.6	12:00	46.6	11:37

Fuel Required Adjustments (1000 LB)

REFERENCE FUEL REQUIRED (1000 LB)	WEIGHT AT CHECK POINT (1000 LB)					
	90	110	130	150	170	190
5	-0.7	-0.4	0.0	0.7	2.7	5.1
10	-1.4	-0.8	0.0	1.4	4.6	8.8
15	-2.1	-1.2	0.0	2.1	6.2	12.1
20	-2.8	-1.6	0.0	2.7	7.7	15.0
25	-3.6	-2.0	0.0	3.2	9.0	17.4
30	-4.3	-2.3	0.0	3.7	10.2	19.4
35	-5.1	-2.7	0.0	4.2	11.1	20.9
40	-5.9	-3.0	0.0	4.6	11.9	22.0
45	-6.6	-3.4	0.0	5.0	12.5	22.6
50	-7.4	-3.7	0.0	5.3	12.9	22.8
55	-8.2	-4.0	0.0	5.6	13.2	22.6

Long Range Cruise Wind-Altitude Trade

PRESSURE ALTITUDE (1000 FT)	CRUISE WEIGHT (1000 LB)								
	180	170	160	150	140	130	120	110	100
41					26	8	1	1	9
39				18	5	0	2	9	21
37		27	11	2	0	3	10	21	34
35	16	5	1	0	5	12	22	34	48
33	2	0	2	7	14	24	35	48	61
31	1	4	10	17	27	37	49	61	72
29	7	13	21	30	40	50	61	72	82
27	17	25	33	43	52	62	72	82	91

The above wind factor tables are for calculation of wind required to maintain present range capability at new pressure altitude, i.e., break-even wind.

Method:
1. **Read wind factors for present and new altitudes from table.**
2. **Determine difference (new altitude wind factor minus present altitude wind factor); This difference may be negative or positive.**
3. **Break-even wind at new altitude is present altitude wind plus difference from step 2.**

Descent

.78/280/250

PRESSURE ALTITUDE (FT)	TIME (MIN)	FUEL (LB)	DISTANCE (NM)				
			LANDING WEIGHT (1000 LB)				
			90	110	130	150	170
41000	26	780	102	117	129	137	141
39000	26	770	97	112	123	132	136
37000	25	760	92	106	118	126	131
35000	24	750	88	101	112	120	126
33000	24	740	84	97	108	115	121
31000	23	720	80	92	102	109	114
29000	22	710	75	86	95	102	107
27000	21	690	70	81	89	96	100
25000	20	670	66	75	83	89	93
23000	19	650	61	70	77	82	86
21000	18	630	57	65	71	76	79
19000	17	600	52	59	65	69	72
17000	15	580	48	54	59	63	65
15000	14	550	43	49	53	56	58
10000	11	460	30	33	36	37	38
5000	7	350	18	19	20	21	21
1500	4	270	9	9	9	9	9

Allowances for a straight-in approach are included.

Holding
Flaps Up

WEIGHT (1000 LB)		PRESSURE ALTITUDE (FT)								
		1500	5000	10000	15000	20000	25000	30000	35000	41000
190	%N1	64.8	67.3	71.1	75.1	79.5	83.8	88.1		
	KIAS	252	252	254	255	257	259	262		
	FF/ENG	3350	3300	3270	3250	3220	3240	3350		
180	%N1	63.2	66.1	69.6	73.8	78.1	82.4	86.6		
	KIAS	245	246	247	248	250	252	255		
	FF/ENG	3190	3140	3100	3090	3040	3060	3140		
170	%N1	61.7	64.7	68.2	72.4	76.5	80.9	85.2	90.4	
	KIAS	238	239	240	241	242	244	247	250	
	FF/ENG	3040	2980	2940	2920	2860	2870	2950	3120	
160	%N1	60.1	63.0	66.8	70.8	74.9	79.4	83.6	88.4	
	KIAS	231	231	232	233	235	237	239	242	
	FF/ENG	2880	2820	2780	2750	2700	2690	2750	2860	
150	%N1	58.6	61.3	65.3	69.0	73.3	77.7	82.0	86.5	
	KIAS	224	224	225	226	227	229	231	234	
	FF/ENG	2720	2670	2620	2580	2540	2510	2570	2640	
140	%N1	57.0	59.5	63.7	67.3	71.6	75.9	80.3	84.7	
	KIAS	216	216	217	218	219	221	223	225	
	FF/ENG	2570	2510	2460	2420	2380	2330	2380	2430	
130	%N1	55.3	57.8	61.7	65.6	69.7	74.0	78.4	82.8	
	KIAS	208	209	209	210	211	213	214	217	
	FF/ENG	2410	2350	2310	2260	2220	2160	2200	2240	
120	%N1	53.5	56.0	59.6	63.8	67.6	72.0	76.4	80.8	88.7
	KIAS	199	200	201	202	203	204	205	207	211
	FF/ENG	2260	2200	2150	2100	2060	2010	2020	2060	2220
110	%N1	51.5	54.0	57.5	61.7	65.5	69.9	74.1	78.7	86.1
	KIAS	191	191	192	193	194	195	196	198	201
	FF/ENG	2110	2040	1990	1950	1900	1900	1880	1900	2020
100	%N1	49.4	51.8	55.4	59.2	63.3	67.4	71.7	76.3	83.6
	KIAS	182	182	183	184	184	185	187	188	191
	FF/ENG	1960	1890	1870	1830	1780	1740	1720	1720	1810
90	%N1	47.2	49.6	53.1	56.6	61.0	64.8	69.2	73.7	80.9
	KIAS	176	176	176	176	176	176	177	178	180
	FF/ENG	1850	1780	1720	1670	1630	1590	1570	1550	1620

This table includes 5% additional fuel for holding in a racetrack pattern.

Intentionally
Blank

Performance Inflight — Chapter PI
Advisory Information — Section 82

ADVISORY INFORMATION

Normal Configuration Landing Distance
Flaps 15

BRAKING CONFIGURATION	REF DIST 155000 LB LANDING WEIGHT	WT ADJ PER 10000 LB ABV/BLW 155000 LB	ALT ADJ PER 1000 FT STD/HIGH*	WIND ADJ PER 10 KTS HEAD/ TAIL WIND	SLOPE ADJ PER 1% DOWN/ UP HILL	TEMP ADJ PER 10°C ABV/ BLW ISA	APP SPD ADJ PER 5 KTS ABOVE VREF15	REVERSE THRUST ADJ ONE REV	REVERSE THRUST ADJ NO REV
Dry Runway									
MAX MANUAL	3320	240/-170	80/110	-120/410	40/-40	70/-70	120	70	140
AUTOBRAKE MAX	4250	190/-190	100/140	-150/510	10/0	100/-100	190	10	20
AUTOBRAKE 3	6090	290/-310	170/240	-250/840	0/0	170/-170	330	0	0
AUTOBRAKE 2	7800	420/-450	240/340	-350/1170	90/-140	230/-230	330	190	190
AUTOBRAKE 1	8670	510/-530	290/400	-410/1380	220/-270	260/-260	310	680	990
Good Reported Braking Action									
MAX MANUAL	4540	210/-220	120/170	-200/680	110/-100	120/-120	160	220	490
AUTOBRAKE MAX	4870	230/-240	130/190	-200/710	100/-90	120/-120	190	240	540
AUTOBRAKE 3	6100	290/-310	170/240	-250/860	20/-10	170/-170	330	10	40
AUTOBRAKE 2	7800	420/-450	240/340	-350/1170	90/-140	230/-230	330	190	190
AUTOBRAKE 1	8670	510/-530	290/400	-410/1380	220/-270	260/-260	310	680	990
Medium Reported Braking Action									
MAX MANUAL	6330	340/-350	200/280	-320/1130	290/-230	180/-180	210	630	1500
AUTOBRAKE MAX	6460	350/-360	200/290	-320/1140	270/-210	180/-180	240	640	1520
AUTOBRAKE 3	6780	360/-370	210/300	-330/1180	210/-150	190/-200	330	450	1300
AUTOBRAKE 2	7990	430/-460	250/360	-380/1320	210/-200	230/-240	330	330	720
AUTOBRAKE 1	8710	510/-530	290/410	-420/1440	300/-290	260/-260	310	730	1170
Poor Reported Braking Action									
MAX MANUAL	8390	500/-500	290/420	-480/1800	720/-470	240/-260	260	1390	3640
AUTOBRAKE MAX	8400	500/-500	290/430	-480/1810	730/-470	240/-260	270	1390	3640
AUTOBRAKE 3	8460	510/-510	300/430	-480/1810	700/-440	250/-260	300	1400	3670
AUTOBRAKE 2	9000	530/-530	310/450	-500/1870	660/-440	270/-280	320	1140	3160
AUTOBRAKE 1	9410	560/-570	330/470	-520/1920	690/-480	280/-290	300	1310	3210

Reference distance is based on sea level, standard day, no wind or slope, VREF15, two-engine detent No. 2 reverse thrust, and auto speedbrakes.
For max manual braking and manual speedbrakes, increase reference landing distance by 200 ft.
For autobrake and manual speedbrakes, increase reference landing distance by 180 ft.
Reference Distance includes an air distance allowance of 1000 ft from threshold to touchdown.
Actual (unfactored) distances are shown.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Normal Configuration Landing Distance

Flaps 30

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	155000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 155000 LB	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF30	ONE REV	NO REV

Dry Runway

MAX MANUAL	3160	200/-150	70/90	-120/400	40/-40	70/-70	110	60	120
AUTOBRAKE MAX	3990	170/-170	90/120	-150/490	10/0	90/-90	190	0	10
AUTOBRAKE 3	5650	270/-290	150/200	-240/810	0/-20	160/-160	300	0	0
AUTOBRAKE 2	7170	380/-400	220/280	-330/1120	90/-130	210/-210	300	190	190
AUTOBRAKE 1	7930	450/-470	260/340	-390/1320	210/-240	230/-230	280	560	880

Good Reported Braking Action

MAX MANUAL	4300	200/-200	110/150	-190/660	100/-90	110/-110	160	190	430
AUTOBRAKE MAX	4620	210/-220	120/160	-200/690	100/-80	110/-120	190	210	470
AUTOBRAKE 3	5660	270/-290	150/200	-240/820	20/-20	160/-160	300	10	40
AUTOBRAKE 2	7170	380/-400	220/280	-330/1120	90/-130	210/-210	300	190	190
AUTOBRAKE 1	7930	450/-470	260/340	-390/1320	210/-240	230/-230	280	560	880

Medium Reported Braking Action

MAX MANUAL	5920	310/-320	180/240	-300/1100	270/-220	160/-170	200	540	1270
AUTOBRAKE MAX	6060	320/-330	190/250	-310/1110	260/-200	170/-170	240	550	1290
AUTOBRAKE 3	6330	330/-340	190/250	-320/1140	200/-160	180/-180	290	400	1110
AUTOBRAKE 2	7360	390/-410	220/300	-360/1270	210/-190	210/-220	300	320	640
AUTOBRAKE 1	7970	460/-470	260/340	-400/1370	290/-260	230/-240	280	600	1040

Poor Reported Braking Action

MAX MANUAL	7770	450/-450	260/360	-460/1740	670/-440	220/-240	250	1170	3010
AUTOBRAKE MAX	7790	460/-450	270/370	-460/1740	680/-430	220/-240	270	1170	3010
AUTOBRAKE 3	7870	460/-460	270/370	-470/1750	650/-430	220/-240	270	1190	3050
AUTOBRAKE 2	8310	480/-480	280/380	-480/1800	620/-410	240/-260	300	1010	2630
AUTOBRAKE 1	8640	500/-510	290/400	-500/1850	650/-450	250/-270	280	1110	2720

Reference distance is based on sea level, standard day, no wind or slope, VREF30, two-engine detent No. 2 reverse thrust, and auto speedbrakes.
For max manual braking and manual speedbrakes, increase reference landing distance by 190 ft.
For autobrake and manual speedbrakes, increase reference landing distance by 170 ft.
Reference Distance includes an air distance allowance of 1000 ft from threshold to touchdown.
Actual (unfactored) distances are shown.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Normal Configuration Landing Distance

Flaps 40

BRAKING CONFIGURATION	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
	155000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 155000 LB	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF40	ONE REV	NO REV

LANDING DISTANCE AND ADJUSTMENTS (FT)

Dry Runway

MAX MANUAL	3030	190/-150	70/100	-110/390	40/-30	70/-70	110	50	100
AUTOBRAKE MAX	3750	200/-160	90/130	-140/470	0/0	100/-100	180	0	10
AUTOBRAKE 3	5260	320/-270	160/210	-230/770	0/-10	170/-170	290	0	0
AUTOBRAKE 2	6720	430/-380	220/300	-320/1080	60/-110	230/-230	310	90	90
AUTOBRAKE 1	7500	490/-440	250/350	-380/1280	180/-220	260/-260	290	450	670

Good Reported Braking Action

MAX MANUAL	4130	230/-200	120/160	-190/650	100/-90	120/-120	160	180	390
AUTOBRAKE MAX	4430	250/-210	130/170	-190/680	100/-80	120/-120	190	200	430
AUTOBRAKE 3	5280	320/-270	160/220	-230/790	30/-20	170/-170	300	10	40
AUTOBRAKE 2	6720	430/-380	220/300	-320/1080	60/-110	230/-230	310	90	90
AUTOBRAKE 1	7500	490/-440	250/350	-380/1280	180/-220	260/-260	290	450	670

Medium Reported Braking Action

MAX MANUAL	5680	350/-310	180/250	-300/1080	270/-210	180/-180	210	500	1160
AUTOBRAKE MAX	5790	370/-320	190/260	-300/1090	250/-200	180/-180	240	500	1170
AUTOBRAKE 3	5970	380/-320	190/270	-310/1110	220/-150	190/-200	290	410	1100
AUTOBRAKE 2	6920	440/-390	220/310	-350/1230	190/-180	230/-240	310	230	550
AUTOBRAKE 1	7540	500/-450	250/350	-380/1340	260/-240	260/-260	290	500	840

Poor Reported Braking Action

MAX MANUAL	7450	500/-440	260/370	-450/1720	660/-430	240/-260	250	1080	2750
AUTOBRAKE MAX	7470	500/-440	270/380	-450/1720	670/-430	240/-260	260	1090	2760
AUTOBRAKE 3	7530	510/-450	270/380	-460/1730	640/-420	250/-260	270	1100	2780
AUTOBRAKE 2	7890	530/-460	280/390	-470/1770	610/-400	270/-280	300	890	2430
AUTOBRAKE 1	8220	550/-490	290/410	-490/1810	630/-430	280/-290	280	1010	2440

Reference distance is based on sea level, standard day, no wind or slope, VREF40, two-engine detent No. 2 reverse thrust, and auto speedbrakes.
For max manual braking and manual speedbrakes, increase reference landing distance by 180 ft.
For autobrake and manual speedbrakes, increase reference landing distance by 160 ft.
Reference Distance includes an air distance allowance of 1000 ft from threshold to touchdown.
Actual (unfactored) distances are shown.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

Airspeed Unreliable (Flaps 15)

VREF15

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	155000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 155000 LB	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	3540	250/-170	80/130	-130/430	40/-40	80/-80	N/A	80	170
AUTOBRAKE MAX	4640	200/-200	110/160	-160/540	10/0	110/-120	N/A	0	20
AUTOBRAKE 2	8350	450/-480	270/370	-360/1210	150/-180	250/-250	N/A	460	510

Good Reported Braking Action

MAX MANUAL	4810	220/-230	130/190	-200/700	110/-100	120/-130	N/A	260	580
AUTOBRAKE MAX	5200	240/-250	140/200	-210/720	110/-80	130/-130	N/A	290	650
AUTOBRAKE 2	8350	450/-480	270/370	-360/1210	150/-180	250/-250	N/A	460	510

Medium Reported Braking Action

MAX MANUAL	6650	350/-360	210/300	-320/1150	290/-230	190/-190	N/A	710	1730
AUTOBRAKE MAX	6840	360/-370	220/310	-330/1160	270/-220	190/-200	N/A	730	1770
AUTOBRAKE 3	7380	370/-380	230/320	-340/1210	200/-170	210/-220	N/A	450	1340

Poor Reported Braking Action

MAX MANUAL	8690	510/-510	310/440	-480/1810	700/-460	250/-270	N/A	1510	4050
AUTOBRAKE MAX	8720	510/-510	310/440	-490/1810	700/-440	260/-270	N/A	1510	4040
AUTOBRAKE 3	8880	510/-510	310/440	-490/1820	660/-430	260/-280	N/A	1470	4050

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 1000 ft from threshold to touchdown.
Actual (unfactored) distances are shown.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

Airspeed Unreliable (Flaps 30)

VREF30

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	155000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 155000 LB	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	3370	200/-160	80/100	-120/420	40/-40	80/-80	N/A	70	150
AUTOBRAKE MAX	4360	180/-190	100/130	-150/520	10/0	100/-110	N/A	10	20
AUTOBRAKE 2	7680	410/-430	240/310	-340/1150	140/-170	220/-220	N/A	400	500

Good Reported Braking Action

MAX MANUAL	4570	210/-210	120/160	-190/680	110/-90	120/-120	N/A	230	510
AUTOBRAKE MAX	4950	220/-230	130/170	-210/710	100/-90	120/-130	N/A	250	570
AUTOBRAKE 2	7680	410/-430	240/310	-340/1150	140/-170	220/-220	N/A	400	500

Medium Reported Braking Action

MAX MANUAL	6240	320/-330	190/260	-310/1110	270/-220	170/-180	N/A	610	1460
AUTOBRAKE MAX	6440	330/-340	200/270	-320/1130	260/-210	180/-180	N/A	630	1510
AUTOBRAKE 3	6870	340/-350	210/270	-330/1170	210/-160	200/-200	N/A	400	1150

Poor Reported Braking Action

MAX MANUAL	8080	460/-460	280/380	-470/1750	650/-430	230/-250	N/A	1280	3350
AUTOBRAKE MAX	8140	470/-470	280/380	-470/1760	640/-410	240/-250	N/A	1280	3350
AUTOBRAKE 3	8250	460/-460	280/380	-470/1770	640/-400	240/-250	N/A	1260	3350

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 1000 ft from threshold to touchdown.
Actual (unfactored) distances are shown.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

Airspeed Unreliable (Flaps 40)

VREF40

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	155000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 155000 LB	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	3240	180/-150	80/110	-120/410	40/-40	70/-70	N/A	60	130
AUTOBRAKE MAX	4110	200/-180	100/140	-150/500	10/0	100/-100	N/A	0	10
AUTOBRAKE 2	7270	440/-400	240/320	-330/1120	120/-150	210/-210	N/A	300	340

Good Reported Braking Action

MAX MANUAL	4410	230/-210	130/170	-190/670	110/-90	110/-110	N/A	210	470
AUTOBRAKE MAX	4760	250/-220	140/180	-200/700	100/-90	120/-120	N/A	240	530
AUTOBRAKE 2	7270	440/-400	240/320	-330/1120	120/-150	210/-210	N/A	300	340

Medium Reported Braking Action

MAX MANUAL	6010	350/-320	200/270	-310/1100	270/-210	160/-170	N/A	570	1350
AUTOBRAKE MAX	6180	370/-330	200/280	-310/1120	260/-200	170/-170	N/A	580	1380
AUTOBRAKE 3	6500	380/-330	210/290	-320/1150	210/-170	180/-190	N/A	400	1140

Poor Reported Braking Action

MAX MANUAL	7780	490/-440	280/390	-460/1730	650/-420	220/-240	N/A	1190	3080
AUTOBRAKE MAX	7820	500/-450	280/390	-460/1730	650/-410	220/-240	N/A	1190	3070
AUTOBRAKE 3	7910	500/-450	280/390	-460/1740	640/-410	230/-240	N/A	1200	3110

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 1000 ft from threshold to touchdown.
Actual (unfactored) distances are shown.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

All Flaps Up Landing

VREF40 + 55

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	155000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 155000 LB	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	4610	710/-240	240/470	-160/890	80/-60	180/-120	230	160	490
AUTOBRAKE MAX	6050	350/-230	180/370	-200/650	20/-10	160/-160	250	30	90
AUTOBRAKE 2	11670	640/-620	410/540	-440/1450	180/-240	360/-360	400	580	580

Good Reported Braking Action

MAX MANUAL	6100	300/-280	190/250	-230/790	150/-130	170/-170	170	370	830
AUTOBRAKE MAX	6660	310/-280	200/270	-240/820	100/-80	180/-180	240	330	840
AUTOBRAKE 2	11670	640/-620	410/540	-440/1450	180/-240	360/-360	400	580	580

Medium Reported Braking Action

MAX MANUAL	8780	490/-460	310/420	-380/1320	390/-310	260/-260	240	1070	2610
AUTOBRAKE MAX	8940	500/-460	320/430	-380/1330	370/-290	260/-270	270	1080	2640
AUTOBRAKE 3	9840	500/-450	330/450	-400/1400	240/-160	300/-300	410	650	1940

Poor Reported Braking Action

MAX MANUAL	11850	730/-680	460/640	-580/2080	940/-640	360/-380	310	2390	6570
AUTOBRAKE MAX	11820	730/-670	460/640	-580/2080	950/-630	360/-380	310	2370	6540
AUTOBRAKE 3	11990	720/-650	460/640	-580/2090	880/-550	370/-390	390	2320	6520

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 1000 ft from threshold to touchdown.
Actual (unfactored) distances are shown.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance
ANTISKID INOPERATIVE (Flaps 15)
VREF15

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	155000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 155000 LB	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	5870	290/-300	170/230	-270/940	190/-150	150/-150	200	420	990
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Good Reported Braking Action

MAX MANUAL	6610	340/-350	200/280	-320/1150	270/-220	180/-180	220	630	1530
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Medium Reported Braking Action

MAX MANUAL	8530	490/-490	290/410	-480/1800	670/-440	240/-250	260	1380	3720
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Poor Reported Braking Action

MAX MANUAL	11490	720/-700	430/630	-810/3340	6280/-1020	320/-390	300	3350	11270
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 1000 ft from threshold to touchdown.
Actual (unfactored) distances are shown.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance
ANTISKID INOPERATIVE (Flaps 30)
VREF30

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	155000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 155000 LB	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	5520	270/-270	150/200	-260/920	180/-140	140/-140	190	360	840
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Good Reported Braking Action

MAX MANUAL	6200	310/-320	180/240	-310/1120	260/-200	160/-170	210	540	1290
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Medium Reported Braking Action

MAX MANUAL	7940	450/-450	260/350	-460/1750	630/-410	220/-230	250	1170	3070
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Poor Reported Braking Action

MAX MANUAL	10630	650/-640	380/540	-770/3240	5770/-950	290/-360	280	2850	9190
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 1000 ft from threshold to touchdown.
Actual (unfactored) distances are shown.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance
ANTISKID INOPERATIVE (Flaps 40)
VREF40

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	155000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 155000 LB	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	5290	290/-260	160/210	-250/900	170/-140	130/-140	200	330	770
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Good Reported Braking Action

MAX MANUAL	5930	340/-310	180/250	-310/1100	250/-200	150/-160	210	490	1180
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Medium Reported Braking Action

MAX MANUAL	7600	480/-430	260/360	-460/1720	620/-400	210/-220	250	1080	2800
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Poor Reported Braking Action

MAX MANUAL	10210	680/-610	380/550	-760/3200	5640/-930	270/-340	280	2670	8470
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 1000 ft from threshold to touchdown.
Actual (unfactored) distances are shown.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

Jammed or Restricted Flight Controls (Flaps 15)

VREF15

BRAKING CONFIGURATION	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
	155000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 155000 LB	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV
Dry Runway									
MAX MANUAL	3310	230/-160	80/110	-120/410	40/-40	70/-70	110	70	150
AUTOBRAKE MAX	4250	190/-190	100/140	-150/510	10/0	100/-100	190	10	20
AUTOBRAKE 2	7730	430/-450	240/340	-350/1160	110/-150	230/-230	310	270	270
Good Reported Braking Action									
MAX MANUAL	4510	210/-220	120/170	-190/670	110/-90	110/-120	150	230	530
AUTOBRAKE MAX	4830	230/-240	130/180	-200/700	100/-90	120/-120	180	260	580
AUTOBRAKE 2	7730	430/-450	240/340	-350/1160	110/-150	230/-230	310	270	270
Medium Reported Braking Action									
MAX MANUAL	6240	340/-340	200/280	-310/1120	280/-220	170/-180	210	660	1600
AUTOBRAKE MAX	6370	350/-350	200/280	-320/1130	260/-210	180/-180	240	670	1620
AUTOBRAKE 3	6730	350/-360	200/290	-330/1160	200/-140	190/-200	320	450	1350
Poor Reported Braking Action									
MAX MANUAL	8190	490/-480	290/410	-470/1770	680/-450	240/-250	250	1430	3830
AUTOBRAKE MAX	8210	490/-480	290/410	-470/1770	690/-450	240/-250	260	1420	3830
AUTOBRAKE 3	8280	500/-490	290/420	-470/1780	660/-410	240/-260	300	1430	3860

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 1000 ft from threshold to touchdown.
Actual (unfactored) distances are shown.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance
LEADING EDGE FLAPS TRANSIT (Flaps 15)
VREF15 + 15

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	155000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 155000 LB	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	3710	240/-180	90/150	-130/440	50/-40	90/-90	120	90	190
AUTOBRAKE MAX	4830	200/-210	120/160	-170/550	10/0	120/-120	210	10	20
AUTOBRAKE 2	8720	470/-500	280/390	-370/1240	160/-190	260/-260	300	520	610

Good Reported Braking Action

MAX MANUAL	5070	230/-240	140/200	-210/720	120/-110	130/-130	160	290	650
AUTOBRAKE MAX	5450	250/-260	150/210	-220/750	110/-90	140/-140	200	320	720
AUTOBRAKE 2	8720	470/-500	280/390	-370/1240	160/-190	260/-260	300	520	610

Medium Reported Braking Action

MAX MANUAL	6980	370/-380	230/320	-330/1180	310/-240	200/-200	210	780	1890
AUTOBRAKE MAX	7170	380/-390	230/320	-340/1190	290/-230	200/-210	240	790	1930
AUTOBRAKE 3	7730	380/-400	240/340	-350/1240	210/-180	220/-230	320	490	1470

Poor Reported Braking Action

MAX MANUAL	9080	530/-530	330/460	-500/1840	720/-480	270/-280	250	1620	4350
AUTOBRAKE MAX	9110	530/-530	330/460	-500/1850	720/-460	270/-280	280	1610	4340
AUTOBRAKE 3	9280	530/-530	330/460	-500/1860	680/-450	270/-290	300	1560	4330

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 1000 ft from threshold to touchdown.
Actual (unfactored) distances are shown.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance
LOSS OF SYSTEM A (Flaps 15)
VREF15

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	155000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 155000 LB	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	3750	200/-170	90/130	-130/450	60/-50	90/-90	160	110	180
AUTOBRAKE MAX	4240	180/-190	100/140	-150/500	10/0	100/-100	190	30	80
AUTOBRAKE 2	8030	420/-450	240/340	-360/1190	0/-10	240/-240	460	0	0

Good Reported Braking Action

MAX MANUAL	5400	270/-270	160/220	-230/770	160/-140	140/-140	240	410	840
AUTOBRAKE MAX	5430	270/-280	160/230	-230/770	140/-120	140/-150	250	410	830
AUTOBRAKE 2	8030	420/-450	240/340	-360/1190	0/-10	240/-240	460	0	0

Medium Reported Braking Action

MAX MANUAL	7500	420/-430	250/360	-360/1260	400/-320	210/-220	300	1100	2610
AUTOBRAKE MAX	7450	420/-420	250/360	-360/1260	410/-320	210/-220	300	1090	2580
AUTOBRAKE 3	7450	420/-420	250/360	-360/1260	410/-310	210/-220	300	1090	2580

Poor Reported Braking Action

MAX MANUAL	9800	610/-600	370/530	-540/1970	920/-600	290/-300	360	2270	6330
AUTOBRAKE MAX	9780	610/-600	370/530	-540/1970	930/-610	290/-310	350	2270	6320
AUTOBRAKE 3	9780	610/-600	370/530	-540/1970	930/-610	290/-310	350	2270	6320

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 1000 ft from threshold to touchdown.
Actual (unfactored) distances are shown.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance
LOSS OF SYSTEM A (Flaps 30)
VREF30

BRAKING CONFIGURATION	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
	155000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 155000 LB	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	3520	180/-150	80/110	-130/430	50/-50	80/-80	150	90	150
AUTOBRAKE MAX	3980	170/-170	90/120	-140/480	10/0	90/-90	180	20	60
AUTOBRAKE 2	7420	380/-410	220/280	-340/1140	0/-10	220/-220	440	0	0

Good Reported Braking Action

MAX MANUAL	5030	240/-250	140/190	-220/740	150/-130	130/-130	220	350	680
AUTOBRAKE MAX	5090	250/-260	140/190	-220/750	130/-110	130/-130	240	350	690
AUTOBRAKE 2	7420	380/-410	220/280	-340/1140	0/-10	220/-220	440	0	0

Medium Reported Braking Action

MAX MANUAL	6910	380/-380	220/300	-340/1210	370/-290	190/-200	280	910	2090
AUTOBRAKE MAX	6880	380/-380	220/300	-340/1210	380/-300	190/-200	290	900	2080
AUTOBRAKE 3	6890	380/-380	220/300	-340/1210	380/-270	190/-200	300	900	2080

Poor Reported Braking Action

MAX MANUAL	8980	550/-540	320/440	-510/1890	840/-550	260/-280	330	1860	4960
AUTOBRAKE MAX	8980	550/-540	330/450	-510/1890	850/-560	260/-280	330	1860	4960
AUTOBRAKE 3	8980	550/-540	330/450	-510/1890	850/-560	260/-280	330	1860	4960

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 1000 ft from threshold to touchdown.
Actual (unfactored) distances are shown.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance
LOSS OF SYSTEM A (Flaps 40)
VREF40

BRAKING CONFIGURATION	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
	155000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 155000 LB	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	3350	200/-140	80/120	-120/420	50/-50	70/-80	150	80	130
AUTOBRAKE MAX	3750	190/-160	90/130	-140/460	10/0	90/-90	180	30	70
AUTOBRAKE 2	6860	430/-380	220/300	-320/1090	0/0	200/-200	420	0	0

Good Reported Braking Action

MAX MANUAL	4780	270/-240	140/200	-210/730	150/-130	120/-120	230	310	600
AUTOBRAKE MAX	4840	280/-240	150/200	-210/730	130/-110	120/-130	240	310	610
AUTOBRAKE 2	6860	430/-380	220/300	-320/1090	0/0	200/-200	420	0	0

Medium Reported Braking Action

MAX MANUAL	6530	410/-360	220/310	-330/1190	350/-280	180/-190	280	800	1820
AUTOBRAKE MAX	6520	420/-360	230/310	-330/1190	370/-290	180/-190	280	800	1820
AUTOBRAKE 3	6520	420/-360	230/310	-330/1190	370/-260	180/-190	300	800	1820

Poor Reported Braking Action

MAX MANUAL	8480	580/-500	320/450	-500/1850	810/-530	240/-260	320	1640	4290
AUTOBRAKE MAX	8490	580/-500	320/450	-500/1850	830/-540	250/-260	320	1650	4300
AUTOBRAKE 3	8490	580/-500	320/450	-500/1850	830/-540	250/-260	320	1650	4300

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 1000 ft from threshold to touchdown.
Actual (unfactored) distances are shown.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

LOSS OF SYSTEM A AND SYSTEM B (Flaps 15)

VREF15

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	155000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 155000 LB	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	5240	220/-240	130/190	-200/660	130/-120	130/-130	270	-20	210
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Good Reported Braking Action

MAX MANUAL	7690	380/-400	230/330	-330/1130	350/-290	210/-210	360	330	1450
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Medium Reported Braking Action

MAX MANUAL	10260	580/-580	350/500	-500/1760	770/-560	290/-300	420	1220	4630
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Poor Reported Braking Action

MAX MANUAL	12820	790/-770	480/710	-710/2630	1690/-950	370/-400	460	2740	11050
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 1000 ft from threshold to touchdown.
Actual (unfactored) distances are shown.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance
LOSS OF SYSTEM B (Flaps 15)
VREF15

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	155000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 155000 LB	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	3730	160/-160	90/130	-140/480	60/-50	90/-90	130	110	190
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Good Reported Braking Action

MAX MANUAL	5360	270/-270	150/220	-240/830	170/-140	140/-140	190	410	830
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Medium Reported Braking Action

MAX MANUAL	7320	410/-410	240/340	-380/1360	420/-320	210/-210	250	1020	2410
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Poor Reported Braking Action

MAX MANUAL	9430	580/-570	340/500	-560/2110	1010/-600	270/-300	290	2040	5570
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 1000 ft from threshold to touchdown.
Actual (unfactored) distances are shown.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance
MANUAL REVERSION (Flaps 15)
VREF15

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	155000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 155000 LB	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	5240	220/-240	130/190	-200/660	130/-120	130/-130	270	-20	210
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Good Reported Braking Action

MAX MANUAL	7690	380/-400	230/330	-330/1130	350/-290	210/-210	360	330	1450
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Medium Reported Braking Action

MAX MANUAL	10260	580/-580	350/500	-500/1760	770/-560	290/-300	420	1220	4630
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Poor Reported Braking Action

MAX MANUAL	12820	790/-770	480/710	-710/2630	1690/-950	370/-400	460	2740	11050
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 1000 ft from threshold to touchdown.
Actual (unfactored) distances are shown.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

One Engine Inoperative Landing (Flaps 15)

VREF15

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	155000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 155000 LB	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	3360	240/-170	80/110	-120/420	40/-40	80/-80	120	0	80
AUTOBRAKE MAX	4250	200/-190	100/140	-150/510	10/0	100/-100	190	0	10
AUTOBRAKE 2	7970	410/-440	240/340	-350/1190	20/-80	240/-240	390	0	0

Good Reported Braking Action

MAX MANUAL	4690	220/-230	130/180	-200/700	120/-110	120/-120	170	0	280
AUTOBRAKE MAX	5040	240/-250	130/190	-210/730	120/-100	130/-130	200	0	320
AUTOBRAKE 2	7970	410/-440	240/340	-350/1190	20/-80	240/-240	390	0	0

Medium Reported Braking Action

MAX MANUAL	6760	360/-370	210/290	-340/1210	350/-270	190/-200	230	0	900
AUTOBRAKE MAX	6920	370/-380	210/300	-350/1220	330/-260	200/-200	260	0	910
AUTOBRAKE 3	7090	380/-390	220/300	-350/1240	300/-220	200/-210	310	0	830

Poor Reported Braking Action

MAX MANUAL	9330	550/-550	320/440	-540/1980	940/-600	280/-290	290	0	2230
AUTOBRAKE MAX	9330	550/-560	320/440	-540/1980	960/-590	280/-290	310	0	2230
AUTOBRAKE 3	9430	560/-560	320/450	-540/1990	930/-600	280/-290	310	0	2250

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 1000 ft from threshold to touchdown.
Actual (unfactored) distances are shown.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance
One Engine Inoperative Landing (Flaps 30)
VREF30

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	155000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 155000 LB	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	3180	190/-150	70/90	-120/410	40/-40	70/-70	120	0	70
AUTOBRAKE MAX	3990	170/-180	90/120	-150/490	10/0	90/-90	190	0	10
AUTOBRAKE 2	7330	380/-400	210/280	-340/1130	30/-90	220/-220	350	0	10

Good Reported Braking Action

MAX MANUAL	4420	200/-210	120/150	-200/680	120/-100	110/-110	160	0	240
AUTOBRAKE MAX	4750	220/-230	120/160	-210/710	110/-90	120/-120	190	0	270
AUTOBRAKE 2	7330	380/-400	210/280	-340/1130	30/-90	220/-220	350	0	10

Medium Reported Braking Action

MAX MANUAL	6280	330/-340	190/250	-330/1160	330/-250	180/-180	220	0	750
AUTOBRAKE MAX	6440	340/-350	190/250	-330/1180	310/-240	180/-180	260	0	760
AUTOBRAKE 3	6590	340/-360	200/260	-340/1190	280/-220	190/-190	280	0	700

Poor Reported Braking Action

MAX MANUAL	8550	490/-500	280/370	-510/1900	860/-540	250/-260	270	0	1810
AUTOBRAKE MAX	8560	500/-500	280/380	-510/1900	870/-520	260/-260	310	0	1810
AUTOBRAKE 3	8680	500/-510	290/380	-520/1910	850/-560	260/-270	270	0	1840

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 1000 ft from threshold to touchdown.
Actual (unfactored) distances are shown.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

Stabilizer Trim Inoperative (Flaps 15)

VREF15

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	155000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 155000 LB	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	3310	230/-160	80/110	-120/410	40/-40	70/-70	110	70	150
AUTOBRAKE MAX	4250	190/-190	100/140	-150/510	10/0	100/-100	190	10	20
AUTOBRAKE 2	7730	430/-450	240/340	-350/1160	110/-150	230/-230	310	270	270

Good Reported Braking Action

MAX MANUAL	4510	210/-220	120/170	-190/670	110/-90	110/-120	150	230	530
AUTOBRAKE MAX	4830	230/-240	130/180	-200/700	100/-90	120/-120	180	260	580
AUTOBRAKE 2	7730	430/-450	240/340	-350/1160	110/-150	230/-230	310	270	270

Medium Reported Braking Action

MAX MANUAL	6240	340/-340	200/280	-310/1120	280/-220	170/-180	210	660	1600
AUTOBRAKE MAX	6370	350/-350	200/280	-320/1130	260/-210	180/-180	240	670	1620
AUTOBRAKE 3	6730	350/-360	200/290	-330/1160	200/-140	190/-200	320	450	1350

Poor Reported Braking Action

MAX MANUAL	8190	490/-480	290/410	-470/1770	680/-450	240/-250	250	1430	3830
AUTOBRAKE MAX	8210	490/-480	290/410	-470/1770	690/-450	240/-250	260	1420	3830
AUTOBRAKE 3	8280	500/-490	290/420	-470/1780	660/-410	240/-260	300	1430	3860

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 1000 ft from threshold to touchdown.
Actual (unfactored) distances are shown.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

Trailing Edge Flap Asymmetry (1 ≤ Flap Lever <15)

VREF40 + 30

BRAKING CONFIGURATION	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
	155000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 155000 LB	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	3750	300/-190	100/220	-130/460	50/-50	90/-90	140	90	200
AUTOBRAKE MAX	4940	250/-200	130/180	-170/570	10/-10	120/-130	220	10	50
AUTOBRAKE 2	8930	520/-490	310/410	-380/1250	170/-200	270/-270	310	530	610

Good Reported Braking Action

MAX MANUAL	4920	240/-220	140/190	-200/700	110/-100	130/-130	150	260	570
AUTOBRAKE MAX	5410	260/-240	160/210	-210/740	80/-60	140/-140	210	240	590
AUTOBRAKE 2	8930	520/-490	310/410	-380/1250	170/-200	270/-270	310	530	610

Medium Reported Braking Action

MAX MANUAL	6900	390/-360	230/320	-330/1160	290/-230	190/-200	200	730	1760
AUTOBRAKE MAX	7100	400/-370	240/320	-330/1180	280/-220	200/-210	230	750	1810
AUTOBRAKE 3	7810	420/-380	260/350	-350/1240	200/-160	230/-230	330	430	1270

Poor Reported Braking Action

MAX MANUAL	9140	570/-520	340/470	-500/1840	720/-480	270/-280	250	1600	4290
AUTOBRAKE MAX	9170	570/-520	340/480	-500/1850	710/-460	270/-290	280	1600	4270
AUTOBRAKE 3	9370	570/-510	340/480	-500/1860	670/-430	280/-290	320	1510	4230

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 1000 ft from threshold to touchdown.
Actual (unfactored) distances are shown.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance
Trailing Edge Flap Asymmetry (Flap Lever 15 or 25)
VREF15

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	155000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 155000 LB	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	3310	230/-160	80/110	-120/410	40/-40	70/-70	110	70	150
AUTOBRAKE MAX	4250	190/-190	100/140	-150/510	10/0	100/-100	190	10	20
AUTOBRAKE 2	7730	430/-450	240/340	-350/1160	110/-150	230/-230	310	270	270

Good Reported Braking Action

MAX MANUAL	4510	210/-220	120/170	-190/670	110/-90	110/-120	150	230	530
AUTOBRAKE MAX	4830	230/-240	130/180	-200/700	100/-90	120/-120	180	260	580
AUTOBRAKE 2	7730	430/-450	240/340	-350/1160	110/-150	230/-230	310	270	270

Medium Reported Braking Action

MAX MANUAL	6240	340/-340	200/280	-310/1120	280/-220	170/-180	210	660	1600
AUTOBRAKE MAX	6370	350/-350	200/280	-320/1130	260/-210	180/-180	240	670	1620
AUTOBRAKE 3	6730	350/-360	200/290	-330/1160	200/-140	190/-200	320	450	1350

Poor Reported Braking Action

MAX MANUAL	8190	490/-480	290/410	-470/1770	680/-450	240/-250	250	1430	3830
AUTOBRAKE MAX	8210	490/-480	290/410	-470/1770	690/-450	240/-250	260	1420	3830
AUTOBRAKE 3	8280	500/-490	290/420	-470/1780	660/-410	240/-260	300	1430	3860

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 1000 ft from threshold to touchdown.
Actual (unfactored) distances are shown.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance
Trailing Edge Flap Asymmetry (Flap Lever 30)
VREF30

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	155000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 155000 LB	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	3150	180/-150	70/90	-120/400	40/-40	70/-70	110	60	130
AUTOBRAKE MAX	3990	170/-180	90/120	-150/490	0/0	90/-90	180	0	10
AUTOBRAKE 2	7110	380/-400	220/280	-330/1110	100/-140	210/-200	290	250	250

Good Reported Braking Action

MAX MANUAL	4270	200/-200	110/150	-190/650	100/-90	110/-110	150	200	460
AUTOBRAKE MAX	4580	210/-220	120/160	-200/680	90/-80	110/-110	180	230	510
AUTOBRAKE 2	7110	380/-400	220/280	-330/1110	100/-140	210/-200	290	250	250

Medium Reported Braking Action

MAX MANUAL	5840	310/-310	180/240	-300/1080	260/-210	160/-160	200	560	1350
AUTOBRAKE MAX	5980	320/-320	180/240	-300/1100	240/-190	160/-170	230	570	1380
AUTOBRAKE 3	6280	320/-330	190/250	-310/1130	190/-150	180/-180	290	400	1160

Poor Reported Braking Action

MAX MANUAL	7610	440/-440	260/350	-450/1720	640/-420	220/-230	240	1210	3170
AUTOBRAKE MAX	7630	450/-440	260/360	-450/1720	640/-410	220/-230	260	1210	3170
AUTOBRAKE 3	7710	450/-450	260/360	-460/1730	620/-400	220/-240	270	1220	3210

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 1000 ft from threshold to touchdown.
Actual (unfactored) distances are shown.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

Trailing Edge Flap Disagree (1 ≤ Indicated Flaps <15)

VREF40 + 30

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	155000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 155000 LB	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	3750	300/-190	100/220	-130/460	50/-50	90/-90	140	90	200
AUTOBRAKE MAX	4940	250/-200	130/180	-170/570	10/-10	120/-130	220	10	50
AUTOBRAKE 2	8930	520/-490	310/410	-380/1250	170/-200	270/-270	310	530	610

Good Reported Braking Action

MAX MANUAL	4920	240/-220	140/190	-200/700	110/-100	130/-130	150	260	570
AUTOBRAKE MAX	5410	260/-240	160/210	-210/740	80/-60	140/-140	210	240	590
AUTOBRAKE 2	8930	520/-490	310/410	-380/1250	170/-200	270/-270	310	530	610

Medium Reported Braking Action

MAX MANUAL	6900	390/-360	230/320	-330/1160	290/-230	190/-200	200	730	1760
AUTOBRAKE MAX	7100	400/-370	240/320	-330/1180	280/-220	200/-210	230	750	1810
AUTOBRAKE 3	7810	420/-380	260/350	-350/1240	200/-160	230/-230	330	430	1270

Poor Reported Braking Action

MAX MANUAL	9140	570/-520	340/470	-500/1840	720/-480	270/-280	250	1600	4290
AUTOBRAKE MAX	9170	570/-520	340/480	-500/1850	710/-460	270/-290	280	1600	4270
AUTOBRAKE 3	9370	570/-510	340/480	-500/1860	670/-430	280/-290	320	1510	4230

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 1000 ft from threshold to touchdown.
Actual (unfactored) distances are shown.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

Trailing Edge Flap Disagree (15 ≤ Indicated Flaps <30)

VREF15

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	155000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 155000 LB	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	3310	230/-160	80/110	-120/410	40/-40	70/-70	110	70	150
AUTOBRAKE MAX	4250	190/-190	100/140	-150/510	10/0	100/-100	190	10	20
AUTOBRAKE 2	7730	430/-450	240/340	-350/1160	110/-150	230/-230	310	270	270

Good Reported Braking Action

MAX MANUAL	4510	210/-220	120/170	-190/670	110/-90	110/-120	150	230	530
AUTOBRAKE MAX	4830	230/-240	130/180	-200/700	100/-90	120/-120	180	260	580
AUTOBRAKE 2	7730	430/-450	240/340	-350/1160	110/-150	230/-230	310	270	270

Medium Reported Braking Action

MAX MANUAL	6240	340/-340	200/280	-310/1120	280/-220	170/-180	210	660	1600
AUTOBRAKE MAX	6370	350/-350	200/280	-320/1130	260/-210	180/-180	240	670	1620
AUTOBRAKE 3	6730	350/-360	200/290	-330/1160	200/-140	190/-200	320	450	1350

Poor Reported Braking Action

MAX MANUAL	8190	490/-480	290/410	-470/1770	680/-450	240/-250	250	1430	3830
AUTOBRAKE MAX	8210	490/-480	290/410	-470/1770	690/-450	240/-250	260	1420	3830
AUTOBRAKE 3	8280	500/-490	290/420	-470/1780	660/-410	240/-260	300	1430	3860

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 1000 ft from threshold to touchdown.
Actual (unfactored) distances are shown.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance
Trailing Edge Flap Disagree (30 ≤ Indicated Flaps <40)
VREF30

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	155000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 155000 LB	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	3150	180/-150	70/90	-120/400	40/-40	70/-70	110	60	130
AUTOBRAKE MAX	3990	170/-180	90/120	-150/490	0/0	90/-90	180	0	10
AUTOBRAKE 2	7110	380/-400	220/280	-330/1110	100/-140	210/-200	290	250	250

Good Reported Braking Action

MAX MANUAL	4270	200/-200	110/150	-190/650	100/-90	110/-110	150	200	460
AUTOBRAKE MAX	4580	210/-220	120/160	-200/680	90/-80	110/-110	180	230	510
AUTOBRAKE 2	7110	380/-400	220/280	-330/1110	100/-140	210/-200	290	250	250

Medium Reported Braking Action

MAX MANUAL	5840	310/-310	180/240	-300/1080	260/-210	160/-160	200	560	1350
AUTOBRAKE MAX	5980	320/-320	180/240	-300/1100	240/-190	160/-170	230	570	1380
AUTOBRAKE 3	6280	320/-330	190/250	-310/1130	190/-150	180/-180	290	400	1160

Poor Reported Braking Action

MAX MANUAL	7610	440/-440	260/350	-450/1720	640/-420	220/-230	240	1210	3170
AUTOBRAKE MAX	7630	450/-440	260/360	-450/1720	640/-410	220/-230	260	1210	3170
AUTOBRAKE 3	7710	450/-450	260/360	-460/1730	620/-400	220/-240	270	1220	3210

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 1000 ft from threshold to touchdown.
Actual (unfactored) distances are shown.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

Trailing Edge Flaps Up Landing

VREF40 + 40

	LANDING DISTANCE AND ADJUSTMENTS (FT)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	155000 LB LANDING WEIGHT	PER 10000 LB ABV/BLW 155000 LB	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	4090	390/-200	130/320	-140/510	60/-50	100/-100	150	110	230
AUTOBRAKE MAX	5360	270/-210	150/230	-180/590	10/-10	140/-140	230	10	50
AUTOBRAKE 2	10140	570/-550	350/470	-410/1340	160/-210	310/-310	360	460	460

Good Reported Braking Action

MAX MANUAL	5490	270/-250	170/220	-220/750	130/-110	150/-150	160	310	690
AUTOBRAKE MAX	5940	290/-260	180/240	-230/780	100/-80	160/-160	220	320	750
AUTOBRAKE 2	10140	570/-550	350/470	-410/1340	160/-210	310/-310	360	460	460

Medium Reported Braking Action

MAX MANUAL	7810	440/-410	270/370	-350/1250	350/-280	230/-230	230	890	2150
AUTOBRAKE MAX	7960	450/-410	280/370	-360/1260	330/-260	230/-240	250	900	2180
AUTOBRAKE 3	8630	460/-410	290/390	-380/1310	230/-150	260/-260	380	560	1650

Poor Reported Braking Action

MAX MANUAL	10460	650/-600	400/550	-540/1970	850/-570	310/-330	280	1970	5330
AUTOBRAKE MAX	10430	650/-600	400/550	-540/1970	850/-560	320/-330	300	1950	5300
AUTOBRAKE 3	10570	650/-580	400/560	-540/1980	800/-500	320/-340	360	1930	5310

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 1000 ft from threshold to touchdown.
Actual (unfactored) distances are shown.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Recommended Brake Cooling Schedule

Reference Brake Energy Per Brake (Millions of Foot Pounds)

		WIND CORRECTED BRAKES ON SPEED (KIAS)																	
		80			100			120			140			160			180		
WEIGHT (1000 LB)	OAT (°C)	PRESSURE ALTITUDE (1000 FT)																	
		0	5	10	0	5	10	0	5	10	0	5	10	0	5	10	0	5	10
180	0	16.0	18.2	20.8	23.4	26.6	30.5	31.9	36.3	41.8	41.3	47.0	54.2	51.3	58.5	67.7	60.8	69.3	80.6
	10	16.6	18.8	21.5	24.2	27.5	31.5	33.0	37.5	43.1	42.6	48.5	56.0	53.0	60.3	69.9	62.7	71.5	83.1
	15	16.8	19.1	21.8	24.6	28.0	32.0	33.5	38.1	43.8	43.3	49.2	56.8	53.7	61.2	70.9	63.6	72.5	84.3
	20	17.1	19.4	22.1	25.0	28.3	32.5	34.0	38.6	44.4	43.8	49.9	57.5	54.4	62.0	71.8	64.4	73.4	85.3
	30	17.5	19.9	22.7	25.6	29.1	33.3	34.9	39.6	45.5	45.0	51.1	58.9	55.8	63.5	73.5	66.0	75.2	87.3
	40	17.8	20.2	23.0	26.0	29.5	33.8	35.4	40.2	46.2	45.7	52.0	60.0	56.8	64.7	75.0	67.2	76.7	89.2
	50	17.8	20.2	23.1	26.1	29.7	34.1	35.6	40.6	46.7	46.2	52.7	60.9	57.6	65.8	76.4	68.4	78.2	91.3
160	0	14.7	16.7	19.0	21.3	24.2	27.8	29.0	32.9	37.8	37.3	42.5	49.0	46.3	52.7	61.0	55.6	63.4	73.6
	10	15.2	17.2	19.7	22.1	25.1	28.7	29.9	34.0	39.1	38.6	43.9	50.6	47.8	54.5	63.0	57.4	65.4	75.9
	15	15.4	17.5	20.0	22.4	25.4	29.1	30.4	34.5	39.7	39.1	44.5	51.3	48.5	55.2	63.9	58.2	66.3	76.9
	20	15.6	17.8	20.3	22.7	25.8	29.5	30.8	35.0	40.2	39.7	45.1	52.0	49.2	56.0	64.7	59.0	67.2	77.9
	30	16.1	18.2	20.8	23.3	26.5	30.3	31.6	35.9	41.2	40.7	46.3	53.3	50.4	57.4	66.2	60.4	68.8	79.7
	40	16.3	18.5	21.1	23.6	26.9	30.7	32.1	36.5	41.9	41.3	47.0	54.2	51.3	58.4	67.5	61.5	70.1	81.4
	50	16.3	18.5	21.2	23.7	27.0	30.9	32.3	36.8	42.3	41.7	47.6	54.9	51.9	59.2	68.7	62.5	71.4	83.1
140	0	13.4	15.2	17.3	19.2	21.8	25.0	25.9	29.5	33.8	33.3	37.9	43.6	41.3	47.0	54.3	49.7	56.7	65.6
	10	13.8	15.7	17.9	19.9	22.6	25.8	26.8	30.5	34.9	34.4	39.2	45.0	42.7	48.6	56.0	51.3	58.5	67.7
	15	14.0	15.9	18.2	20.2	22.9	26.2	27.2	30.9	35.5	34.9	39.7	45.7	43.3	49.3	56.8	52.1	59.3	68.7
	20	14.2	16.2	18.4	20.5	23.3	26.6	27.6	31.4	36.0	35.4	40.3	46.3	43.9	49.9	57.6	52.8	60.1	69.5
	30	14.6	16.6	18.9	21.0	23.9	27.3	28.3	32.2	36.9	36.4	41.3	47.5	45.0	51.2	59.0	54.1	61.6	71.2
	40	14.8	16.8	19.2	21.3	24.2	27.7	28.7	32.6	37.4	36.9	42.0	48.3	45.7	52.1	60.1	55.0	62.7	72.6
	50	14.8	16.8	19.2	21.4	24.3	27.8	28.9	32.9	37.8	37.2	42.4	48.8	46.2	52.7	61.0	55.8	63.7	74.0
120	0	12.0	13.6	15.6	17.1	19.5	22.2	22.9	26.0	29.8	29.2	33.2	38.2	36.1	41.1	47.3	43.5	49.5	57.2
	10	12.4	14.1	16.1	17.7	20.1	23.0	23.7	26.9	30.8	30.2	34.4	39.4	37.3	42.4	48.8	44.9	51.1	59.0
	15	12.6	14.3	16.3	18.0	20.4	23.3	24.0	27.3	31.3	30.7	34.9	40.0	37.8	43.0	49.5	45.5	51.8	59.8
	20	12.8	14.5	16.6	18.2	20.7	23.7	24.4	27.7	31.7	31.1	35.3	40.6	38.4	43.6	50.2	46.2	52.5	60.6
	30	13.2	14.9	17.0	18.7	21.3	24.3	25.0	28.4	32.6	31.9	36.3	41.6	39.3	44.7	51.5	47.3	53.8	62.1
	40	13.3	15.1	17.2	19.0	21.5	24.6	25.4	28.8	33.0	32.4	36.8	42.3	39.9	45.4	52.3	48.1	54.8	63.3
	50	13.3	15.1	17.3	19.0	21.6	24.7	25.5	29.0	33.3	32.6	37.1	42.7	40.3	45.9	53.0	48.7	55.5	64.3
100	0	10.7	12.2	13.9	15.0	17.1	19.5	19.9	22.6	25.8	25.2	28.6	32.8	30.9	35.1	40.3	37.0	42.1	48.5
	10	11.1	12.6	14.3	15.5	17.6	20.1	20.6	23.3	26.7	26.0	29.6	33.9	31.9	36.3	41.7	38.2	43.4	50.0
	15	11.2	12.8	14.6	15.8	17.9	20.4	20.9	23.7	27.1	26.4	30.0	34.4	32.4	36.8	42.3	38.8	44.1	50.8
	20	11.4	13.0	14.8	16.0	18.2	20.7	21.2	24.0	27.5	26.8	30.4	34.9	32.8	37.3	42.8	39.3	44.7	51.4
	30	11.7	13.3	15.2	16.4	18.7	21.3	21.7	24.7	28.2	27.5	31.2	35.8	33.7	38.3	43.9	40.3	45.8	52.7
	40	11.9	13.5	15.3	16.6	18.9	21.6	22.0	25.0	28.6	27.9	31.7	36.3	34.2	38.9	44.6	40.9	46.6	53.6
	50	11.9	13.5	15.4	16.7	18.9	21.6	22.1	25.1	28.8	28.0	31.9	36.6	34.4	39.2	45.1	41.3	47.1	54.3

***To correct for wind, enter table with the brakes on speed minus one half the headwind or plus 1.5 times the tailwind. If ground speed is used for brakes on speed, ignore wind and enter table with sea level, 15°C.**

Adjusted Brake Energy Per Brake (Millions of Foot Pounds)
No Reverse Thrust

		REFERENCE BRAKE ENERGY PER BRAKE (MILLIONS OF FOOT POUNDS)								
EVENT		10	20	30	40	50	60	70	80	90
RTO MAX MAN		10	20	30	40	50	60	70	80	90
LANDING	MAX MAN	7.6	15.9	24.8	34.3	44.3	54.6	65.2	76.0	86.9
	MAX AUTO	7.1	14.7	22.8	31.5	40.9	51.1	62.0	73.7	86.4
	AUTOBRAKE 3	6.6	13.5	20.8	28.5	36.9	45.9	55.7	66.5	78.4
	AUTOBRAKE 2	6.0	12.1	18.4	25.1	32.2	40.0	48.4	57.8	68.1
	AUTOBRAKE 1	5.6	11.0	16.4	22.1	28.0	34.4	41.5	49.4	58.3

ADVISORY INFORMATION

Recommended Brake Cooling Schedule

Adjusted Brake Energy Per Brake (Millions of Foot Pounds)

Two Engine Detent Reverse Thrust

		REFERENCE BRAKE ENERGY PER BRAKE (MILLIONS OF FOOT POUNDS)								
EVENT		10	20	30	40	50	60	70	80	90
RTO MAX MAN		10	20	30	40	50	60	70	80	90
LANDING	MAX MAN	7.2	15.0	23.4	32.2	41.5	51.2	61.2	71.5	82.1
	MAX AUTO	5.9	12.3	19.4	27.2	35.7	45.0	55.1	66.2	78.3
	AUTOBRAKE 3	4.1	8.8	14.0	20.0	26.6	34.0	42.1	51.1	60.9
	AUTOBRAKE 2	2.2	4.8	8.1	11.9	16.3	21.4	27.2	33.6	40.8
	AUTOBRAKE 1	1.7	3.5	5.5	7.9	10.7	14.1	18.3	23.3	29.2

Cooling Time (Minutes) - Category H Steel Brakes

	EVENT ADJUSTED BRAKE ENERGY (MILLIONS OF FOOT POUNDS)								
	16 & BELOW	17	20	23	25	28	32	33 TO 48	49 & ABOVE
	BRAKE TEMPERATURE MONITOR SYSTEM INDICATION ON CDS								
	UP TO 2.4	2.6	3.1	3.5	3.9	4.4	4.9	5.0 TO 7.5	7.5 & ABOVE
INFLIGHT GEAR DOWN	NO SPECIAL PROCEDURE REQUIRED	1	2	3	4	5	6	CAUTION	FUSE PLUG MELT ZONE
GROUND		10	20	30	40	50	60		

Cooling Time (Minutes) - Category P Carbon Brakes

	EVENT ADJUSTED BRAKE ENERGY (MILLIONS OF FOOT POUNDS)								
	16 & BELOW	17	19	20.9	23.5	26.9	29.4	30 TO 41	41 & ABOVE
	BRAKE TEMPERATURE MONITOR SYSTEM INDICATION ON CDS								
	UP TO 2.5	2.6	3	3.3	3.8	4.5	4.9	5.0 TO 7.1	7.1 & ABOVE
INFLIGHT GEAR DOWN	NO SPECIAL PROCEDURE REQUIRED	1	4	5	6	7	7.6	CAUTION	FUSE PLUG MELT ZONE
GROUND		6.7	16.0	24.1	35.2	45.9	53.3		

Observe maximum quick turnaround limit.
Table shows energy per brake added by a single stop with all brakes operating. Energy is assumed to be equally distributed among the operating brakes. Total energy is the sum of residual energy plus energy added.
Add 1.0 million foot pounds per brake for each taxi mile.

When in caution zone, wheel fuse plugs may melt. Delay takeoff and inspect after one hour. If overheat occurs after takeoff, extend gear soon for at least 7 minutes.

When in fuse plug melt zone, clear runway immediately. Unless required, do not set parking brake. Do not approach gear or attempt to taxi for one hour. Tire, wheel and brake replacement may be required. If overheat occurs after takeoff, extend gear soon for at least 12 minutes.

Brake temperature monitor system (BTMS) indication on CDS systems page may be used 10 to 15 minutes after airplane has come to a complete stop or inflight with gear retracted to determine recommended cooling schedule.

Performance Inflight — Chapter PI
Engine Inoperative — Section 83

ENGINE INOP

Initial Max Continuous %N1
Based on .79M, A/C high and anti-ice off

TAT (°C)	PRESSURE ALTITUDE (1000 FT)								
	25	27	29	31	33	35	37	39	41
20	96.8	96.6	96.3	96.1	95.9	95.4	95.0	94.7	93.9
15	97.4	97.2	96.9	96.8	96.6	96.2	95.7	95.5	94.8
10	98.0	97.8	97.5	97.4	97.4	96.9	96.5	96.3	95.7
5	98.3	98.6	98.3	98.1	98.1	97.7	97.3	97.1	96.6
0	97.5	98.7	99.2	99.0	98.9	98.5	98.2	98.0	97.5
-5	96.7	98.0	99.1	99.8	99.7	99.3	98.9	98.7	98.4
-10	96.0	97.2	98.4	99.6	100.5	100.2	99.8	99.6	99.4
-15	95.2	96.4	97.6	98.8	100.1	101.0	100.8	100.6	100.3
-20	94.4	95.6	96.8	98.0	99.3	100.5	101.1	100.8	100.6
-25	93.6	94.9	96.0	97.2	98.5	99.7	100.2	100.0	99.8
-30	92.8	94.1	95.2	96.4	97.7	98.8	99.4	99.2	99.0
-35	92.0	93.2	94.4	95.6	96.8	98.0	98.5	98.3	98.1
-40	91.2	92.4	93.5	94.7	96.0	97.1	97.6	97.4	97.2

%N1 Adjustments for Engine Bleeds

BLEED CONFIGURATION	PRESSURE ALTITUDE (1000 FT)								
	25	27	29	31	33	35	37	39	41
ENGINE ANTI-ICE ON	-1.2	-1.1	-1.0	-0.9	-0.8	-0.8	-0.8	-0.8	-0.8
ENGINE & WING ANTI-ICE ON	-4.2	-4.4	-4.5	-4.7	-5.0	-4.8	-4.8	-4.8	-4.8

ENGINE INOP

Max Continuous %N1
37000 FT to 29000 FT Pressure Altitudes

37000 FT PRESS ALT		TAT (°C)											
KIAS	M	-55	-50	-45	-40	-35	-30	-25	-20	-15	-10	-5	0
160	.51	96.6	97.6	98.5	99.4	100.2	99.6	98.8	97.6	96.3	94.7	93.2	91.8
200	.63	96.0	96.9	97.8	98.7	99.6	100.4	100.1	99.3	98.4	97.5	96.3	95.2
240	.74	95.1	96.0	96.8	97.7	98.6	99.4	100.3	100.7	100.0	99.2	98.4	97.5
280	.86	94.3	95.2	96.1	97.0	97.8	98.7	99.5	100.4	101.2	100.9	100.0	99.1
35000 FT PRESS ALT		TAT (°C)											
KIAS	M	-55	-50	-45	-40	-35	-30	-25	-20	-15	-10	-5	0
160	.49	96.5	97.4	98.3	99.2	100.1	99.8	99.0	98.0	96.8	95.4	94.0	92.7
200	.60	96.1	97.0	97.9	98.8	99.7	100.6	100.5	99.6	98.6	97.6	96.5	95.4
240	.71	95.0	95.9	96.8	97.7	98.6	99.4	100.3	100.8	100.2	99.5	98.6	97.7
280	.82	93.8	94.6	95.5	96.4	97.3	98.1	98.9	99.8	100.6	100.3	99.5	98.8
33000 FT PRESS ALT		TAT (°C)											
KIAS	M	-50	-45	-40	-35	-30	-25	-20	-15	-10	-5	0	5
160	.47	97.4	98.3	99.2	100.0	100.8	100.0	99.1	97.9	96.7	95.3	93.9	92.6
200	.58	97.0	97.9	98.8	99.7	100.6	101.4	100.6	99.6	98.6	97.5	96.3	95.1
240	.68	95.9	96.8	97.7	98.5	99.4	100.2	101.1	100.9	100.2	99.4	98.4	97.4
280	.79	94.3	95.1	96.0	96.8	97.7	98.5	99.3	100.2	100.5	99.7	98.9	98.1
320	.89	93.6	94.5	95.4	96.2	97.1	97.9	98.7	99.5	100.3	101.1	100.7	99.8
31000 FT PRESS ALT		TAT (°C)											
KIAS	M	-50	-45	-40	-35	-30	-25	-20	-15	-10	-5	0	5
160	.45	97.3	98.2	99.1	100.0	100.9	101.1	100.2	99.2	98.0	96.6	95.2	93.9
200	.55	97.1	98.0	98.9	99.7	100.6	101.5	101.6	100.7	99.7	98.6	97.4	96.2
240	.66	95.6	96.5	97.4	98.3	99.1	100.0	100.8	101.3	100.5	99.8	98.8	97.8
280	.76	93.8	94.7	95.5	96.4	97.2	98.0	98.8	99.7	100.5	99.8	98.9	98.0
320	.85	92.4	93.2	94.1	94.9	95.7	96.5	97.4	98.2	98.9	99.7	99.9	99.1
29000 FT PRESS ALT		TAT (°C)											
KIAS	M	-45	-40	-35	-30	-25	-20	-15	-10	-5	0	5	10
160	.43	98.1	99.0	99.9	100.8	101.6	101.2	100.2	99.1	97.9	96.4	95.1	93.8
200	.53	97.5	98.4	99.3	100.2	101.0	101.9	101.3	100.4	99.3	98.2	96.9	95.8
240	.63	96.3	97.1	98.0	98.9	99.7	100.5	101.4	101.1	100.2	99.2	98.3	97.2
280	.73	94.2	95.0	95.9	96.7	97.5	98.3	99.1	99.9	100.1	99.1	98.2	97.5
320	.82	92.1	92.9	93.7	94.5	95.3	96.1	96.9	97.7	98.5	99.2	98.5	97.6
360	.91	92.1	92.9	93.7	94.5	95.3	96.1	96.9	97.7	98.5	99.2	100.0	100.1

%N1 Adjustments for Engine Bleeds

BLEED CONFIGURATION	PRESSURE ALTITUDE (1000 FT)				
	29	31	33	35	37
ENGINE ANTI-ICE ON	-0.9	-0.9	-0.8	-0.8	-0.8
ENGINE & WING ANTI-ICE ON	-4.1	-4.3	-4.5	-4.7	-4.7

ENGINE INOP

Max Continuous %N1
27000 FT to 20000 FT Pressure Altitudes

27000 FT PRESS ALT		TAT (°C)											
KIAS	M	-45	-40	-35	-30	-25	-20	-15	-10	-5	0	5	10
160	.41	98.0	98.8	99.7	100.6	101.4	102.2	101.2	100.2	99.0	97.8	96.4	95.1
200	.51	96.9	97.8	98.7	99.6	100.4	101.2	101.8	100.8	99.9	98.8	97.6	96.4
240	.60	95.6	96.5	97.4	98.2	99.1	99.9	100.7	101.3	100.4	99.4	98.5	97.5
280	.70	93.6	94.4	95.3	96.1	96.9	97.7	98.5	99.3	100.1	99.4	98.4	97.6
320	.79	91.6	92.4	93.2	94.0	94.8	95.6	96.4	97.2	98.0	98.7	98.6	97.8
360	.88	91.0	91.8	92.6	93.4	94.2	95.0	95.8	96.6	97.3	98.1	98.8	99.4
25000 FT PRESS ALT		TAT (°C)											
KIAS	M	-40	-35	-30	-25	-20	-15	-10	-5	0	5	10	15
160	.39	98.8	99.7	100.5	101.4	102.2	102.4	101.4	100.3	99.1	97.7	96.5	95.2
200	.49	97.5	98.3	99.2	100.0	100.9	101.7	101.5	100.6	99.5	98.4	97.3	96.2
240	.58	95.7	96.5	97.4	98.2	99.0	99.9	100.7	100.5	99.5	98.6	97.6	96.7
280	.67	93.9	94.7	95.5	96.3	97.1	97.9	98.7	99.5	99.5	98.6	97.6	96.9
320	.76	91.7	92.6	93.4	94.2	95.0	95.8	96.5	97.3	98.0	98.6	97.8	97.2
360	.85	90.4	91.2	92.1	92.9	93.7	94.5	95.3	96.1	96.9	97.6	98.4	98.2
24000 FT PRESS ALT		TAT (°C)											
KIAS	M	-40	-35	-30	-25	-20	-15	-10	-5	0	5	10	15
160	.38	98.6	99.5	100.4	101.2	102.1	102.9	101.9	100.8	99.6	98.4	97.1	95.8
200	.48	97.5	98.4	99.2	100.1	100.9	101.8	102.2	101.1	100.1	99.0	97.8	96.7
240	.57	95.9	96.8	97.6	98.5	99.3	100.1	100.9	101.2	100.2	99.2	98.2	97.3
280	.66	94.2	95.1	95.9	96.7	97.5	98.3	99.1	99.9	100.4	99.4	98.3	97.5
320	.75	92.1	93.0	93.8	94.6	95.4	96.2	96.9	97.7	98.5	99.2	98.6	97.8
360	.83	90.6	91.4	92.2	93.1	93.9	94.7	95.5	96.2	97.0	97.8	98.5	98.6
22000 FT PRESS ALT		TAT (°C)											
KIAS	M	-35	-30	-25	-20	-15	-10	-5	0	5	10	15	20
160	.37	99.1	100.0	100.9	101.7	102.5	102.8	101.8	100.7	99.5	98.2	97.0	95.8
200	.46	98.4	99.3	100.1	101.0	101.8	102.6	102.3	101.2	100.0	98.9	97.8	96.8
240	.55	97.2	98.1	98.9	99.7	100.5	101.3	102.1	101.6	100.5	99.4	98.5	97.5
280	.63	95.7	96.5	97.4	98.2	99.0	99.8	100.6	101.3	101.0	99.8	98.9	98.1
320	.72	93.9	94.7	95.5	96.3	97.1	97.9	98.6	99.4	100.1	100.2	99.3	98.6
360	.80	92.2	93.0	93.8	94.6	95.4	96.1	96.9	97.7	98.4	99.2	99.7	99.1
20000 FT PRESS ALT		TAT (°C)											
KIAS	M	-35	-30	-25	-20	-15	-10	-5	0	5	10	15	20
160	.35	98.7	99.5	100.4	101.2	102.0	102.8	102.5	101.5	100.4	99.2	98.0	96.8
200	.44	98.3	99.2	100.0	100.9	101.7	102.5	103.3	102.3	101.1	100.0	98.9	97.8
240	.53	97.5	98.4	99.2	100.0	100.8	101.7	102.5	103.1	101.8	100.5	99.5	98.6
280	.61	96.2	97.0	97.8	98.7	99.5	100.3	101.1	101.8	102.5	101.3	100.1	99.3
320	.69	94.7	95.5	96.3	97.1	97.9	98.7	99.5	100.2	101.0	101.7	100.9	99.9
360	.77	93.0	93.8	94.6	95.4	96.2	97.0	97.7	98.5	99.2	100.0	100.7	100.4

%N1 Adjustments for Engine Bleeds

BLEED CONFIGURATION	PRESSURE ALTITUDE (1000 FT)				
	20	22	24	25	27
ENGINE ANTI-ICE ON	-0.9	-0.9	-1.0	-1.0	-1.0
ENGINE & WING ANTI-ICE ON	-3.6	-3.8	-3.8	-3.9	-4.0

ENGINE INOP

Max Continuous %N1
18000 FT to 12000 FT Pressure Altitudes

18000 FT PRESS ALT		TAT (°C)											
KIAS	M	-30	-25	-20	-15	-10	-5	0	5	10	15	20	25
160	.34	98.5	99.3	100.2	101.0	101.8	102.6	101.6	100.3	99.2	98.1	97.0	95.9
200	.42	98.7	99.6	100.4	101.2	102.0	102.8	103.1	101.7	100.4	99.3	98.3	97.3
240	.51	97.8	98.7	99.5	100.3	101.1	101.9	102.7	102.5	101.1	99.9	99.0	98.1
280	.59	96.3	97.1	97.9	98.7	99.5	100.3	101.0	101.8	101.6	100.5	99.6	98.8
320	.67	94.8	95.6	96.4	97.2	97.9	98.7	99.5	100.2	101.0	100.9	100.0	99.2
360	.75	93.0	93.8	94.6	95.3	96.1	96.9	97.6	98.4	99.1	99.9	100.2	99.6
16000 FT PRESS ALT		TAT (°C)											
KIAS	M	-30	-25	-20	-15	-10	-5	0	5	10	15	20	25
160	.33	97.1	98.0	98.8	99.6	100.4	101.2	101.6	100.3	99.1	98.1	97.1	96.1
200	.41	98.0	98.8	99.6	100.4	101.2	102.0	102.8	102.5	101.3	100.2	99.3	98.3
240	.49	97.1	97.9	98.7	99.5	100.3	101.1	101.9	102.7	101.8	100.5	99.6	98.7
280	.57	95.6	96.4	97.2	98.0	98.8	99.6	100.3	101.1	101.8	100.9	99.8	99.0
320	.64	94.0	94.8	95.6	96.4	97.2	97.9	98.7	99.4	100.2	100.9	100.2	99.4
360	.72	92.1	92.9	93.7	94.5	95.3	96.1	96.9	97.7	98.4	99.2	99.9	99.6
14000 FT PRESS ALT		TAT (°C)											
KIAS	M	-25	-20	-15	-10	-5	0	5	10	15	20	25	30
160	.31	96.6	97.4	98.2	99.0	99.8	100.6	100.4	99.1	98.0	97.1	96.2	95.3
200	.39	97.1	97.9	98.7	99.5	100.3	101.1	101.8	101.5	101.0	100.1	99.3	98.4
240	.47	96.6	97.4	98.2	99.0	99.8	100.6	101.3	101.8	101.1	100.3	99.5	98.7
280	.54	95.5	96.3	97.1	97.8	98.6	99.4	100.1	100.9	101.0	100.1	99.2	98.5
320	.62	94.1	94.9	95.7	96.5	97.2	98.0	98.7	99.5	100.2	100.3	99.5	98.8
360	.69	92.2	93.1	93.9	94.7	95.5	96.3	97.0	97.8	98.6	99.3	99.6	99.0
12000 FT PRESS ALT		TAT (°C)											
KIAS	M	-20	-15	-10	-5	0	5	10	15	20	25	30	35
160	.30	96.3	97.0	97.8	98.6	99.4	100.1	99.3	98.1	97.1	96.3	95.4	94.5
200	.38	97.1	97.9	98.7	99.5	100.3	101.0	101.5	100.8	99.8	99.0	98.2	97.3
240	.45	96.5	97.3	98.0	98.8	99.6	100.3	101.1	101.0	100.1	99.4	98.6	97.9
280	.52	95.5	96.3	97.0	97.8	98.6	99.3	100.0	100.8	100.3	99.4	98.6	98.0
320	.60	94.0	94.8	95.6	96.4	97.2	97.9	98.7	99.4	100.2	99.7	98.9	98.2
360	.67	92.3	93.2	94.0	94.8	95.6	96.4	97.1	97.9	98.7	99.4	99.1	98.5

%N1 Adjustments for Engine Bleeds

BLEED CONFIGURATION	PRESSURE ALTITUDE (1000 FT)			
	12	14	16	18
ENGINE ANTI-ICE ON	-0.9	-0.9	-0.9	-0.9
ENGINE & WING ANTI-ICE ON	-3.2	-3.4	-3.4	-3.5

ENGINE INOP

Max Continuous %N1
10000 FT to 1000 FT Pressure Altitudes

10000 FT PRESS ALT		TAT (°C)											
KIAS	M	-20	-15	-10	-5	0	5	10	15	20	25	30	35
160	.29	95.2	96.0	96.8	97.6	98.3	99.1	99.8	98.6	97.4	96.6	95.8	94.9
200	.36	96.0	96.7	97.5	98.3	99.0	99.8	100.5	100.5	99.4	98.5	97.8	97.0
240	.43	95.6	96.4	97.2	97.9	98.7	99.4	100.2	100.9	100.1	99.2	98.4	97.7
280	.51	94.5	95.3	96.1	96.9	97.6	98.4	99.1	99.9	100.4	99.5	98.7	98.0
320	.58	93.0	93.9	94.7	95.5	96.2	97.0	97.8	98.6	99.3	99.7	99.0	98.2
360	.65	91.6	92.4	93.2	94.0	94.8	95.6	96.4	97.2	98.0	98.7	99.1	98.5
5000 FT PRESS ALT		TAT (°C)											
KIAS	M	-10	-5	0	5	10	15	20	25	30	35	40	45
160	.26	94.9	95.7	96.4	97.2	98.0	98.8	99.2	98.3	97.4	96.6	95.9	95.1
200	.33	94.7	95.5	96.3	97.1	97.8	98.6	99.4	98.9	98.0	97.3	96.6	95.8
240	.40	94.0	94.8	95.6	96.4	97.2	97.9	98.7	99.5	98.7	97.9	97.2	96.5
280	.46	93.3	94.1	94.9	95.7	96.5	97.3	98.1	98.8	98.9	98.2	97.5	96.8
320	.53	92.5	93.3	94.1	94.9	95.7	96.5	97.2	98.0	98.7	98.4	97.7	97.1
360	.59	91.5	92.3	93.1	93.9	94.7	95.5	96.2	97.0	97.8	98.5	98.0	97.3
3000 FT PRESS ALT		TAT (°C)											
KIAS	M	-5	0	5	10	15	20	25	30	35	40	45	50
160	.26	94.8	95.6	96.4	97.2	98.0	98.7	98.8	97.9	97.1	96.4	95.6	94.8
200	.32	94.5	95.3	96.1	96.9	97.6	98.4	99.2	98.3	97.5	96.8	96.1	95.3
240	.38	94.1	94.9	95.6	96.4	97.2	98.0	98.7	98.8	98.0	97.2	96.6	95.9
280	.45	93.2	94.0	94.8	95.6	96.4	97.2	97.9	98.7	98.3	97.5	96.9	96.2
320	.51	92.5	93.3	94.1	94.9	95.7	96.4	97.2	98.0	98.5	97.8	97.1	96.5
360	.57	91.6	92.4	93.2	94.0	94.7	95.5	96.3	97.1	97.8	98.1	97.4	96.8
1000 FT PRESS ALT		TAT (°C)											
KIAS	M	-5	0	5	10	15	20	25	30	35	40	45	50
160	.25	93.9	94.7	95.4	96.2	97.0	97.8	98.5	98.2	97.4	96.7	96.0	95.2
200	.31	93.5	94.3	95.1	95.9	96.7	97.4	98.2	98.5	97.8	97.0	96.3	95.6
240	.37	93.0	93.8	94.6	95.4	96.1	96.9	97.7	98.4	98.1	97.3	96.6	95.9
280	.43	92.3	93.2	93.9	94.7	95.5	96.3	97.1	97.8	98.3	97.6	96.9	96.2
320	.49	91.6	92.4	93.2	94.0	94.8	95.6	96.3	97.1	97.9	97.9	97.2	96.5
360	.55	90.7	91.5	92.3	93.1	93.9	94.7	95.4	96.2	96.9	97.7	97.3	96.6

%N1 Adjustments for Engine Bleeds

BLEED CONFIGURATION	PRESSURE ALTITUDE (1000 FT)			
	1	3	5	10
ENGINE ANTI-ICE ON	-0.6	-0.8	-0.8	-0.8
ENGINE & WING ANTI-ICE ON	-2.9	-3.0	-3.1	-3.2

ENGINE INOP

MAX CONTINUOUS THRUST

Driftdown Speed/Level Off Altitude

100 ft/min residual rate of climb

WEIGHT (1000 LB)		OPTIMUM DRIFTDOWN SPEED (KIAS)	LEVEL OFF ALTITUDE (FT)		
START DRIFTDOWN	LEVEL OFF		ISA + 10°C & BELOW	ISA + 15°C	ISA + 20°C
190	183	258	17800	16600	15400
180	173	251	19300	18100	16900
170	164	244	20700	19700	18400
160	154	237	22000	21100	20000
150	145	230	23500	22600	21600
140	135	222	25000	24200	23200
130	125	214	26900	26000	24900
120	115	206	28900	28000	26900
110	106	198	30800	30000	29100
100	96	189	32700	32000	31100
90	87	180	34900	34200	33300

Includes APU fuel burn.

ENGINE INOP

MAX CONTINUOUS THRUST

Driftdown/LRC Cruise Range Capability

Ground to Air Miles Conversion

AIR DISTANCE (NM)					GROUND DISTANCE (NM)	AIR DISTANCE (NM)				
HEADWIND COMPONENT (KTS)						TAILWIND COMPONENT (KTS)				
100	80	60	40	20		20	40	60	80	100
141	130	121	113	106	100	94	89	85	81	77
282	260	242	226	212	200	188	179	170	162	154
422	390	363	339	318	300	283	268	255	243	232
563	520	484	452	424	400	378	358	340	324	310
703	650	604	565	530	500	472	448	426	406	387
843	779	725	678	636	600	567	537	511	487	465
982	909	846	791	742	700	661	627	596	569	543
1122	1038	966	903	848	800	756	717	682	650	621
1262	1168	1087	1016	954	900	851	807	767	732	699
1401	1297	1207	1129	1060	1000	945	897	853	813	777
1541	1426	1328	1242	1166	1100	1040	986	938	895	855
1680	1556	1448	1355	1272	1200	1135	1076	1024	976	933
1820	1685	1569	1467	1378	1300	1229	1166	1109	1057	1010
1960	1815	1689	1580	1484	1400	1324	1256	1195	1139	1088
2100	1944	1810	1693	1590	1500	1418	1346	1280	1220	1166
2240	2074	1931	1806	1697	1600	1513	1435	1365	1302	1244
2381	2204	2052	1919	1803	1700	1607	1525	1450	1383	1321
2522	2334	2173	2032	1909	1800	1702	1615	1536	1464	1399

Driftdown/Cruise Fuel and Time

AIR DIST (NM)	FUEL REQUIRED (1000 LB)											TIME (HR:MIN)
	WEIGHT AT START OF DRIFTDOWN (1000 LB)											
	90	100	110	120	130	140	150	160	170	180	190	
100	0.8	0.8	0.8	0.9	0.9	1.0	1.1	1.1	1.2	1.2	1.2	0:17
200	1.8	1.9	2.0	2.1	2.2	2.4	2.5	2.6	2.7	2.8	3.0	0:35
300	2.8	3.0	3.2	3.4	3.6	3.8	4.1	4.3	4.5	4.7	4.9	0:52
400	3.8	4.1	4.4	4.7	5.0	5.3	5.7	5.9	6.3	6.6	6.9	1:09
500	4.7	5.1	5.5	5.9	6.3	6.7	7.1	7.5	7.9	8.3	8.7	1:27
600	5.6	6.1	6.6	7.0	7.6	8.1	8.5	9.0	9.5	10.0	10.5	1:44
700	6.5	7.1	7.7	8.2	8.8	9.4	10.0	10.5	11.1	11.6	12.3	2:01
800	7.4	8.1	8.7	9.4	10.0	10.7	11.4	12.0	12.6	13.3	14.0	2:18
900	8.3	9.1	9.8	10.5	11.3	12.0	12.7	13.4	14.2	14.9	15.7	2:35
1000	9.2	10.0	10.8	11.6	12.5	13.3	14.1	14.9	15.7	16.5	17.4	2:52
1100	10.1	11.0	11.9	12.7	13.7	14.6	15.5	16.3	17.3	18.2	19.1	3:09
1200	10.9	11.9	12.9	13.8	14.9	15.8	16.8	17.8	18.8	19.7	20.8	3:26
1300	11.8	12.9	13.9	14.9	16.0	17.1	18.2	19.2	20.3	21.3	22.5	3:43
1400	12.6	13.8	14.9	16.0	17.2	18.4	19.5	20.6	21.8	22.9	24.1	3:60
1500	13.5	14.7	15.9	17.1	18.4	19.6	20.8	22.0	23.2	24.5	25.8	4:17
1600	14.3	15.6	16.9	18.2	19.5	20.8	22.1	23.4	24.7	26.0	27.4	4:34
1700	15.1	16.5	17.9	19.2	20.7	22.0	23.4	24.8	26.2	27.5	29.0	4:51
1800	16.0	17.4	18.9	20.3	21.8	23.3	24.7	26.1	27.6	29.1	30.6	5:09

Includes APU fuel burn.
Driftdown at optimum driftdown speed and cruise at LRC speed.

ENGINE INOP

MAX CONTINUOUS THRUST

Long Range Cruise Altitude Capability

100 ft/min residual rate of climb

WEIGHT (1000 LB)	PRESSURE ALTITUDE (FT)		
	ISA + 10°C & BELOW	ISA + 15°C	ISA + 20°C
190	14900	12600	9600
180	16700	14900	12100
170	18500	16800	14600
160	20300	18700	16700
150	21600	20500	18700
140	23100	22000	20600
130	24600	23500	22200
120	26800	25300	24000
110	29200	27900	26300
100	31300	30400	29100
90	33500	32600	31500

With engine anti-ice on, decrease altitude capability by 1300 ft.
With engine and wing anti-ice on, decrease altitude capability by 5900 ft.

ENGINE INOP

Long Range Cruise Control

WEIGHT (1000 LB)		PRESSURE ALTITUDE (1000 FT)										
		10	15	17	19	21	23	25	27	29	31	33
180	%N1	90.8	94.3	96.4								
	MACH	.540	.575	.590								
	KIAS	300	291	287								
	FF/ENG	6475	6334	6327								
170	%N1	89.4	92.8	94.6	97.0							
	MACH	.529	.567	.579	.594							
	KIAS	293	286	282	278							
	FF/ENG	6145	6019	5954	5977							
160	%N1	88.0	91.5	92.9	94.9	97.7						
	MACH	.517	.556	.570	.583	.599						
	KIAS	287	280	277	273	269						
	FF/ENG	5815	5696	5624	5580	5652						
150	%N1	86.5	90.0	91.4	93.0	95.2	98.2					
	MACH	.505	.543	.559	.572	.587	.603					
	KIAS	279	274	271	267	264	260					
	FF/ENG	5487	5369	5309	5237	5227	5345					
140	%N1	84.9	88.3	89.8	91.2	93.0	95.4					
	MACH	.491	.530	.546	.561	.575	.590					
	KIAS	272	267	265	262	258	254					
	FF/ENG	5161	5041	4984	4922	4866	4890					
130	%N1	83.1	86.6	88.0	89.5	91.0	93.0	95.6				
	MACH	.477	.515	.531	.547	.563	.577	.592				
	KIAS	264	260	258	255	252	248	245				
	FF/ENG	4831	4714	4658	4601	4547	4506	4560				
120	%N1	81.3	84.8	86.2	87.7	89.1	90.7	92.8	95.6			
	MACH	.462	.500	.516	.532	.548	.564	.578	.593			
	KIAS	255	252	250	248	245	243	239	235			
	FF/ENG	4497	4387	4332	4276	4227	4181	4157	4223			
110	%N1	79.3	82.8	84.2	85.6	87.1	88.6	90.2	92.4	95.4		
	MACH	.446	.483	.499	.515	.531	.548	.564	.578	.594		
	KIAS	246	243	241	240	238	235	233	229	225		
	FF/ENG	4167	4061	4007	3952	3903	3859	3829	3817	3882		
100	%N1	77.1	80.6	82.0	83.5	84.9	86.4	87.9	89.6	91.8	94.9	
	MACH	.429	.465	.480	.496	.512	.529	.546	.562	.577	.593	
	KIAS	237	234	232	231	229	227	225	222	219	215	
	FF/ENG	3845	3730	3682	3629	3582	3538	3504	3488	3476	3537	
90	%N1	74.9	78.2	79.6	81.1	82.5	84.0	85.5	87.0	88.6	90.9	94.0
	MACH	.411	.445	.460	.476	.492	.509	.525	.543	.560	.575	.591
	KIAS	227	223	222	221	220	218	216	214	212	208	205
	FF/ENG	3529	3401	3353	3306	3261	3219	3185	3164	3148	3135	3187

ENGINE INOP

MAX CONTINUOUS THRUST

Long Range Cruise Diversion Fuel and Time

Ground to Air Miles Conversion

AIR DISTANCE (NM) HEADWIND COMPONENT (KTS)					GROUND DISTANCE (KTS)	AIR DISTANCE (NM) TAILWIND COMPONENT (KTS)				
100	80	60	40	20		20	40	60	80	100
295	270	248	230	214	200	190	180	172	164	158
594	543	498	461	429	400	379	361	344	328	315
895	817	749	692	643	600	569	541	516	492	472
1196	1091	999	923	858	800	759	722	687	656	629
1500	1368	1252	1155	1073	1000	949	902	859	820	785
1805	1645	1504	1387	1288	1200	1138	1081	1030	983	942
2113	1924	1758	1621	1504	1400	1327	1261	1201	1146	1098
2422	2204	2013	1854	1719	1600	1517	1442	1372	1309	1253
2733	2485	2267	2087	1935	1800	1707	1621	1543	1472	1409

Reference Fuel and Time Required at Check Point

AIR DIST (NM)	PRESSURE ALTITUDE (1000 FT)									
	10		14		18		22		26	
	FUEL (1000 LB)	TIME (HR:MIN)	FUEL (1000 LB)	TIME (HR:MIN)	FUEL (1000 LB)	TIME (HR:MIN)	FUEL (1000 LB)	TIME (HR:MIN)	FUEL (1000 LB)	TIME (HR:MIN)
200	3.1	0:42	2.7	0:41	2.4	0:39	2.2	0:38	2.0	0:37
400	6.3	1:22	5.7	1:19	5.2	1:16	4.8	1:13	4.6	1:11
600	9.5	2:03	8.8	1:57	8.1	1:52	7.4	1:48	7.1	1:45
800	12.7	2:44	11.7	2:36	10.8	2:29	10.0	2:23	9.6	2:19
1000	15.9	3:25	14.7	3:15	13.6	3:06	12.6	2:59	12.1	2:53
1200	19.0	4:07	17.6	3:55	16.3	3:44	15.1	3:35	14.5	3:27
1400	22.1	4:49	20.5	4:35	19.0	4:22	17.6	4:11	16.9	4:02
1600	25.1	5:32	23.3	5:15	21.6	5:00	20.1	4:47	19.2	4:37
1800	28.1	6:15	26.1	5:56	24.2	5:39	22.6	5:24	21.5	5:12

Fuel Required Adjustments (1000 LB)

REFERENCE FUEL REQUIRED (1000 LB)	WEIGHT AT CHECK POINT (1000 LB)					
	90	110	130	150	170	190
2	-0.2	-0.1	0.0	0.2	0.4	0.8
4	-0.5	-0.2	0.0	0.5	1.2	2.0
6	-0.7	-0.4	0.0	0.9	1.9	3.1
8	-1.0	-0.5	0.0	1.2	2.6	4.2
10	-1.3	-0.7	0.0	1.5	3.2	5.3
12	-1.6	-0.8	0.0	1.8	3.9	6.3
14	-1.8	-0.9	0.0	2.0	4.5	7.3
16	-2.1	-1.1	0.0	2.3	5.1	8.3
18	-2.4	-1.2	0.0	2.6	5.7	9.2
20	-2.6	-1.3	0.0	2.8	6.3	10.1
22	-2.9	-1.5	0.0	3.1	6.8	11.0
24	-3.2	-1.6	0.0	3.3	7.3	11.8
26	-3.5	-1.7	0.0	3.5	7.8	12.6
28	-3.7	-1.9	0.0	3.7	8.3	13.4
30	-4.0	-2.0	0.0	3.9	8.8	14.1

Includes APU fuel burn.

ENGINE INOP

MAX CONTINUOUS THRUST

Holding

Flaps Up

WEIGHT (1000 LB)		PRESSURE ALTITUDE (FT)							
		1500	5000	10000	15000	20000	25000	30000	35000
190	%N1	81.6	84.5	88.7	93.4				
	KIAS	252	252	254	255				
	FF/ENG	6130	6130	6150	6290				
180	%N1	80.1	83.0	87.1	91.6	99.7			
	KIAS	245	246	247	248	250			
	FF/ENG	5810	5790	5800	5900	6310			
170	%N1	78.6	81.4	85.5	90.0	96.7			
	KIAS	238	239	240	241	242			
	FF/ENG	5500	5460	5460	5520	5750			
160	%N1	77.0	79.7	83.9	88.2	93.8			
	KIAS	231	231	232	233	235			
	FF/ENG	5180	5140	5120	5160	5270			
150	%N1	75.4	78.0	82.1	86.3	91.2			
	KIAS	224	224	225	226	227			
	FF/ENG	4870	4830	4790	4810	4860			
140	%N1	73.4	76.2	80.2	84.4	89.0	96.9		
	KIAS	216	216	217	218	219	221		
	FF/ENG	4560	4510	4460	4470	4490	4790		
130	%N1	71.4	74.3	78.1	82.4	86.9	93.0		
	KIAS	208	209	209	210	211	213		
	FF/ENG	4250	4200	4150	4130	4130	4270		
120	%N1	69.3	72.1	76.1	80.3	84.6	89.7		
	KIAS	199	200	201	202	203	204		
	FF/ENG	3950	3890	3840	3800	3780	3840		
110	%N1	67.1	69.8	73.9	77.9	82.3	87.0	95.1	
	KIAS	191	191	192	193	194	195	196	
	FF/ENG	3660	3590	3530	3490	3450	3470	3730	
100	%N1	64.7	67.3	71.4	75.4	79.7	84.2	90.1	
	KIAS	182	182	183	184	184	185	187	
	FF/ENG	3360	3290	3230	3180	3130	3130	3240	
90	%N1	61.9	64.7	68.6	72.7	76.9	81.4	86.2	95.7
	KIAS	176	176	176	176	176	176	177	178
	FF/ENG	3060	3000	2940	2880	2810	2800	2850	3130

This table includes 5% additional fuel for holding in a racetrack pattern.

Intentionally
Blank

Performance Inflight — Chapter PI
Alternate Mode EEC — Section 84

ALTERNATE MODE EEC

Alternate Mode EEC Limit Weight

PERFORMANCE LIMIT	NORMAL MODE PERFORMANCE LIMIT WEIGHT (1000 LB)									
	100	110	120	130	140	150	160	170	180	190
FIELD	95.2	104.7	114.2	123.7	133.0	142.5	151.9	161.3	170.8	180.3
CLIMB	93.5	102.7	112.2	121.5	130.9	140.3	149.7	159.1	168.4	177.9
OBSTACLE	93.5	102.7	112.2	121.7	131.0	140.4	149.8	159.1	168.6	177.8
TIRE	99.6	109.6	119.6	129.6	139.6	149.6	159.6	169.6	179.6	189.6
BRAKE	98.5	108.5	118.5	128.5	138.5	148.5	158.5	168.5	178.5	188.5

Alternate Mode EEC Takeoff Speed Adjustment

TAKEOFF SPEEDS	TAKEOFF SPEED ADJUSTMENT (KTS)
DRY V1	+1
WET V1	+2
VR	+1
V2	0

Alternate Mode EEC Max Takeoff %N1

Based on engine bleeds for packs on, engine and wing anti-ice on or off

AIRPORT OAT		AIRPORT PRESSURE ALTITUDE (FT)												
°C	°F	-2000	-1000	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
60	140	93.5	94.0	94.5	94.7	94.5	94.8	95.0	95.1	94.7	94.1	93.8	93.7	93.7
55	131	94.6	95.0	95.2	95.4	95.3	95.5	95.8	95.9	95.6	95.0	94.5	93.8	93.1
50	122	95.4	96.0	96.5	96.4	96.1	96.3	96.5	96.8	96.5	96.0	95.4	94.8	94.1
45	113	96.1	96.7	97.2	97.4	97.4	97.4	97.4	97.6	97.3	96.8	96.3	95.7	95.1
40	104	96.8	97.5	98.0	98.2	98.1	98.2	98.3	98.3	98.1	97.7	97.2	96.6	96.0
35	95	97.5	98.3	99.0	99.2	99.1	99.2	99.3	99.3	99.0	98.5	98.0	97.5	96.9
30	86	97.1	98.6	100.4	100.1	100.1	100.0	100.1	100.2	99.9	99.6	99.2	98.4	97.8
25	77	96.3	97.9	99.7	100.0	100.3	100.4	100.4	100.4	100.3	100.3	100.2	99.2	98.7
20	68	95.6	97.1	99.0	99.3	99.6	99.8	100.1	100.4	100.4	100.4	100.3	99.6	98.8
15	59	94.8	96.3	98.3	98.6	98.9	99.1	99.4	99.6	99.9	100.2	100.3	99.8	99.1
10	50	94.0	95.6	97.5	97.9	98.1	98.4	98.6	98.9	99.2	99.4	99.7	99.6	99.5
5	41	93.2	94.8	96.8	97.1	97.4	97.6	97.9	98.1	98.4	98.7	99.0	98.8	98.7
0	32	92.4	94.0	96.0	96.4	96.6	96.9	97.1	97.4	97.6	97.9	98.2	98.1	97.9
-5	23	91.6	93.2	95.3	95.6	95.9	96.1	96.4	96.6	96.9	97.2	97.4	97.3	97.2
-10	14	90.8	92.4	94.5	94.8	95.1	95.3	95.6	95.8	96.1	96.4	96.6	96.5	96.4
-15	5	90.0	91.6	93.7	94.1	94.3	94.6	94.8	95.1	95.3	95.6	95.9	95.7	95.6
-20	-4	89.2	90.8	93.0	93.3	93.5	93.8	94.0	94.3	94.5	94.8	95.1	94.9	94.8
-25	-13	88.3	90.0	92.2	92.5	92.7	93.0	93.2	93.5	93.7	94.0	94.3	94.1	94.0
-30	-22	87.5	89.1	91.4	91.7	91.9	92.2	92.4	92.7	92.9	93.2	93.4	93.3	93.2
-35	-31	86.6	88.3	90.6	90.9	91.1	91.4	91.6	91.8	92.1	92.4	92.6	92.5	92.4
-40	-40	85.8	87.4	89.7	90.1	90.3	90.5	90.8	91.0	91.3	91.5	91.8	91.7	91.5
-45	-49	84.9	86.6	88.9	89.2	89.5	89.7	89.9	90.2	90.4	90.7	90.9	90.8	90.7
-50	-58	84.0	85.7	88.1	88.4	88.6	88.9	89.1	89.3	89.6	89.8	90.1	90.0	89.8

%N1 Adjustments for Engine Bleed

BLEED CONFIGURATION	AIRPORT PRESSURE ALTITUDE (FT)												
	-2000	-1000	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
PACKS OFF	0.7	0.8	0.8	0.9	0.9	0.9	1.0	1.0	1.0	1.0	1.0	1.0	1.0

Intentionally
Blank

Performance Inflight — Chapter PI
Gear Down — Section 85

GEAR DOWN

Long Range Cruise Altitude Capability
Max Cruise Thrust, 100 ft/min residual rate of climb

WEIGHT (1000 LB)	PRESSURE ALTITUDE (FT)		
	ISA + 10°C & BELOW	ISA + 15°C	ISA + 20°C
190	14400	11200	8200
180	16900	14100	11000
170	19600	16800	14000
160	22000	19400	16700
150	24300	22200	19300
140	26500	25000	22400
130	28800	27300	25500
120	30800	29700	28100
110	32700	31700	30500
100	34700	33700	32600
90	36900	35900	34800

GEAR DOWN

Long Range Cruise Control

WEIGHT (1000 LB)		PRESSURE ALTITUDE (1000 FT)									
		10	21	23	25	27	29	31	33	35	37
180	%N1	85.1									
	MACH	.473									
	KIAS	262									
	FF/ENG	5168									
170	%N1	83.5	93.0								
	MACH	.460	.560								
	KIAS	254	251								
	FF/ENG	4868	4822								
160	%N1	81.9	91.1	93.3							
	MACH	.447	.548	.565							
	KIAS	247	245	243							
	FF/ENG	4571	4524	4525							
150	%N1	80.1	89.4	91.2	93.7						
	MACH	.434	.535	.552	.569						
	KIAS	240	239	237	235						
	FF/ENG	4280	4241	4214	4243						
140	%N1	78.3	87.5	89.2	91.2	94.0					
	MACH	.420	.518	.538	.555	.573					
	KIAS	232	232	231	229	227					
	FF/ENG	3998	3938	3932	3920	3970					
130	%N1	76.4	85.4	87.3	89.0	91.1	94.2				
	MACH	.406	.500	.521	.541	.558	.576				
	KIAS	224	223	224	223	221	218				
	FF/ENG	3719	3633	3633	3634	3637	3696				
120	%N1	74.4	83.3	85.0	86.8	88.6	90.9	94.1			
	MACH	.391	.482	.501	.523	.543	.560	.579			
	KIAS	216	215	215	215	214	212	210			
	FF/ENG	3443	3336	3330	3338	3347	3354	3420			
110	%N1	72.2	81.0	82.7	84.4	86.2	88.0	90.5	93.8		
	MACH	.375	.462	.481	.501	.523	.543	.561	.580		
	KIAS	207	206	206	206	206	205	203	201		
	FF/ENG	3172	3046	3037	3039	3055	3063	3069	3140		
100	%N1	69.7	78.5	80.2	81.9	83.6	85.5	87.3	89.8	93.2	
	MACH	.359	.442	.460	.479	.499	.521	.542	.560	.580	
	KIAS	198	197	197	197	196	197	196	194	192	
	FF/ENG	2910	2764	2749	2750	2761	2773	2779	2784	2854	
90	%N1	67.1	75.7	77.4	79.1	80.8	82.6	84.4	86.4	88.8	92.6
	MACH	.343	.421	.438	.456	.475	.496	.518	.540	.558	.578
	KIAS	189	187	187	187	187	187	187	186	184	182
	FF/ENG	2659	2493	2468	2464	2476	2482	2489	2495	2500	2575

GEAR DOWN

Long Range Cruise Enroute Fuel and Time

Ground to Air Miles Conversion

AIR DISTANCE (NM)					GROUND DISTANCE (NM)	AIR DISTANCE (NM)				
HEADWIND COMPONENT (KTS)						TAILWIND COMPONENT (KTS)				
100	80	60	40	20		20	40	60	80	100
324	290	260	236	217	200	188	178	168	160	153
655	584	523	474	435	400	377	357	338	321	307
990	881	787	713	653	600	566	535	507	482	460
1330	1181	1054	953	871	800	755	713	676	642	613
1675	1485	1323	1195	1091	1000	943	891	844	803	766
2026	1792	1593	1436	1310	1200	1131	1069	1013	962	918
2383	2104	1866	1680	1530	1400	1319	1246	1180	1121	1069
2746	2420	2142	1925	1751	1600	1507	1423	1347	1279	1220
3116	2740	2420	2171	1972	1800	1695	1600	1514	1437	1370

Reference Fuel and Time Required at Check Point

AIR DIST (NM)	PRESSURE ALTITUDE (1000 FT)									
	10		14		20		24		28	
	FUEL (1000 LB)	TIME (HR:MIN)	FUEL (1000 LB)	TIME (HR:MIN)	FUEL (1000 LB)	TIME (HR:MIN)	FUEL (1000 LB)	TIME (HR:MIN)	FUEL (1000 LB)	TIME (HR:MIN)
200	5.3	0:49	4.8	0:47	4.2	0:44	3.8	0:43	3.5	0:42
400	10.9	1:37	10.0	1:32	8.9	1:25	8.2	1:21	7.7	1:18
600	16.3	2:26	15.1	2:18	13.5	2:07	12.5	2:00	11.8	1:55
800	21.6	3:16	20.1	3:05	17.9	2:49	16.7	2:39	15.8	2:32
1000	26.8	4:07	25.0	3:53	22.3	3:33	20.9	3:20	19.7	3:09
1200	31.9	4:59	29.7	4:41	26.6	4:17	24.9	4:01	23.6	3:48
1400	36.9	5:52	34.4	5:31	30.8	5:01	28.9	4:42	27.3	4:26
1600	41.8	6:47	39.0	6:22	35.0	5:47	32.7	5:25	31.0	5:06
1800	46.6	7:43	43.4	7:14	39.0	6:34	36.5	6:08	34.6	5:46

Fuel Required Adjustments (1000 LB)

REFERENCE FUEL REQUIRED (1000 LB)	WEIGHT AT CHECK POINT (1000 LB)				
	90	110	130	150	170
5	-0.7	-0.4	0.0	0.7	1.5
10	-1.5	-0.8	0.0	1.3	3.0
15	-2.2	-1.1	0.0	1.9	4.4
20	-3.0	-1.5	0.0	2.5	5.7
25	-3.8	-1.9	0.0	3.0	6.9
30	-4.5	-2.3	0.0	3.5	8.0
35	-5.3	-2.7	0.0	4.0	8.9
40	-6.1	-3.0	0.0	4.4	9.8
45	-6.9	-3.4	0.0	4.7	10.5
50	-7.7	-3.8	0.0	5.1	11.1

GEAR DOWN

Descent

VREF40 + 70 KIAS

PRESSURE ALTITUDE (FT)	TIME (MIN)	FUEL (LB)	DISTANCE (NM)
41000	21	620	90
39000	20	610	86
37000	19	600	81
35000	19	590	77
33000	18	570	72
31000	17	560	68
29000	16	550	64
27000	16	540	60
25000	15	520	56
23000	14	510	52
21000	13	490	48
19000	12	480	44
17000	12	460	40
15000	11	440	36
10000	8	380	26
5000	6	310	16
1500	4	250	9

Allowances for a straight-in approach are included.

GEAR DOWN

Holding

Flaps Up

WEIGHT (1000 LB)		PRESSURE ALTITUDE (FT)							
		1500	5000	10000	15000	20000	25000	30000	35000
190	%N1	76.4	79.0	83.3	87.7				
	KIAS	229	229	229	229				
	FF/ENG	5050	5020	5010	5050				
180	%N1	74.9	77.6	81.8	86.1	90.9			
	KIAS	225	225	225	225	225			
	FF/ENG	4790	4760	4740	4760	4800			
170	%N1	73.3	76.2	80.2	84.5	89.2			
	KIAS	220	220	220	220	220			
	FF/ENG	4540	4500	4470	4480	4500			
160	%N1	71.7	74.6	78.6	82.9	87.4			
	KIAS	215	215	215	215	215			
	FF/ENG	4290	4250	4210	4210	4210			
150	%N1	70.0	72.9	76.9	81.2	85.6	90.9		
	KIAS	211	211	211	211	211	211		
	FF/ENG	4050	4000	3960	3940	3930	4000		
140	%N1	68.3	71.1	75.2	79.4	83.8	88.5		
	KIAS	206	206	206	206	206	206		
	FF/ENG	3820	3760	3720	3690	3670	3700		
130	%N1	66.6	69.2	73.4	77.4	81.8	86.5	93.5	
	KIAS	200	200	200	200	200	200	200	
	FF/ENG	3580	3520	3470	3440	3400	3420	3580	
120	%N1	64.7	67.3	71.4	75.4	79.8	84.3	89.8	
	KIAS	194	194	194	194	194	194	194	
	FF/ENG	3350	3290	3230	3190	3150	3150	3240	
110	%N1	62.5	65.3	69.2	73.4	77.6	82.1	86.8	
	KIAS	189	189	189	189	189	189	189	
	FF/ENG	3120	3060	3000	2960	2900	2890	2950	
100	%N1	60.2	63.1	67.0	71.2	75.3	79.8	84.4	91.6
	KIAS	182	182	182	182	182	182	182	182
	FF/ENG	2880	2840	2780	2730	2670	2640	2680	2800
90	%N1	58.0	60.7	64.8	68.8	73.0	77.3	81.8	87.1
	KIAS	176	176	176	176	176	176	176	176
	FF/ENG	2670	2620	2570	2510	2450	2400	2440	2480

This table includes 5% additional fuel for holding in a racetrack pattern.

Intentionally
Blank

Performance Inflight — Chapter PI
Gear Down, Engine Inop — Section 86

GEAR DOWN

ENGINE INOP

MAX CONTINUOUS THRUST

Driftdown Speed/Level Off Altitude

100 ft/min residual rate of climb

WEIGHT (1000 LB)		OPTIMUM DRIFTDOWN SPEED (KIAS)	LEVEL OFF ALTITUDE (FT)		
START DRIFTDOWN	LEVEL OFF		ISA + 10°C & BELOW	ISA + 15°C	ISA + 20°C
180	171	224	2800	1000	
170	162	219	5100	3500	1400
160	152	215	7300	5900	3900
150	143	210	9500	8200	6300
140	134	205	11600	10500	8800
130	124	200	13800	12900	11500
120	114	194	16100	15300	14400
110	105	189	18400	17600	16700
100	96	183	20700	19900	19000
90	86	177	22900	22100	21300

Includes APU fuel burn.

Long Range Cruise Altitude Capability

100 ft/min residual rate of climb

WEIGHT (1000 LB)	PRESSURE ALTITUDE (FT)		
	ISA + 10°C & BELOW	ISA + 15°C	ISA + 20°C
160	2600		
150	5400	3400	
140	8200	6500	4000
130	10900	9600	7300
120	13400	12400	10700
110	16100	15300	14300
100	18900	17900	17100
90	21700	20800	19800

GEAR DOWN
ENGINE INOP

MAX CONTINUOUS THRUST

Long Range Cruise Control

WEIGHT (1000 LB)		PRESSURE ALTITUDE (1000 FT) 5	7	9	11	13	15	17	19	21
150	%N1	94.2	96.3							
	MACH	.384	.397							
	KIAS	232	232							
	FF/ENG	8126	8164							
140	%N1	92.1	93.8	96.1						
	MACH	.372	.385	.398						
	KIAS	225	225	224						
	FF/ENG	7546	7546	7597						
130	%N1	90.0	91.6	93.4	95.7					
	MACH	.361	.373	.385	.399					
	KIAS	218	217	217	216					
	FF/ENG	6988	6970	6969	7032					
120	%N1	87.8	89.3	91.0	92.7	95.2				
	MACH	.349	.360	.372	.385	.399				
	KIAS	211	210	209	208	208				
	FF/ENG	6461	6417	6397	6399	6465				
110	%N1	85.6	87.0	88.5	90.2	91.9	94.4	98.3		
	MACH	.337	.348	.359	.371	.383	.397	.412		
	KIAS	204	203	201	200	200	199	198		
	FF/ENG	5963	5897	5851	5833	5838	5886	6060		
100	%N1	83.3	84.6	86.0	87.5	89.1	90.9	93.3	97.3	
	MACH	.325	.335	.345	.356	.368	.381	.395	.409	
	KIAS	197	195	194	193	192	191	190	189	
	FF/ENG	5484	5406	5341	5296	5278	5273	5292	5435	
90	%N1	80.8	82.1	83.4	84.8	86.2	87.9	89.7	91.9	95.4
	MACH	.313	.322	.331	.341	.352	.364	.377	.391	.406
	KIAS	189	188	186	184	183	182	181	181	180
	FF/ENG	5027	4936	4859	4796	4752	4724	4702	4700	4813

GEAR DOWN
ENGINE INOP

MAX CONTINUOUS THRUST

Long Range Cruise Diversion Fuel and Time

Ground to Air Miles Conversion

AIR DISTANCE (NM)					GROUND DISTANCE (NM)	AIR DISTANCE (NM)				
HEADWIND COMPONENT (KTS)						TAILWIND COMPONENT (KTS)				
100	80	60	40	20		20	40	60	80	100
167	148	132	119	109	100	94	88	82	78	74
341	300	266	239	218	200	187	174	164	155	147
516	454	402	361	328	300	280	261	245	231	219
692	608	537	482	438	400	373	348	326	307	291
869	763	673	603	548	500	465	434	407	383	363
1048	919	809	725	658	600	558	521	488	459	434
1228	1076	947	847	768	700	651	607	568	535	506
1410	1234	1084	970	879	800	744	693	648	610	577
1593	1392	1222	1092	989	900	836	779	729	685	648
1778	1552	1361	1215	1100	1000	929	865	809	760	719

Reference Fuel and Time Required at Check Point

AIR DIST (NM)	PRESSURE ALTITUDE (1000 FT)					
	6		10		14	
	FUEL (1000 LB)	TIME (HR:MIN)	FUEL (1000 LB)	TIME (HR:MIN)	FUEL (1000 LB)	TIME (HR:MIN)
100	2.8	0:27	2.4	0:27	2.3	0:26
200	5.7	0:53	5.3	0:51	5.0	0:49
300	8.7	1:19	8.0	1:15	7.8	1:12
400	11.6	1:45	10.8	1:40	10.4	1:36
500	14.4	2:11	13.5	2:05	13.0	1:59
600	17.2	2:38	16.1	2:31	15.6	2:23
700	20.0	3:05	18.8	2:56	18.1	2:47
800	22.8	3:32	21.4	3:22	20.6	3:12
900	25.5	4:00	23.9	3:48	23.0	3:36
1000	28.2	4:27	26.5	4:14	25.4	4:01

Fuel Required Adjustments (1000 LB)

REFERENCE FUEL REQUIRED (1000 LB)	WEIGHT AT CHECK POINT (1000 LB)				
	90	110	130	150	170
2	-0.3	-0.2	0.0	0.3	0.5
4	-0.6	-0.3	0.0	0.6	1.2
6	-0.9	-0.5	0.0	1.0	1.8
8	-1.3	-0.6	0.0	1.3	2.5
10	-1.6	-0.8	0.0	1.6	3.1
12	-1.9	-1.0	0.0	1.9	3.8
14	-2.2	-1.1	0.0	2.2	4.4
16	-2.5	-1.3	0.0	2.5	5.0
18	-2.8	-1.5	0.0	2.8	5.6
20	-3.1	-1.6	0.0	3.1	6.2
22	-3.5	-1.8	0.0	3.4	6.8
24	-3.8	-1.9	0.0	3.7	7.4
26	-4.1	-2.1	0.0	3.9	8.0
28	-4.4	-2.2	0.0	4.2	8.6
30	-4.7	-2.4	0.0	4.4	9.2

Includes APU fuel burn.

GEAR DOWN

ENGINE INOP

MAX CONTINUOUS THRUST

Holding

Flaps Up

WEIGHT (1000 LB)		PRESSURE ALTITUDE (FT)				
		1500	5000	10000	15000	20000
180	%N1	94.2				
	KIAS	225				
	FF/ENG	9390				
170	%N1	92.4	95.9			
	KIAS	220	220			
	FF/ENG	8810	8930			
160	%N1	90.5	93.7			
	KIAS	215	215			
	FF/ENG	8250	8340			
150	%N1	88.6	91.8			
	KIAS	211	211			
	FF/ENG	7720	7780			
140	%N1	86.7	89.7	94.8		
	KIAS	206	206	206		
	FF/ENG	7210	7230	7360		
130	%N1	84.6	87.6	92.2		
	KIAS	200	200	200		
	FF/ENG	6700	6700	6770		
120	%N1	82.5	85.4	89.9	96.3	
	KIAS	194	194	194	194	
	FF/ENG	6210	6200	6230	6450	
110	%N1	80.1	83.1	87.4	92.4	
	KIAS	189	189	189	189	
	FF/ENG	5730	5700	5700	5790	
100	%N1	77.7	80.6	84.9	89.5	97.6
	KIAS	182	182	182	182	182
	FF/ENG	5280	5230	5200	5250	5510
90	%N1	75.3	78.1	82.3	86.7	92.3
	KIAS	176	176	176	176	176
	FF/ENG	4840	4790	4740	4750	4800

This table includes 5% additional fuel for holding in a racetrack pattern.

Performance Inflight — Chapter PI
Text — Section 87

Introduction

This chapter contains information to supplement performance data from the Flight Management Computer (FMC). In addition, sufficient inflight data is provided to complete a flight with the FMC inoperative. In the event of conflict between data presented in this chapter and that contained in the approved Airplane Flight Manual, the Flight Manual shall always take precedence.

General

Takeoff Speeds

The speeds presented in the Takeoff Speeds table as well as FMC computed takeoff speeds can be used for all performance conditions except where adjustments must be made for anti-skid inoperative, thrust reversers inoperative, improved climb, contaminated runway situations, or brake energy limits.

V1 adjustments are not necessary for equal amounts of clearway and stopway. V1 for takeoff limit weights based on unequal clearway and stopway should be obtained from computerized takeoff speeds calculations for the specific takeoff conditions.

These speeds may be used for weights less than or equal to the performance limited weight subject to the restrictions noted above.

The FMC will protect for minimum control speeds by increasing V1, VR and V2 as required. However, the FMC will not compute takeoff speeds for weights where the required speed increase exceeds the maximum certified speed increase. This typically occurs at full rated thrust and light weights. In this case, the message "V SPEEDS UNAVAILABLE" will appear on the FMC scratchpad and the takeoff speed entries will be blank. In this situation, manually verify takeoff speeds using an approved source of takeoff performance information. Upon verifying the takeoff speeds, takeoff is permitted. When selected takeoff speeds cannot be verified, the options are to select a lower number flap setting, select derate thrust and/or increase airplane gross weight (e.g. add fuel). Selecting derate thrust is the preferred method as this will reduce the minimum control speeds. Note that the assumed temperature method will not help this condition as the minimum control speeds are determined at the actual temperature and therefore are not reduced by an assumed temperature selection.

Normal takeoff speeds, V1, VR, and V2 are read from either the dry or wet table by entering with takeoff flap setting and brake release weight. Use the tables provided to adjust takeoff speeds for altitude and actual temperature or assumed temperature for reduced thrust takeoffs. Slope and wind adjustments to V1 are obtained by entering the Slope and Wind V1 Adjustment table.

V1(MCG)

Regulations prohibit scheduling takeoff with a V1 less than minimum V1 for control on the ground, V1(MCG). It is therefore necessary to compare the adjusted V1 to V1(MCG). The V1(MCG) presented in this manual is conservative for all weight and bleed configurations.

To find V1(MCG) enter the V1(MCG) table with the airport pressure altitude and actual OAT. If the adjusted V1 is less than V1(MCG), set V1 equal to V1(MCG). If the adjusted VR is less than V1(MCG), set VR equal to V1(MCG), and determine a new V2 by adding the difference between the normal VR and V1(MCG) to the normal V2. No takeoff weight adjustment is necessary provided that the actual field length exceeds the minimum field length shown in the Field and Climb Limit Weight table in chapter Performance Dispatch.

Stab Trim

To find takeoff stabilizer trim setting, enter Stab Trim Setting table with anticipated brake release weight and center of gravity (C.G. % MAC) and read required stabilizer trim units.

VREF

This table contains flaps 40, 30 and 15 reference speeds for a given weight.

Flap Maneuver Speeds

This table provides flap maneuver speeds for various flap settings. During flap retraction, selection of the next flap position is initiated when reaching the maneuver speed for the existing flap position. During flap retraction, at least adequate maneuver capability or 30° of bank (15° of bank and 15° overshoot) to stick shaker is provided at the flap retraction speed. Full maneuver capability or at least 40° of bank (25° of bank and 15° overshoot) is provided when the airplane has accelerated to the recommended maneuver speed for the selected flap position.

During flap extension, selection of the flaps to the next flap position should be made when approaching, and before decelerating below, the maneuver speed for the existing flap position. The flap extension speed schedule varies with airplane weight and provides full maneuver capability or at least 40° of bank (25° of bank and 15° overshoot) to stick shaker at all weights.

Slush/Standing Water Takeoff

Experience has shown that aircraft performance may deteriorate significantly on runways covered with snow, slush, standing water or ice. Therefore, reductions in field/obstacle limited takeoff weight and revised takeoff speeds are necessary. The tables are intended for guidance in accordance with advisory material and assume an engine failure at the critical point during the takeoff.

The entire runway is assumed to be completely covered by a contaminant of uniform thickness and density. Therefore this information is conservative when operating under typical cold weather conditions where patches of slush exist and some degree of sanding is common. Takeoffs in slush or standing water depths greater than 0.5 inches (13 mm) are not recommended because of possible airplane damage as a result of spray impingement on the airplane structure. The use of assumed temperature for reduced thrust is not allowed on contaminated runways. Interpolation for slush/standing water depths between the values shown is permitted.

Takeoff weight determination:

1. Enter the Weight Adjustment table with the dry field/obstacle limit weight to obtain the weight reduction for the slush/standing water depth and airport pressure altitude.
2. Adjust field length available for temperature by amount shown beneath V1(MCG) limit weight table.
3. Enter the V1(MCG) Limit Weight table with the adjusted field length and pressure altitude to obtain the slush/standing water limit weight with respect to minimum field length required for V1(MCG) speed.
4. The maximum allowable takeoff weight in slush/standing water is the lesser of the limit weights found in steps 1 and 3.

Takeoff speed determination:

1. Determine takeoff speeds V1, VR and V2 for actual brake release weight using the Dry Runway Takeoff Speeds table for the appropriate flap setting and thrust rating.
2. If V1(MCG) limited, set V1=V1(MCG). If not limited by V1(MCG) considerations, enter the V1 Adjustment table with actual brake release weight to determine the V1 reduction to apply to V1 speed. If the adjusted V1 is less than V1(MCG), set V1=V1(MCG).

Slippery Runway Takeoff

Airplane braking action is reported as good, medium or poor, depending on existing runway conditions. If braking action is reported as good, conditions should not be expected to be as good as on clean, dry runways. The value “good” is comparative and is intended to mean that airplanes should not experience braking or directional control difficulties when stopping. The performance level used to calculate the “good” data is consistent with wet runway testing done on early Boeing jets. The performance level used to calculate the “poor” data reflects a runway covered with wet ice. Performance is based on a 15 ft screen height at the end of the runway. The tables provided are used in the same manner as the Slush/Standing Water tables.

Anti-Skid Inoperative

When operating with anti-skid inoperative, the field limit weight and V1 must be reduced to account for the effect on accelerate-stop performance. Anti-skid inoperative is only allowed on a dry runway. A simplified method which conservatively accounts for the effects of anti-skid inoperative is to reduce the normal dry field/obstacle limited weight by 18100 lb and the V1 associated with the reduced weight by the amount shown in the table below.

ANTI-SKID INOPERATIVE V1 ADJUSTMENTS	
FIELD LENGTH (FT)	V1 ADJUSTMENT (KIAS)
6000	-21
8000	-17
10000	-14
12000	-11
14000	-10

If the resulting V1 is less than V1(MCG), takeoff is permitted with V1 set equal to V1(MCG) provided the dry accelerate-stop distance adjusted for wind and slope exceeds approximately 5800 ft.

Detailed analysis for the specific case from the Airplane Flight Manual may yield a less restrictive penalty.

Thrust Reverser Inoperative

When dispatching on a wet runway with both thrust reversers operative, an operative anti-skid system, and all brakes operating, regulations allow deceleration credit for one thrust reverser in the engine failure case and two thrust reversers in the all engine stop case.

When dispatching on a wet runway with one thrust reverser inoperative, the field/obstacle limited weight and V1 must be reduced to account for the effect on accelerate-stop performance. A simplified method, which conservatively accounts for this, is to reduce the normal wet runway/field/obstacle limited weight by 2000 lb and the V1 associated with the reduced weight by 2 knots.

If the resulting V1 is less than minimum V1, takeoff is permitted with V1 set equal to V1(MCG) provided the accelerate-stop distance available adjusted for wind and slope exceeds approximately 4000 ft.

Detailed analysis for the specific case from the Airplane Flight Manual may yield a less restrictive penalty.

Takeoff %N1

To find Max Takeoff %N1 based on normal engine bleed for air conditioning packs on, enter Takeoff %N1 Table with airport pressure altitude and airport OAT and read %N1. Apply %N1 adjustments as provided when applicable.

Assumed Temperature Reduced Thrust

Regulations permit the use of up to 25% takeoff thrust reduction for operation with assumed temperature reduced thrust. Use of assumed temperature reduced thrust is not allowed with anti-skid inoperative or on runways contaminated with standing water, ice, slush, or snow. Use of assumed temperature reduced thrust is not recommended if potential windshear conditions exist.

To find the maximum allowable assumed temperature enter the Maximum Assumed Temperature table with airport pressure altitude and OAT. Compare this temperature to that at which the airplane is performance limited as determined from available takeoff performance data. Next, enter the Maximum Takeoff %N1 table with airport pressure altitude and the lower of the two temperatures previously determined, to obtain a maximum takeoff %N1. Do not use an assumed temperature less than the minimum assumed temperature shown. Enter the %N1 Adjustment table with OAT and the difference between the assumed and actual OAT to obtain a %N1 adjustment. Subtract the %N1 adjustment from the maximum takeoff %N1 found previously to determine the assumed temperature reduced thrust %N1.

Apply %N1 adjustments as provided when applicable.

Max Climb %N1

This table shows Max Climb %N1 for a 280/.78 climb speed schedule, normal engine bleed for packs on or off and anti-ice off. Enter the table with airport pressure altitude and TAT and read %N1. %N1 adjustments are shown for anti-ice operation.

Go-around %N1

To find Max Go-around %N1 based on normal engine bleed for packs on (AUTO) and anti-ice on or off, enter the Go-around %N1 table with airport pressure altitude and reported OAT or TAT and read %N1. For packs OFF or HIGH operation, apply the %N1 adjustment shown below the table.

Flight with Unreliable Airspeed / Turbulent Air Penetration

Pitch attitude and average %N1 information is provided for use in all phases of flight in the event of unreliable airspeed/Mach indications resulting from blocking or freezing of the pitot system. Loss of radome or turbulent air may also cause unreliable airspeed/Mach indications. The cruise table in this section may also be used for turbulent air penetration. The Flight with Unreliable Airspeed - FINAL APPROACH table includes a 10 knot margin for landing.

Pitch attitude is shown in bold type for emphasis since altitude and/or vertical speed indications may also be unreliable.

All Engines

Long Range Cruise Maximum Operating Altitude

These tables provide the maximum operating altitude in the same manner as the FMC. Maximum altitudes are shown for a given cruise weight and maneuver capability. This table considers both thrust and buffet limits, providing the more limiting of the two. Any data that is thrust limited is denoted by an asterisk and represents only a thrust limited condition in level flight with 100 ft/min residual rate of climb. Flying above these altitudes with sustained banks in excess of approximately 15° may cause the airplane to lose speed and/or altitude. The altitudes shown in the table are limited to the maximum certified altitude of 41000 ft.

Long Range Cruise Control

These tables provide target %N1, Long Range Cruise Mach number, IAS and standard day fuel flow per engine for the airplane weight and pressure altitude. As indicated by the shaded area, at optimum altitude .79M approximates the Long Range Cruise Mach schedule.

Long Range Cruise Enroute Fuel and Time

Long Range Cruise Enroute Fuel and Time tables are provided to determine remaining time and fuel required to destination. The data is based on Long Range Cruise and .78/280/250 descent. Tables are presented for low altitudes and high altitudes.

To determine remaining fuel and time required, first enter the Ground to Air Miles Conversion table to convert ground distance and enroute wind to an equivalent still air distance for use with the Reference Fuel and Time tables. Next, enter the Reference Fuel and Time table with air distance from the Ground to Air Miles Conversion table and the desired altitude and read Reference Fuel and Time Required. Lastly, enter the Fuel Required Adjustment table with the Reference Fuel and the actual weight at checkpoint to obtain fuel required to destination.

APU Operation During Flight

For APU operation during flight, increase fuel flow according to the table in the Engine Inoperative text section.

Long Range Cruise Wind-Altitude Trade

Wind is a factor which may justify operations considerably below optimum altitude. For example, a favorable wind component may have an effect on ground speed which more than compensates for the loss in air range.

Using this table, it is possible to determine the break-even wind (advantage necessary or disadvantage that can be tolerated) to maintain the same range at another altitude and long range cruise speed. The tables make no allowance for climb or descent time, fuel or distance, and are based on comparing ground fuel mileage.

Descent

Time, fuel, and distance for descent are shown for a .78/280/250 descent speed schedule. Enter the table with top of descent pressure altitude and read distance, time and fuel. Data is based on flight idle thrust descent in zero wind. Allowances are included for a straight-in approach with gear down and landing flaps at the outer marker.

Holding

Target %N1, indicated airspeed and fuel flow per engine information is tabulated for holding with flaps up based on the FMC optimum holding speed schedule. This is the higher of the maximum endurance speed and the maneuvering speed. Small variations in airspeed will not appreciably affect the overall endurance time. Enter the table with weight and pressure altitude to read %N1, IAS and fuel flow per engine.

Advisory Information

Normal Configuration Landing Distance

The normal configuration distance tables are provided as advisory information to help determine the actual landing distance performance of the airplane for different runway surface conditions and brake configurations.

Flaps 15, 30, and 40 landing distances and adjustments are provided for dry runways as well as runways with good, medium, and poor reported braking action, which are commonly referred to as slippery runway conditions.

If the surface is affected by water, snow or ice, and the braking action is reported as "good", conditions should not be expected to be as good as on clean, dry runways. The value "good" is comparative and is intended to mean that airplanes should not experience braking or directional control difficulties when landing. The performance level used to calculate the "good" data is consistent with wet runway testing done on early Boeing jets. The performance level used to calculate "poor" data reflects runways covered with wet ice.

Dry runway landing performance is shown for max manual braking configuration and autobrake settings max, 3, 2, and 1. The autobrake performance may be used to assist in the selection of the most desirable autobrake setting for a given field length. Selection of an autobrake setting results in a constant rate of deceleration. Maximum effort manual braking should achieve shorter landing distance than the max autobrake setting. The reference landing distance is a reference distance from 50 ft above the threshold to stop based on a reference landing weight and normal approach speed for the selected landing flap at sea level, zero wind, zero slope, and two engine detent reverse thrust. Subsequent columns provide adjustments for off-reference landing weight, altitude, wind, slope, temperature, speed, and reverse thrust. Each adjustment is independently added to the reference landing distance.

Non-normal Configuration Landing Distance

Advisory information is provided to support non-normal configurations that affect the landing performance of the airplane. Landing distances and adjustments are provided for dry runways and runways with good, medium, and poor reported braking action.

Enter the table with the applicable non-normal configuration and read the normal approach speed. The reference landing distance is a reference distance from 50 ft above the threshold to stop based on a reference landing weight and speed at sea level, zero wind, and zero slope. Subsequent columns provide adjustments for off-reference landing weight, altitude, wind, slope, and speed conditions. Each adjustment is independently added to the reference landing distance. Landing distance includes the effect of reverse thrust.

Recommended Brake Cooling Schedule

Advisory information is provided to assist in avoiding the problems associated with hot brakes. For normal operation, most landings are at weights below the AFM quick turnaround limit weight.

Use of the recommended cooling schedule will help avoid brake overheat and fuse plug problems that could result from repeated landings at short time intervals or a rejected takeoff.

Enter the Recommended Brake Cooling Schedule table with the airplane weight and brakes on speed, adjusted for wind at the appropriate temperature and altitude condition. Instructions for applying wind adjustments are included below the table. Linear interpolation may be used to obtain intermediate values. The resulting number is the reference brake energy per brake in millions of foot-pounds, and represents the amount of energy absorbed by each brake during a rejected takeoff. Notes providing adjustments for wind are included below the table.

To determine the energy per brake absorbed during landing, enter the appropriate Adjusted Brake Energy Per Brake table (No Reverse Thrust or 2 Engine Reverse) with the reference brake energy per brake and the type of braking used during landing (Max Manual, Max Auto, or Autobrake). The resulting number is the adjusted brake energy per brake and represents the energy absorbed in each brake during the landing.

The recommended cooling time is found in the appropriate (steel or carbon brakes) final table by entering with the adjusted brake energy per brake. Times are provided for ground cooling and inflight gear down cooling.

Brake Temperature Monitor System (BTMS) indications are also shown. If brake cooling is determined from the BTMS, use the hottest brake indication 10 to 15 minutes after the airplane has come to a complete stop, or inflight with gear retracted to determine recommended cooling schedule.

Engine Inoperative

Initial Max Continuous %N1

The Initial Max Continuous %N1 setting for use following an engine failure is shown. The table is based on the typical all engine cruise speed of .79M to provide a target %N1 setting at the start of driftdown. Once driftdown is established, the Max Continuous %N1 table should be used to determine %N1 for the given conditions.

Max Continuous %N1

Power setting is based on one engine operating with one A/C pack operating and all anti-ice bleeds off. Enter the table with pressure altitude, TAT, and IAS or Mach to read %N1.

It is desirable to maintain engine thrust level within the limits of the Max Cruise thrust rating. However, where thrust level in excess of Max Cruise rating is required, such as for meeting terrain clearance, ATC altitude assignments, or to attain maximum range capability, it is permissible to use the thrust needed up to the Max Continuous thrust rating. The Max Continuous thrust rating is intended primarily for emergency use at the discretion of the pilot and is the maximum thrust that may be used continuously.

Driftdown Speed/Level Off Altitude

The table shows optimum driftdown speed as a function of cruise weight at start of driftdown. Also shown are the approximate weight and pressure altitude at which the airplane will level off considering 100 ft/min residual rate of climb.

The level off altitude is dependent on air temperature (ISA deviation).

Driftdown/LRC Range Capability

This table shows the range capability from the start of driftdown. Driftdown is continued to level off altitude. As weight decreases due to fuel burn, the airplane is accelerated to Long Range Cruise speed. Cruise is continued at level off altitude and Long Range Cruise speed.

To determine fuel required, enter the Ground to Air Miles Conversion table with the desired ground distance and adjust for anticipated winds to obtain air distance to destination. Then enter the Driftdown/Cruise Fuel and Time table with air distance and weight at start of driftdown to determine fuel and time required. If altitudes other than the level off altitude is used, fuel and time required may be obtained by using the Engine Inoperative Long Range Cruise Enroute Fuel and Time table.

Long Range Cruise Altitude Capability

The table shows the maximum altitude that can be maintained at a given weight and air temperature (ISA deviation), based on Long Range Cruise speed, Max Continuous thrust, and 100 ft/min residual rate of climb.

Long Range Cruise Control

The table provides target %N1, engine inoperative Long Range Cruise Mach number, IAS and fuel flow for the airplane weight and pressure altitude. The fuel flow values in this table reflect single engine fuel burn.

APU Operation During Flight

For APU operation during flight, increase fuel flow according to the following table. These increments include the APU fuel flow and the effect of increased drag from the APU door.

PRESSURE ALTITUDE (1000 FT)	APU FUEL FLOW (LB/HR)
39	100
35	100
31	110
25	130
20	150
15	160
10	180
5	200

Long Range Cruise Diversion Fuel and Time

Tables are provided for crews to determine the fuel and time required to proceed to an alternate airfield with one engine inoperative. The data is based on single engine Long Range Cruise speed and .78/280/250 descent. Enter with Air Distance as determined from the Ground to Air Miles Conversion table and read Fuel and Time required at the cruise pressure altitude. Adjust the fuel obtained for deviation from the reference weight at checkpoint as required by entering the off reference fuel adjustments table with the fuel required for the reference weight and the actual weight at checkpoint. Read fuel required and time for the actual weight.

Holding

Single engine holding data is provided in the same format as the all engine holding data and is based on the same assumptions.

Gear Down Landing Rate of Climb Available

Rate of climb data is provided as guidance information in the event an engine inoperative landing (manual or autoland) is planned. The tables show gear down rate of climb available for Flaps 15 and Flaps 30. Enter the table with TAT and pressure altitude to read rate of climb available. Apply adjustments shown to correct for weight.

Alternate Mode EEC

Introduction

This section contains performance data for airplane operation with the Electronic Engine Control (EEC) in the alternate mode (ALTN EEC switch illuminated) for applicable thrust ratings. The data includes engine bleed effects for normal air conditioning operation i.e., two packs on at normal flow all engines operating.

Operation with derate and/or assumed temperature reduced thrust is not permitted with the EEC in alternate mode.

Limit Weight

A simplified method which conservatively accounts for the effects of EEC in alternate mode is to reduce the normal mode (ON EEC switch illuminated) performance limited weights. The Limit Weight table provides takeoff field, climb, obstacle, tire speed and brake energy limit weights. To determine limit weights for operations with the EEC in the alternate mode, enter the table with the limit weights for normal mode EEC operation and read the associated limit weight for each performance condition. The most limiting of the takeoff weights must be used. Analysis from the Airplane Flight Manual - Digital Performance Information may yield less restrictive limit weights.

Takeoff Speed Adjustment

Takeoff speeds for the reduced weight should be increased by the amount shown in the Takeoff Speeds Adjustment table. The adjusted V1 should not exceed the adjusted VR.

Note: The FMC does not incorporate alternate mode EEC performance in its takeoff speeds calculations.

Max Takeoff %N1

The alternate mode EEC thrust schedule provides equal or greater thrust than the normal mode thrust for the same thrust lever position. Thrust limit protection is not provided in alternate mode EEC and maximum rated thrust may be reached at thrust lever position less than full forward. As a result, thrust overboost may occur if the target alternate mode EEC Max Takeoff %N1 settings are not observed.

To find alternate mode EEC Max Takeoff %N1 based on normal engine bleed for air conditioning packs on, enter the Alternate Mode EEC Max Takeoff %N1 table with airport pressure altitude and airport OAT and read %N1. For packs off apply the %N1 adjustment provided below the table. No %N1 adjustment is required for engine or wing anti-ice.

Gear Down

This section contains performance for airplane operation with the landing gear extended. The data is based on engine bleeds for normal air conditioning.

Note: The Flight Management Computer System (FMCS) does not contain special provisions for operation with landing gear extended. As a result, the FMCS may generate inappropriate enroute speed schedules, display non-conservative predictions of fuel burn, estimated time of arrival (ETA), maximum altitude, and compute overly shallow descent path. An accurate estimated time of arrival (ETA) is available if current speed or Mach is entered into the VNAV cruise page.

Tables for gear down performance in this section are identical in format and used in the same manner as tables for the gear up configuration previously described.

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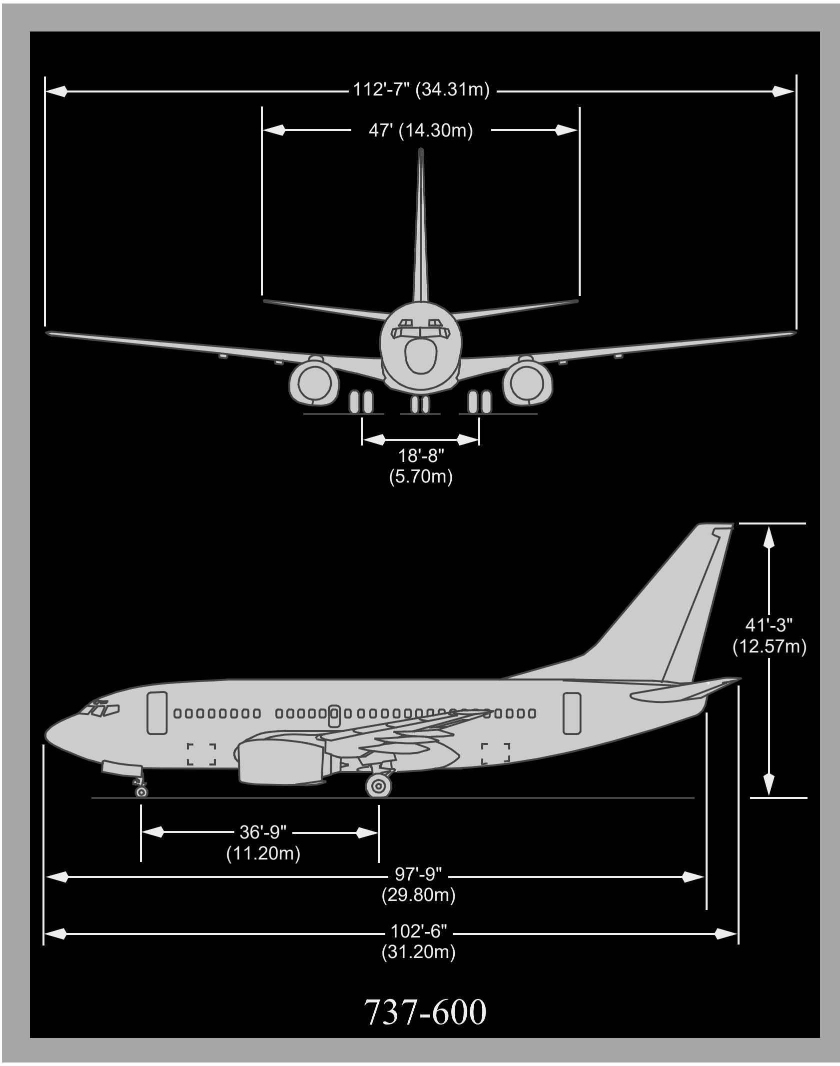
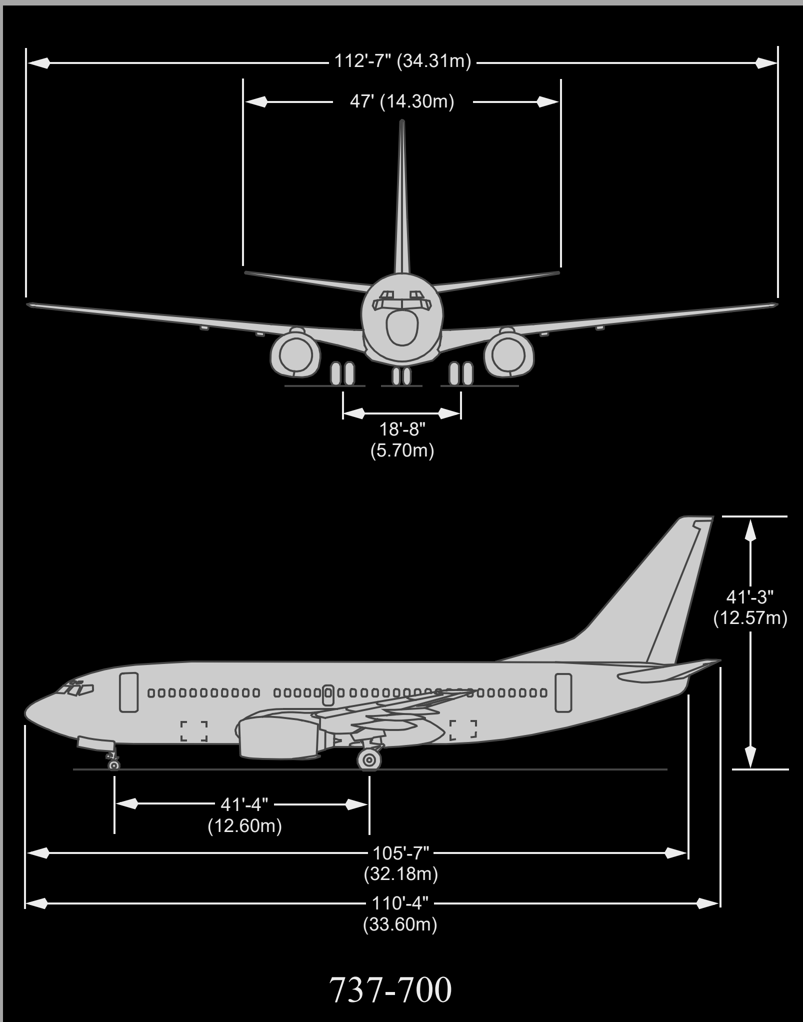
Airplane General, Emergency Equipment, Doors, Windows — Chapter 1

Table of Contents — Section TOC

Airplane General, Emergency Equipment, Doors, Windows — Chapter 1
Dimensions — Section 10

Principal Dimensions

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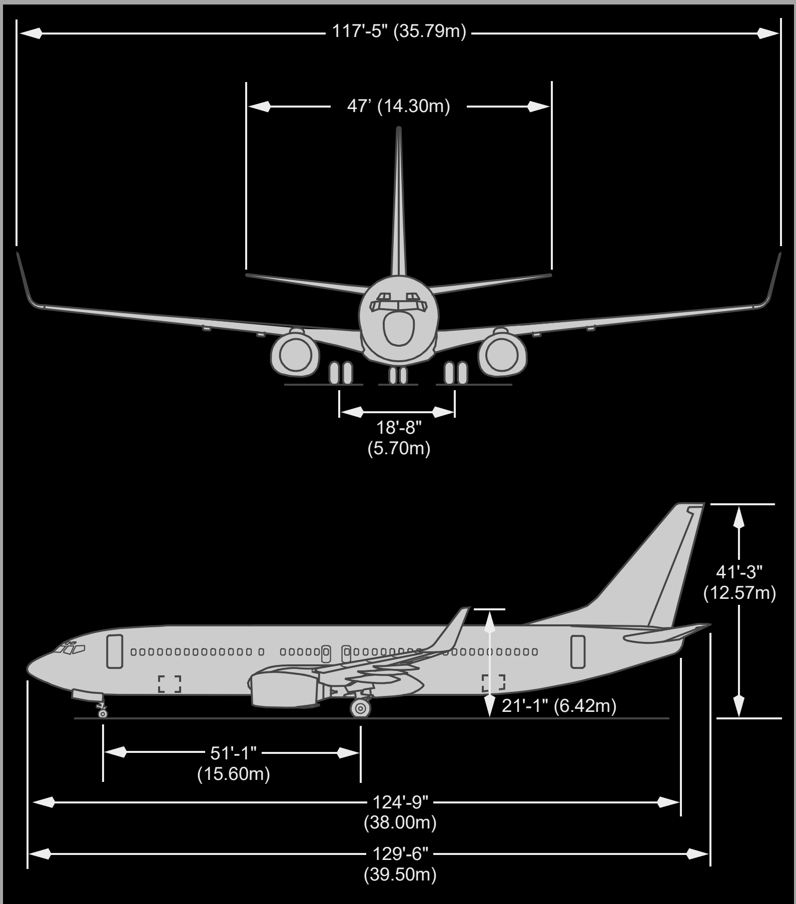
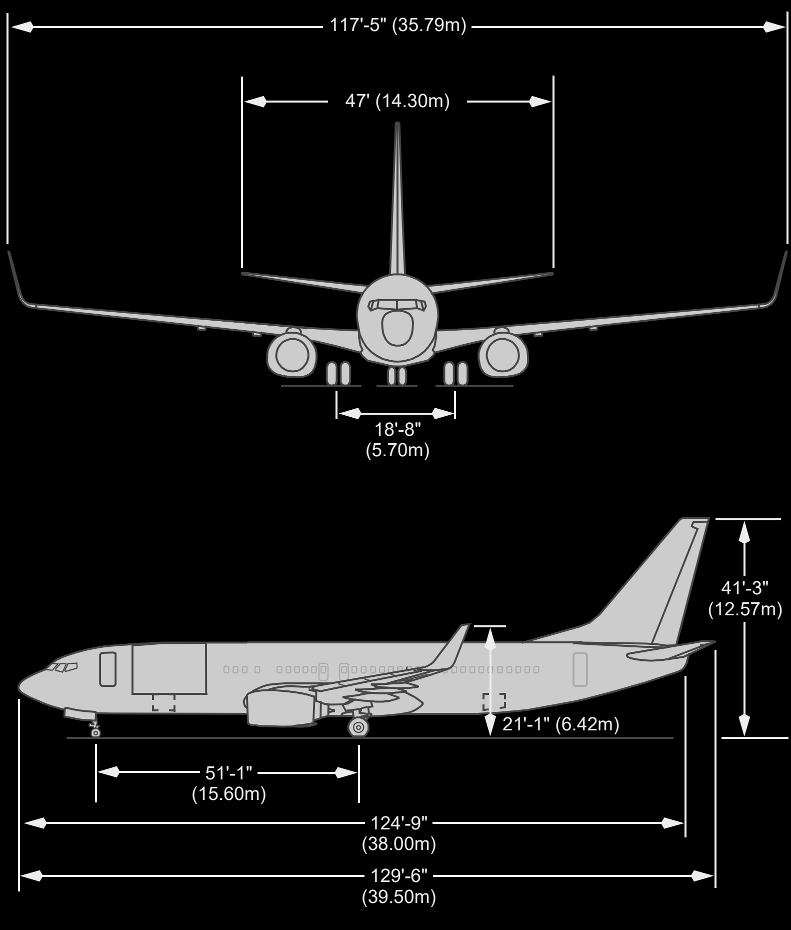
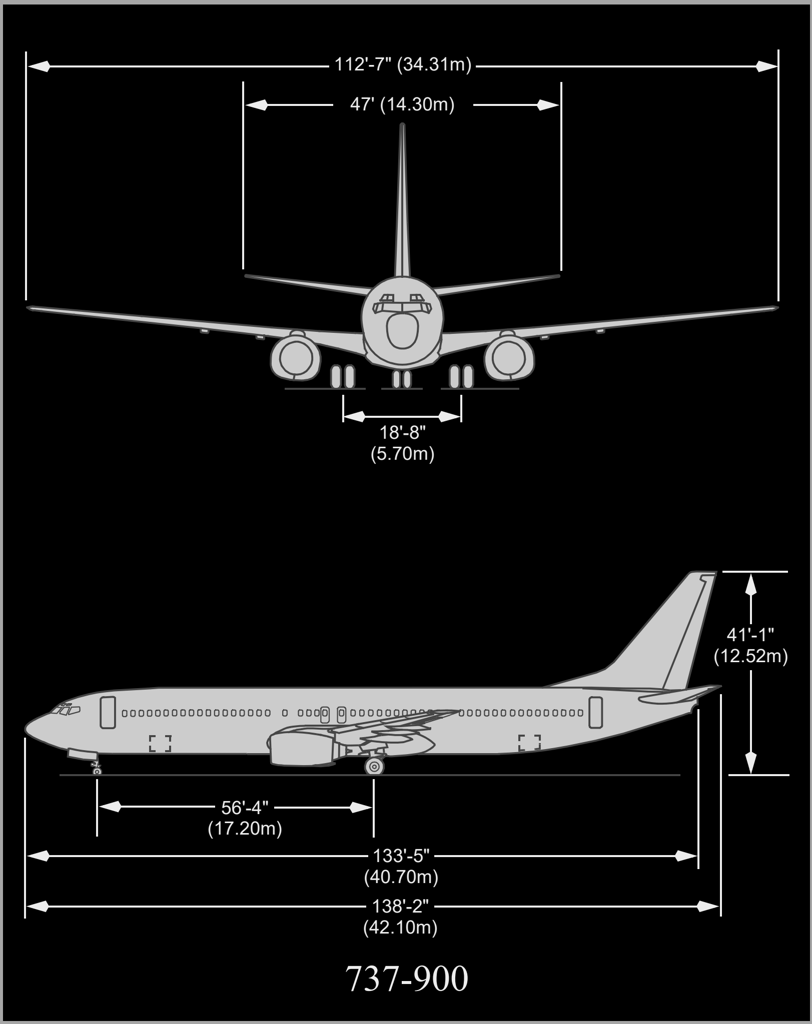
47' (14.30m)
18'-8"
(5.70m)
41'-3"
(12.57m)
41'-4"
(12.60m)
105'-7"
(32.18m)
110'-4"
(33.60m)
737-700

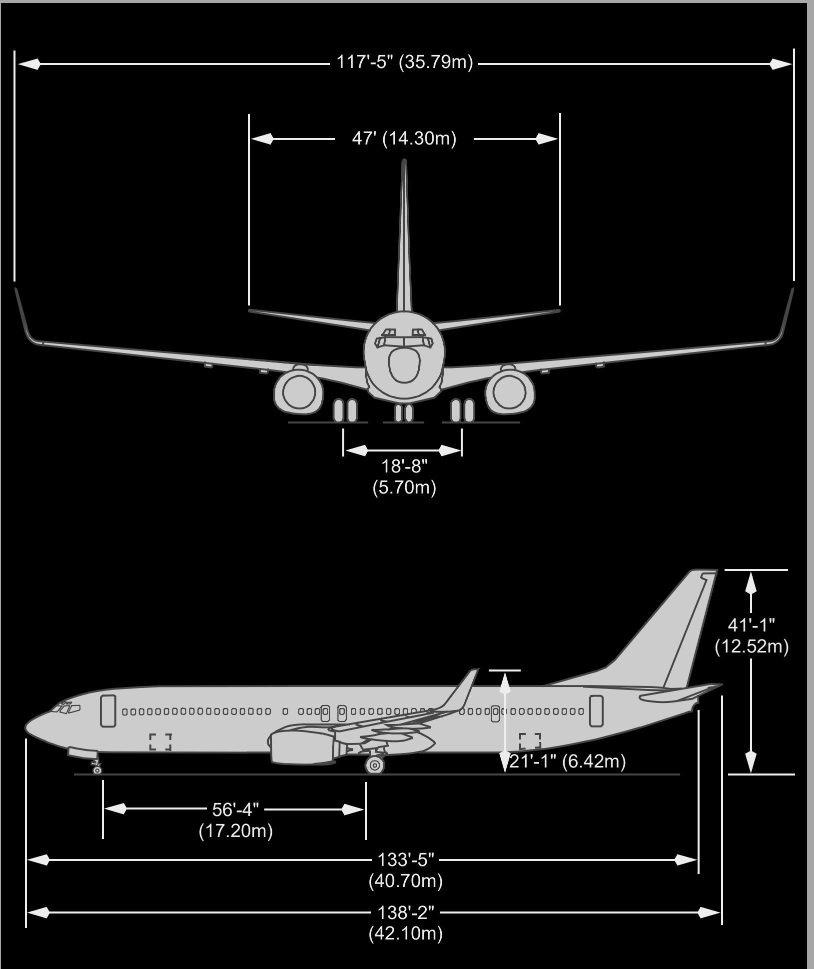


737-800 With Winglets



737-800BCF With Winglets


112'-7" (34.31m)
47' (14.30m)
18'-8"
(5.70m)
41'-1"
(12.52m)
56'-4"
(17.20m)
133'-5"
(40.70m)
138'-2"
(42.10m)
737-900

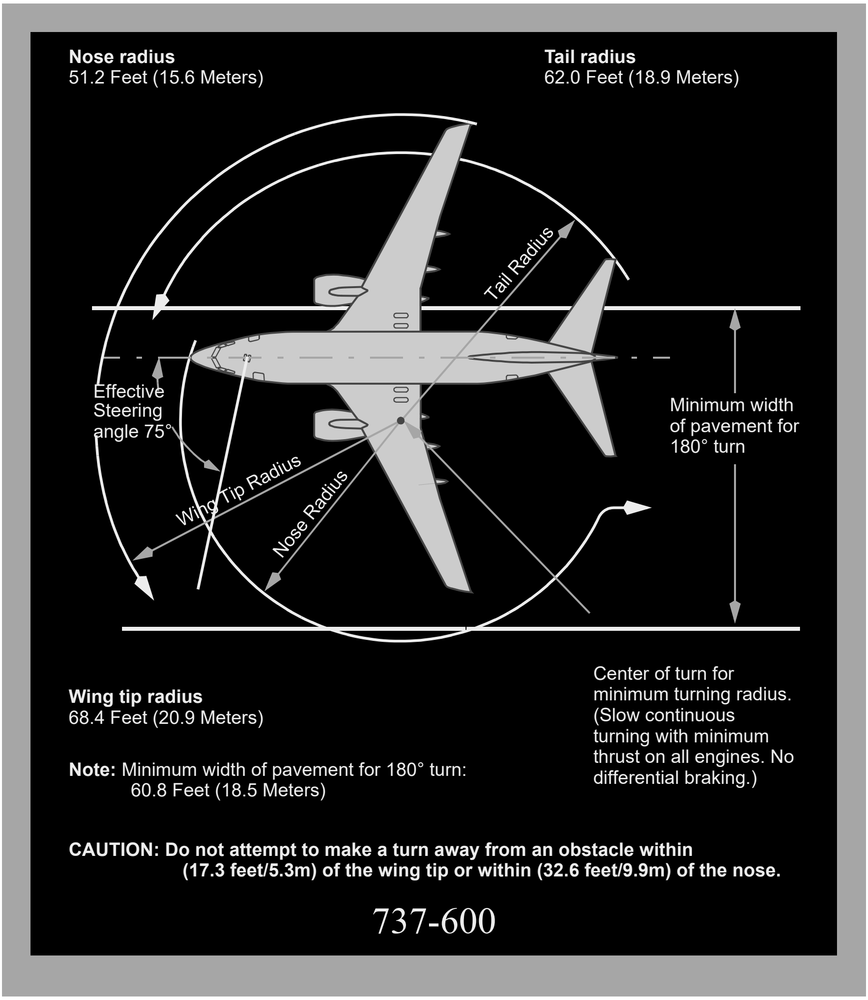


737-900ER With Winglets

Turning Radius

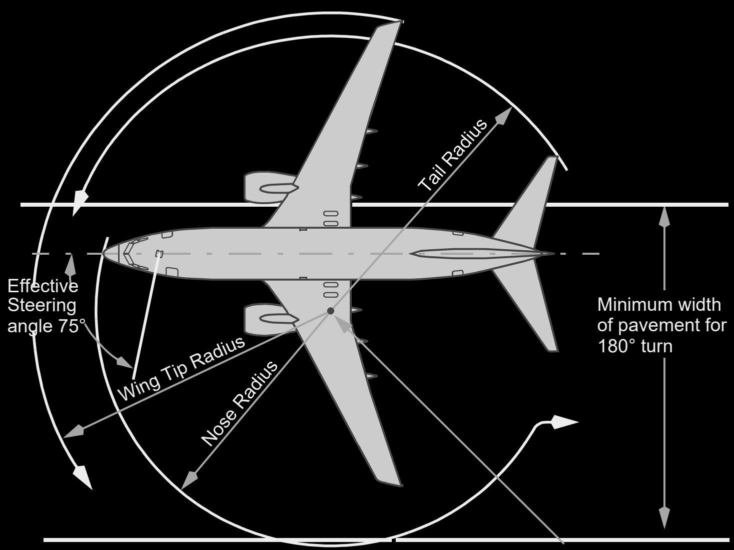
[Option: 737-600 without Winglets or 737-700 or 737-800 with Winglets]
The wingtip swings the largest arc while turning and determines the minimum obstruction clearance path. All other portions of the airplane structure remain within this arc.

[Option: 737-800 without Winglets or 737-900/737-900ER with winglets]
The tail swings the largest arc while turning and determines the minimum obstruction clearance path. All other portions of the airplane remain within this arc.



Nose radius
55.9 Feet (17.0 Meters)

Tail radius
65.5 Feet (20.0 Meters)



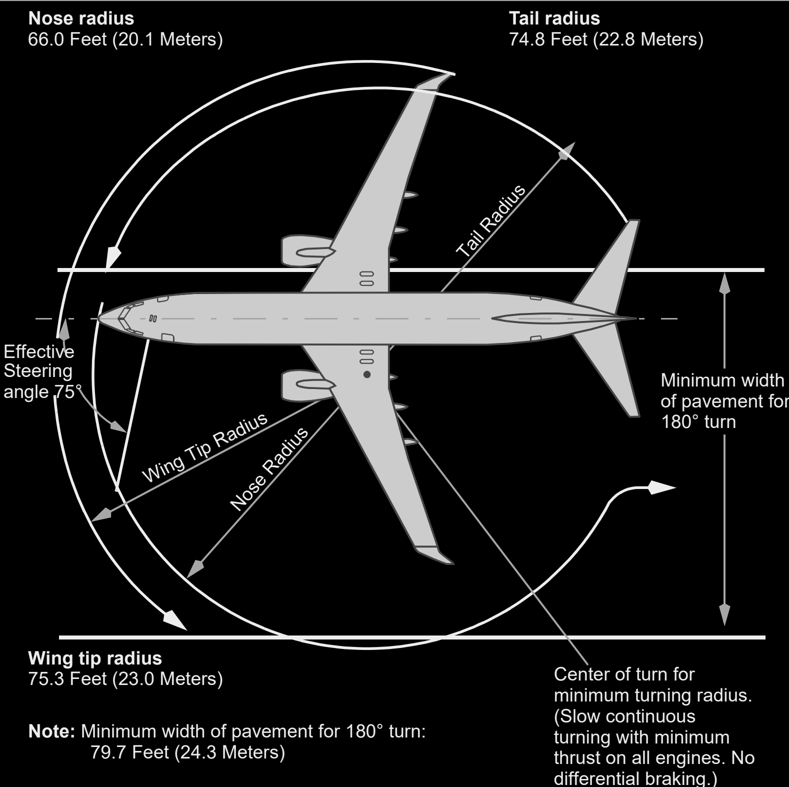
Center of turn for minimum turning radius. (Slow continuous turning with minimum thrust on all engines. No differential braking.)

Wing tip radius
69.6 Feet (21.2 Meters)

Note: Minimum width of pavement for 180° turn:
66.9 Feet (20.4 Meters)

CAUTION: Do not attempt to make a turn away from an obstacle within (17.2 feet/5.2m) of the wing tip or within (29.0 feet/8.8m) of the nose.

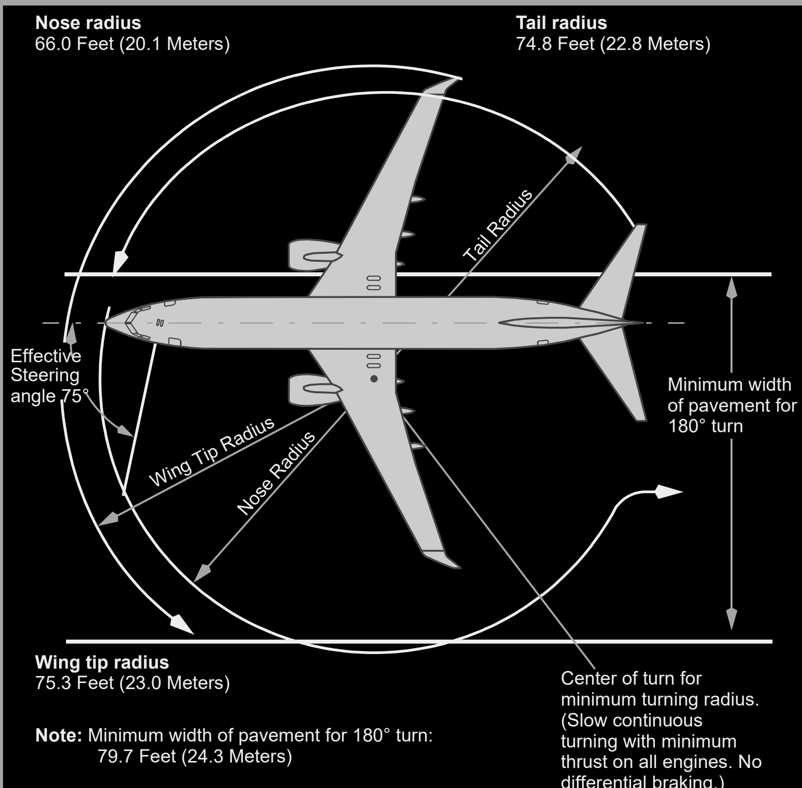
737-700



Note: Minimum width of pavement for 180° turn:
79.7 Feet (24.3 Meters)

CAUTION: Do not attempt to make a turn away from an obstacle within (17.8 feet/5.4m) of the wing tip or within (24.3 feet/7.4m) of the nose.

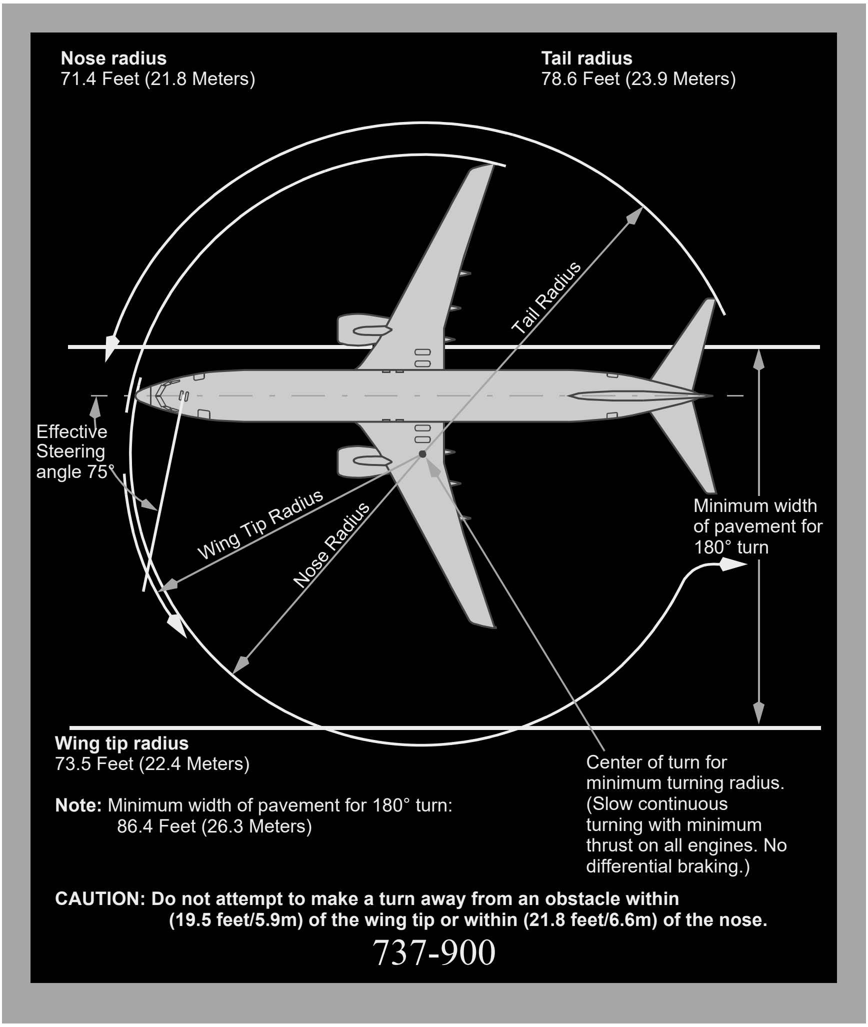
737-800 With Winglets

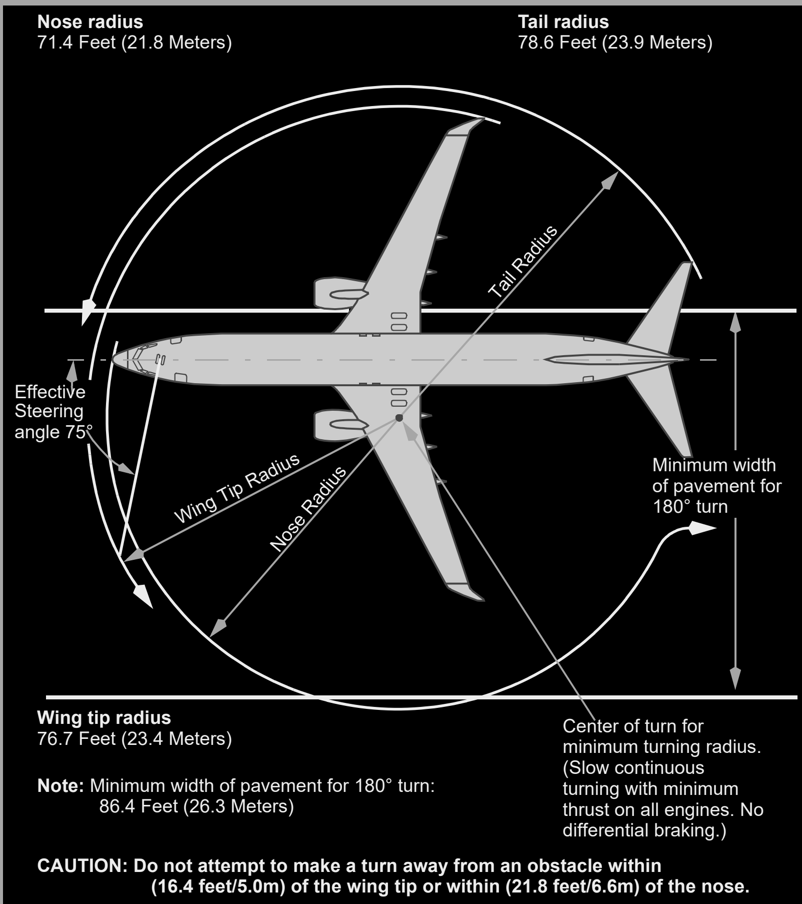


Note: Minimum width of pavement for 180° turn:
79.7 Feet (24.3 Meters)

CAUTION: Do not attempt to make a turn away from an obstacle within (17.8 feet/5.4m) of the wing tip or within (24.3 feet/7.4m) of the nose.

737-800BCF With Winglets


Nose radius
71.4 Feet (21.8 Meters)
Tail radius
78.6 Feet (23.9 Meters)
Tail Radius
Effective
Steering
angle 75°
Wing Tip Radius
Nose Radius
Minimum width
of pavement for
180° turn
Wing tip radius
73.5 Feet (22.4 Meters)
Note: Minimum width of pavement for 180° turn:
86.4 Feet (26.3 Meters)
Center of turn for
minimum turning radius.
(Slow continuous
turning with minimum
thrust on all engines. No
differential braking.)
CAUTION: Do not attempt to make a turn away from an obstacle within
(19.5 feet/5.9m) of the wing tip or within (21.8 feet/6.6m) of the nose.
737-900

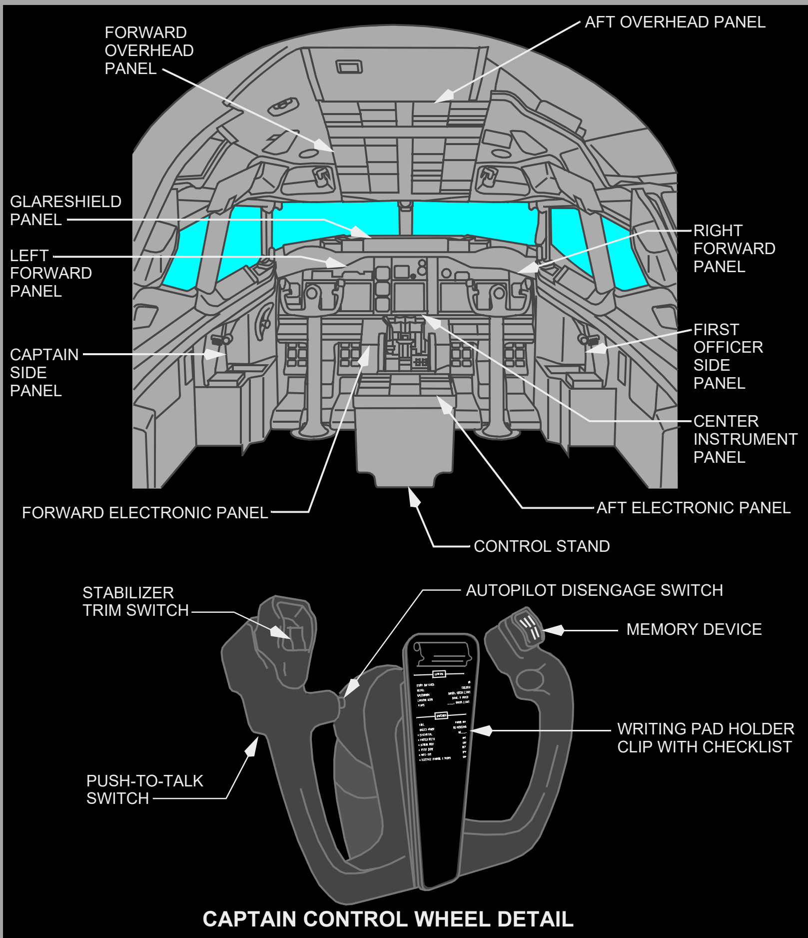


737-900ER With Winglets

Airplane General, Emergency Equipment, Doors, Windows — Chapter 1

Instrument Panels — Section 20

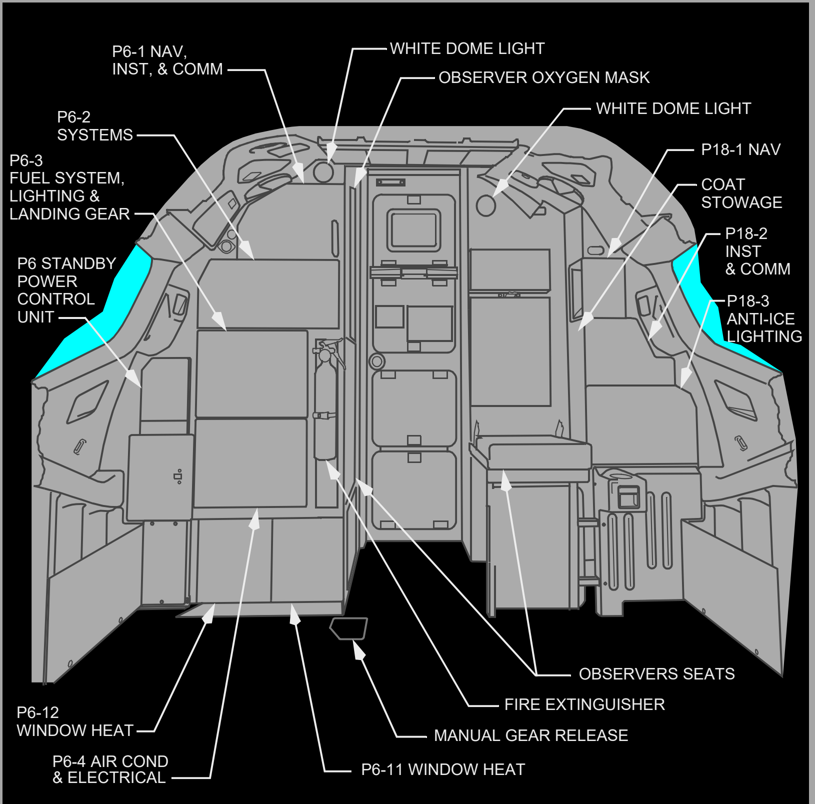
Panel Arrangement



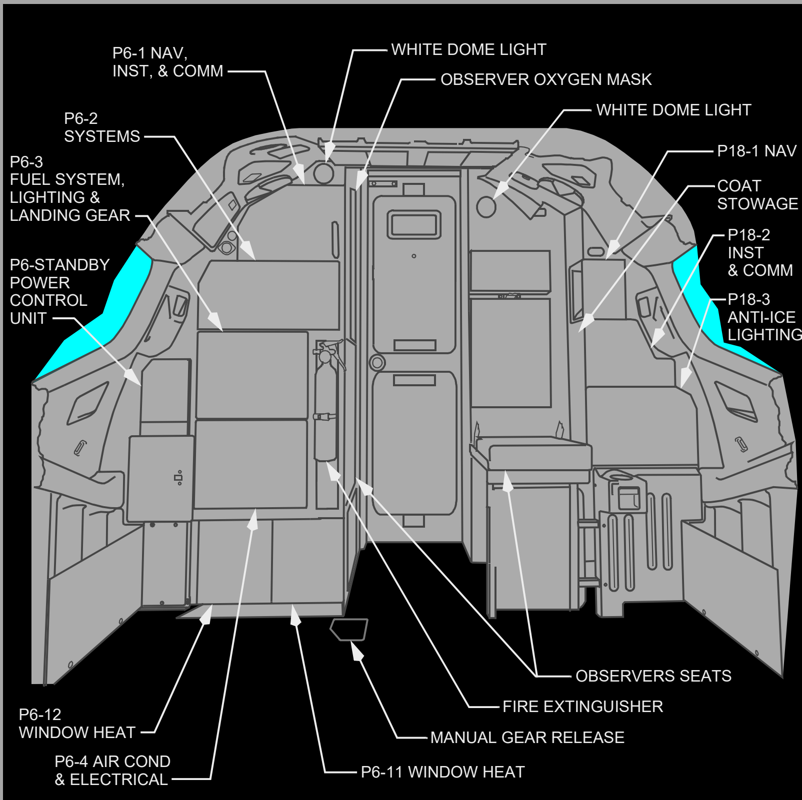
On the following pages, circled numbers refer to chapters where information on the item may be found.

The panels, controls, and indicators shown in this chapter are representative of installed units and may not exactly match the latest configuration. Refer to the appropriate chapter system descriptions for current information.

Aft Flight Deck Overview



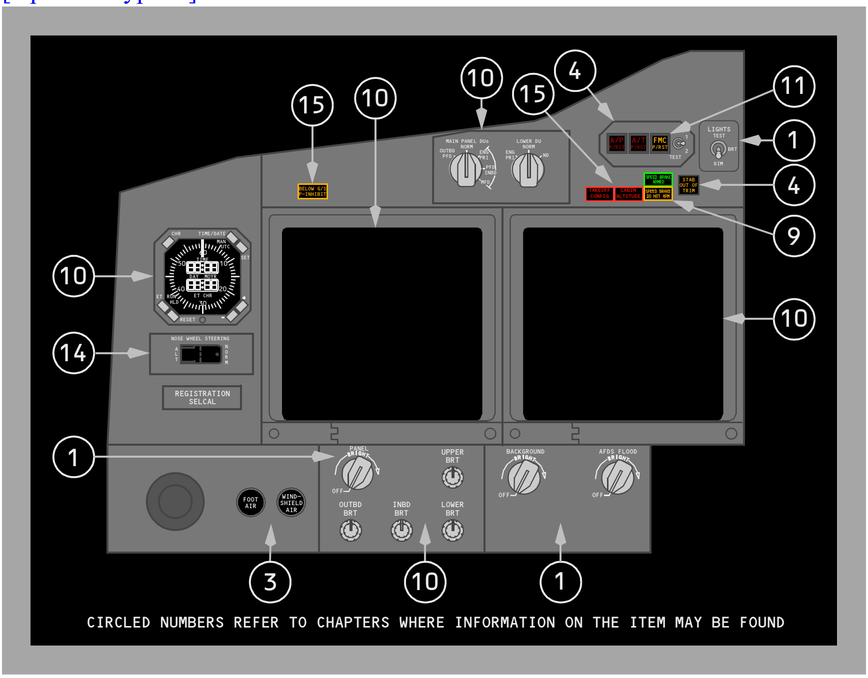
AFT FLIGHT DECK OVERVIEW



AFT FLIGHT DECK OVERVIEW

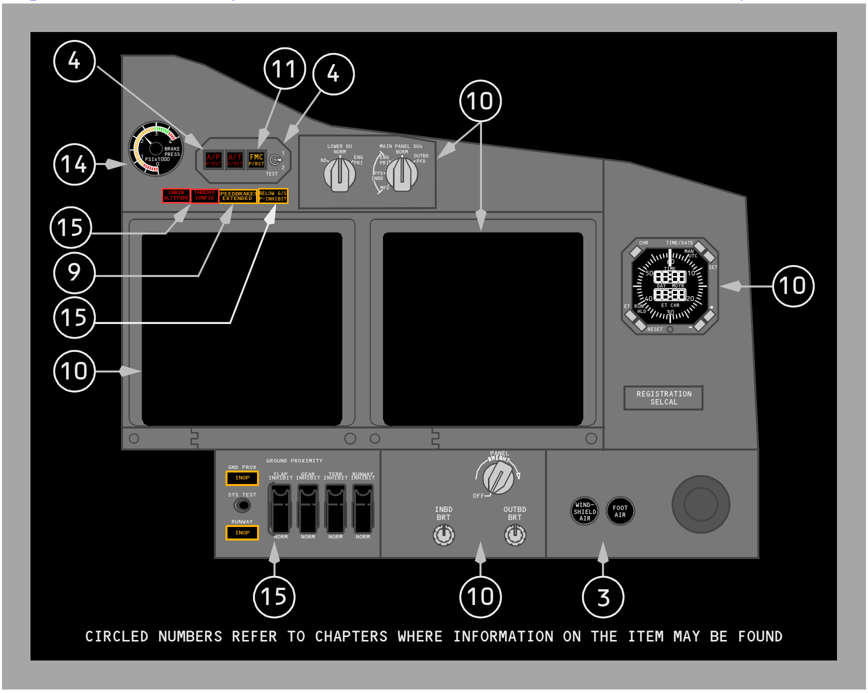
Left Forward Panel

[Option - Typical]



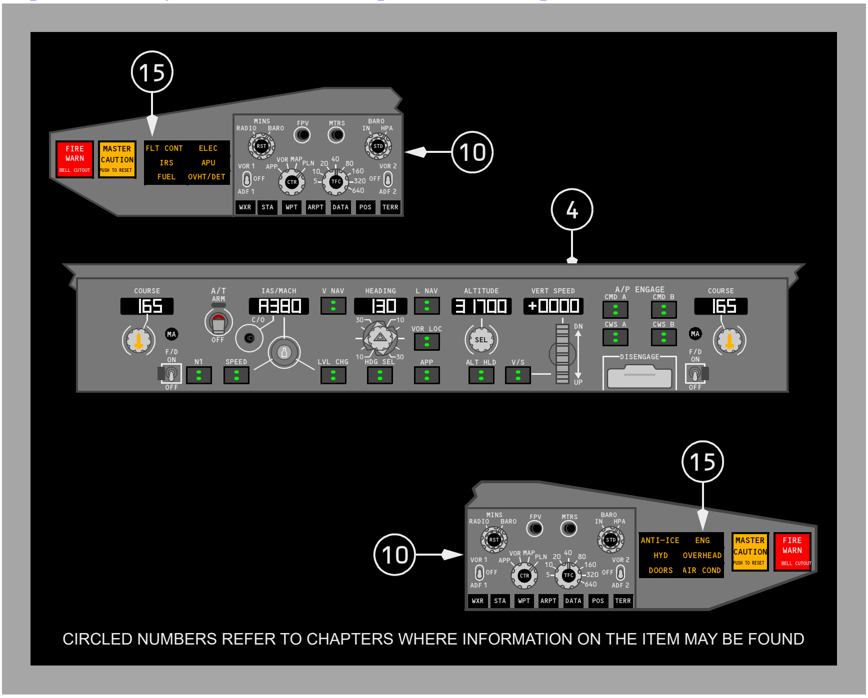
Right Forward Panel

[Option - The Runway Inhibit Switch shown on the Ground Proximity Panel]



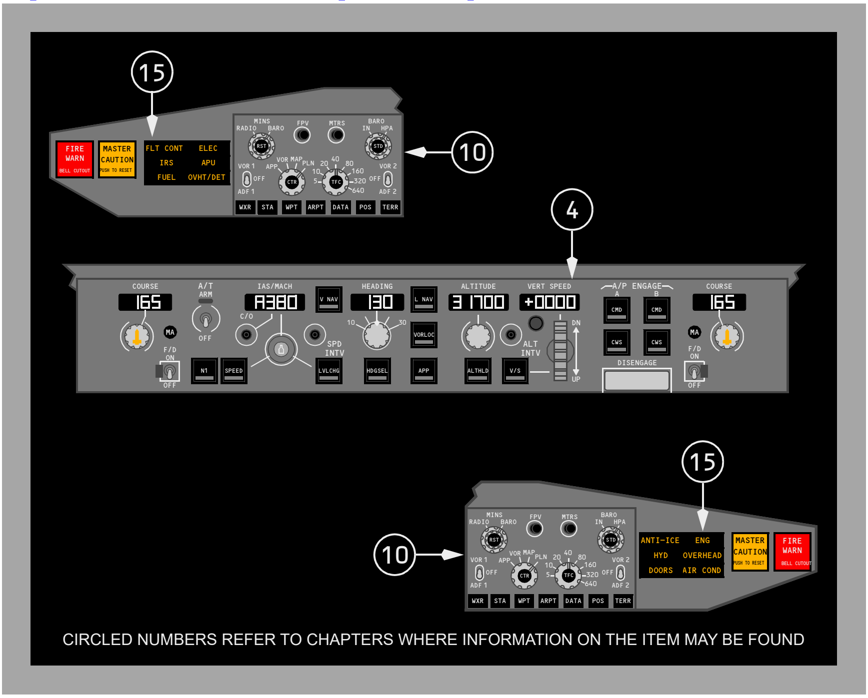
Glareshield Panel

[Option - Honeywell mode control panel without speed and altitude intervention]



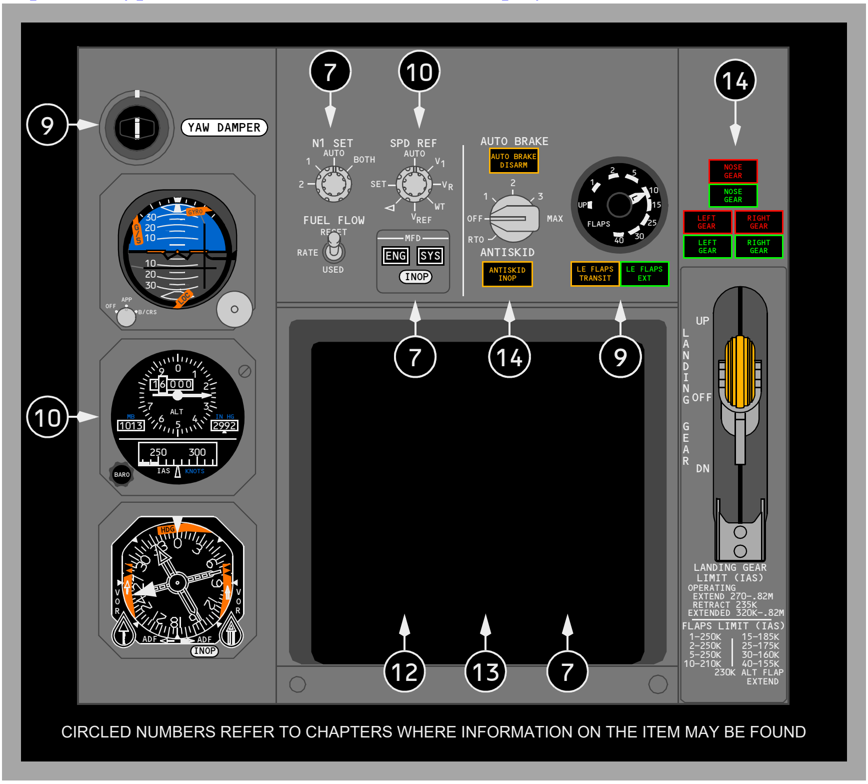
CIRCLED NUMBERS REFER TO CHAPTERS WHERE INFORMATION ON THE ITEM MAY BE FOUND

[Option - Collins mode control panel with speed and altitude intervention]

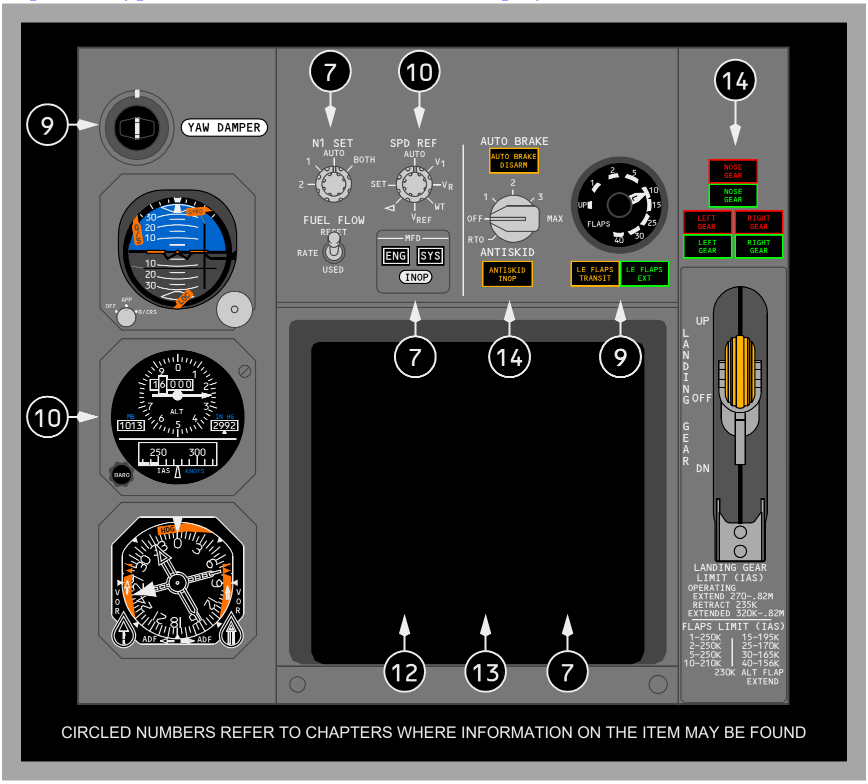


Center Instrument Panel

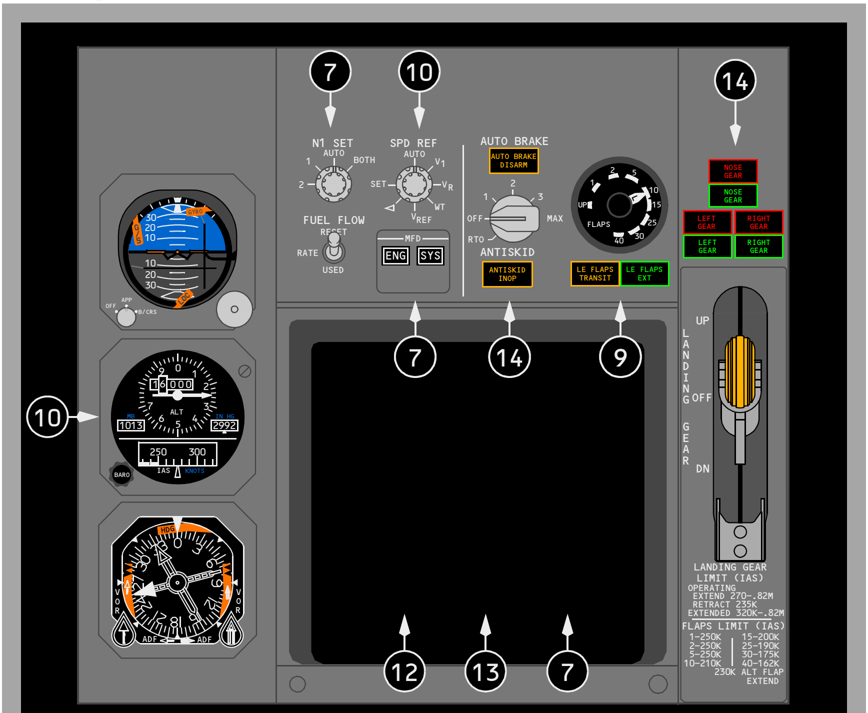
[Option - Typical 737-600 with EFIS/MAP displays]



[Option - Typical 737-700 with EFIS/MAP displays]

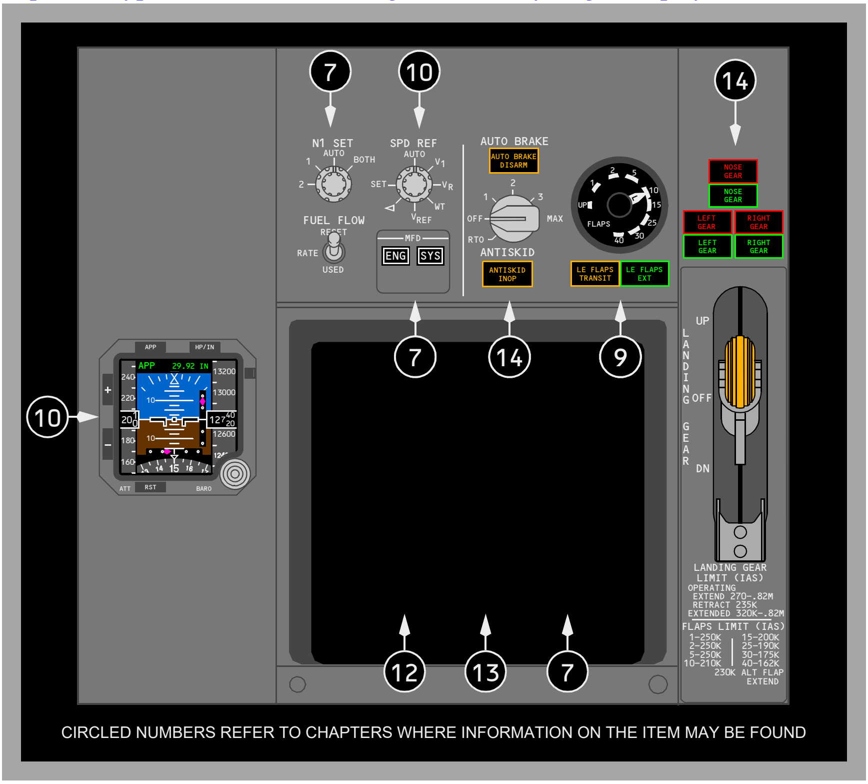


[Option - Typical 737-800/900 with PFD/ND displays and Yaw Damper Indicator removed]



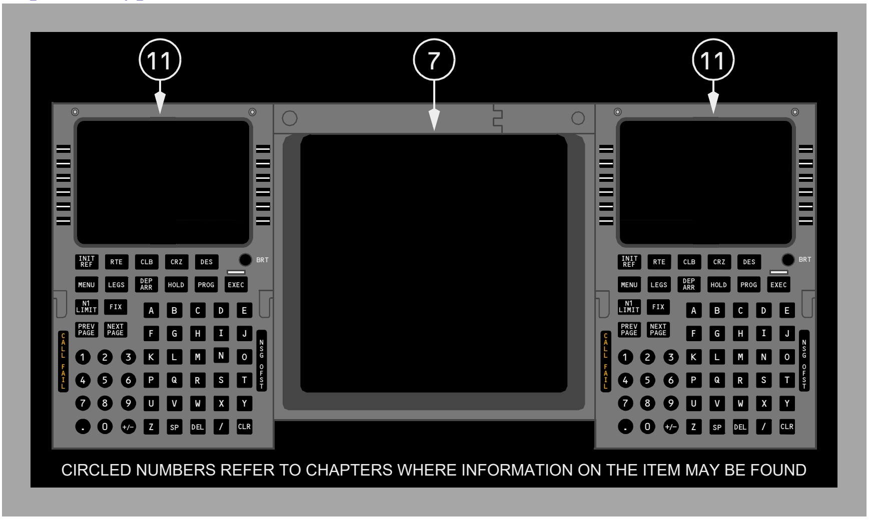
CIRCLED NUMBERS REFER TO CHAPTERS WHERE INFORMATION ON THE ITEM MAY BE FOUND

[Option - Typical 737-900 with Integrated Standby Flight Display and PFD/ND]



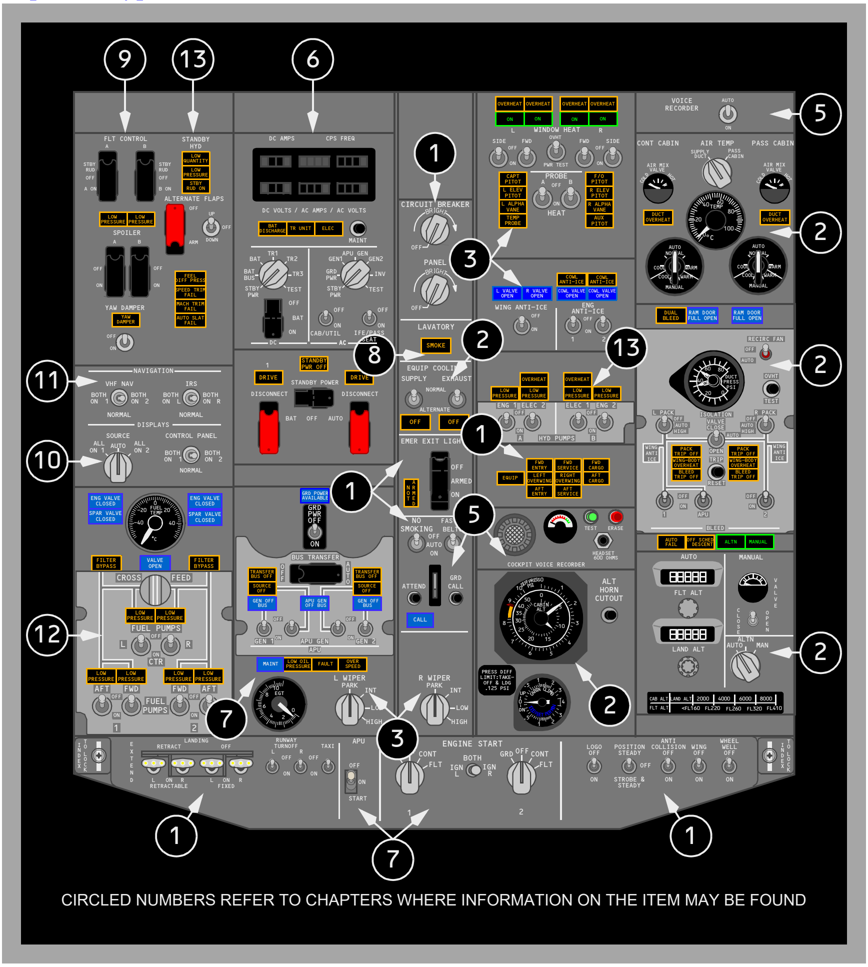
Forward Electronic Panel

[Option - Typical MCDU LCD]



737-600/700 Forward Overhead Panel

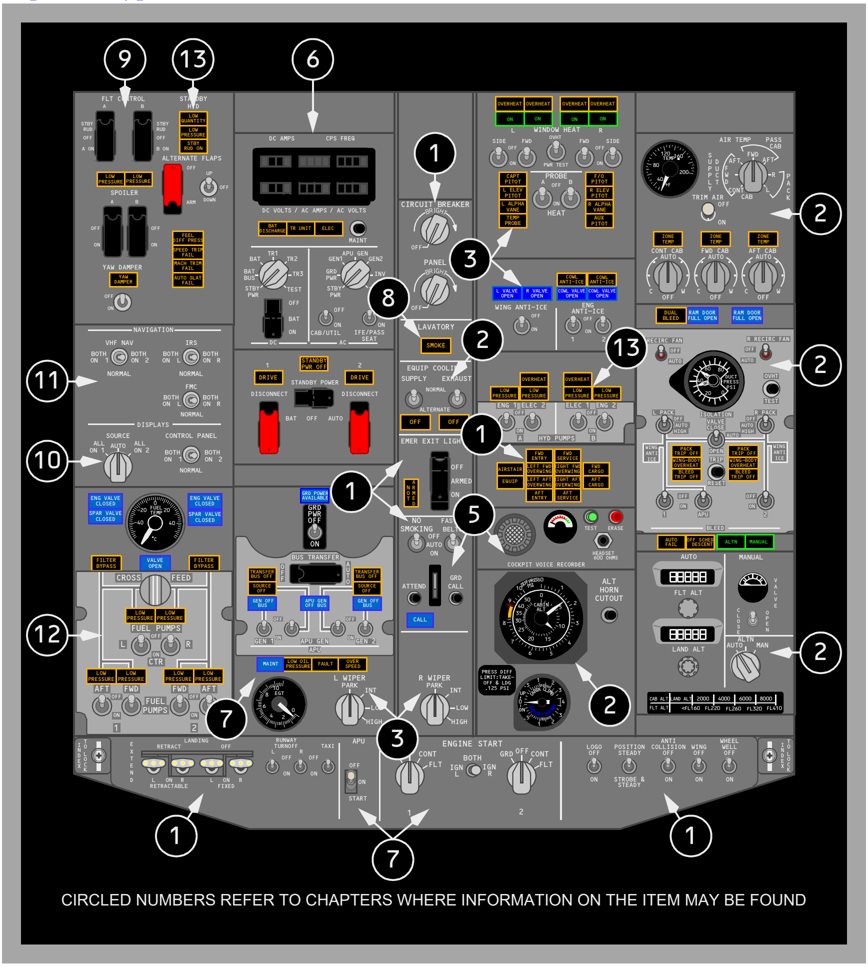
[Option - Typical 737-600/700 Forward Overhead Panel]



CIRCLED NUMBERS REFER TO CHAPTERS WHERE INFORMATION ON THE ITEM MAY BE FOUND

737-800/900 Forward Overhead Panel

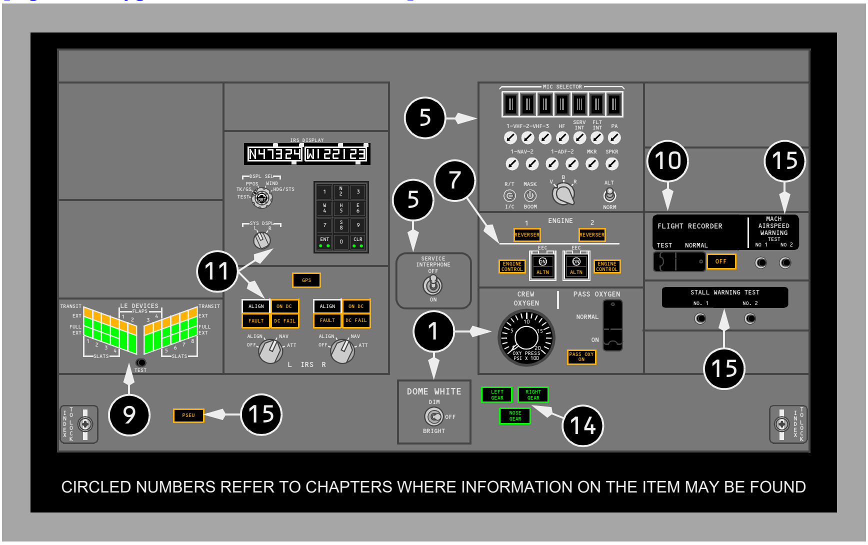
[Option - Typical 737-800/900 Forward Overhead Panel]



CIRCLED NUMBERS REFER TO CHAPTERS WHERE INFORMATION ON THE ITEM MAY BE FOUND

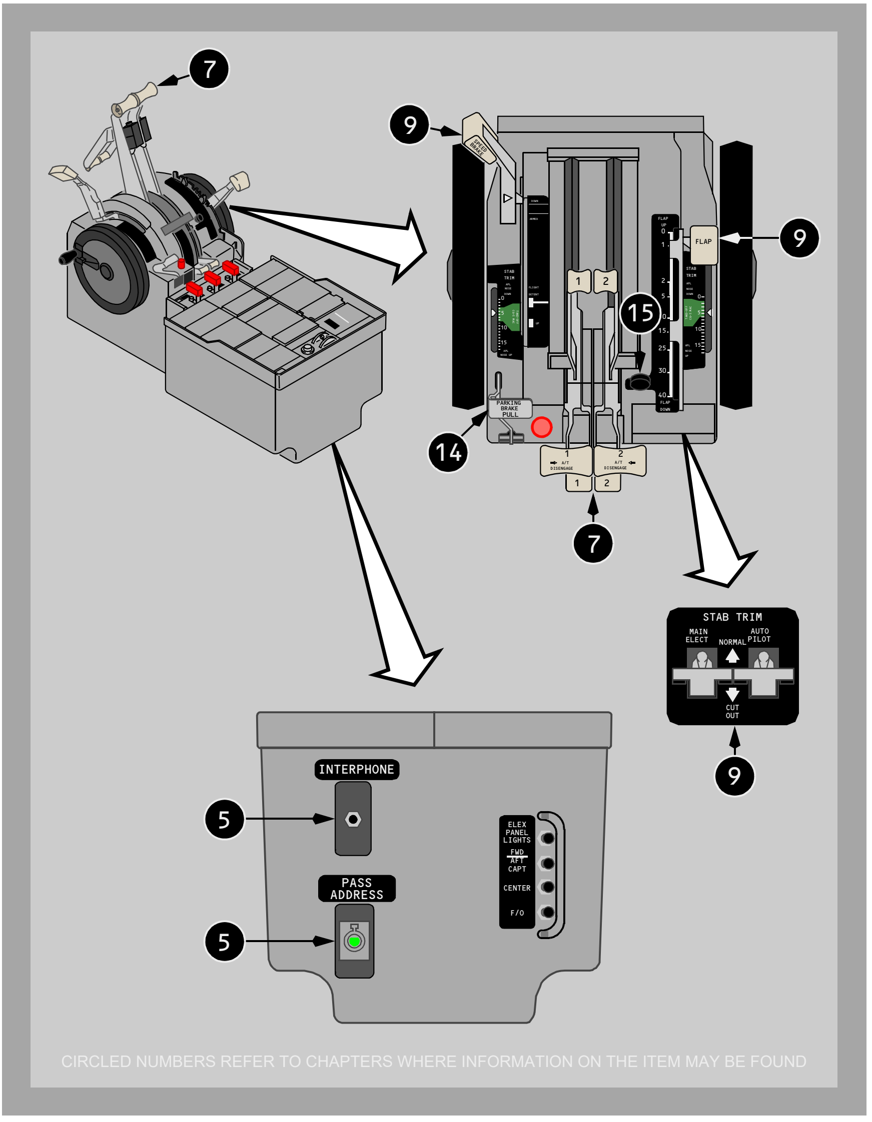
Aft Overhead Panel

[Option - Typical Aft Overhead Panel]

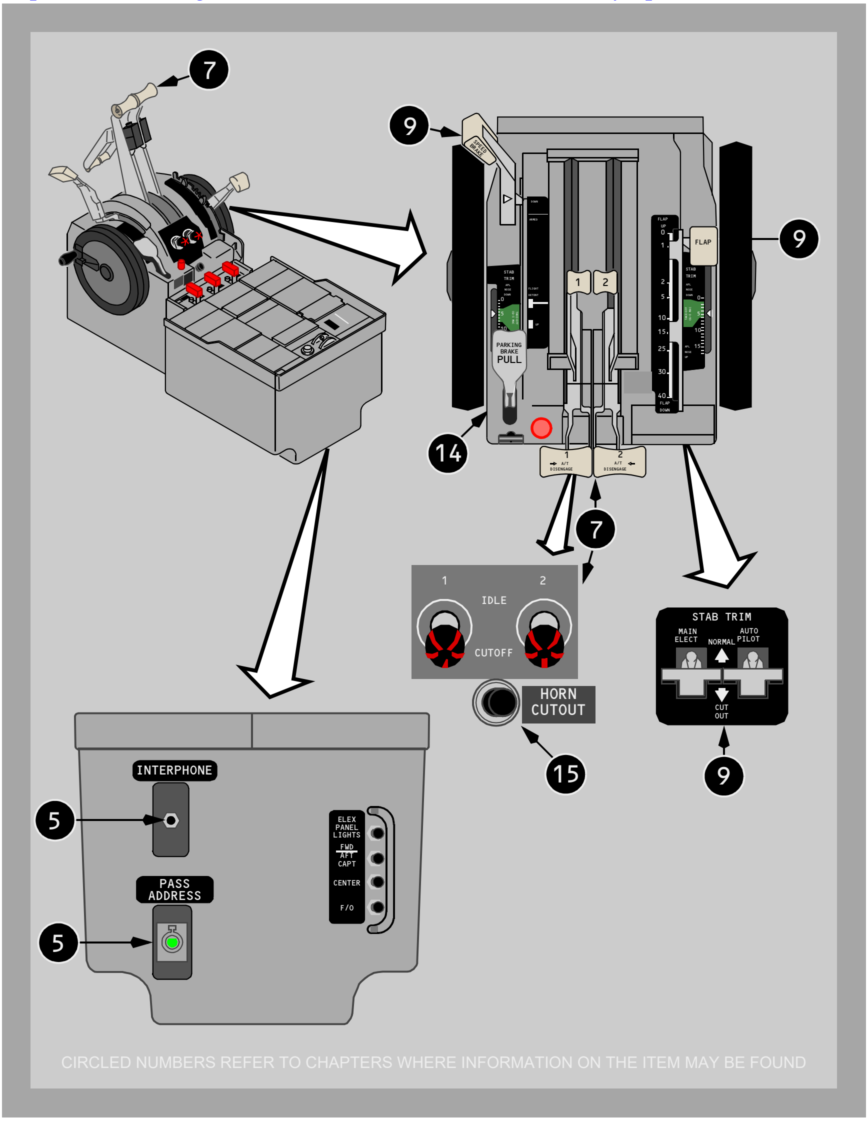


CIRCLED NUMBERS REFER TO CHAPTERS WHERE INFORMATION ON THE ITEM MAY BE FOUND

Control Stand

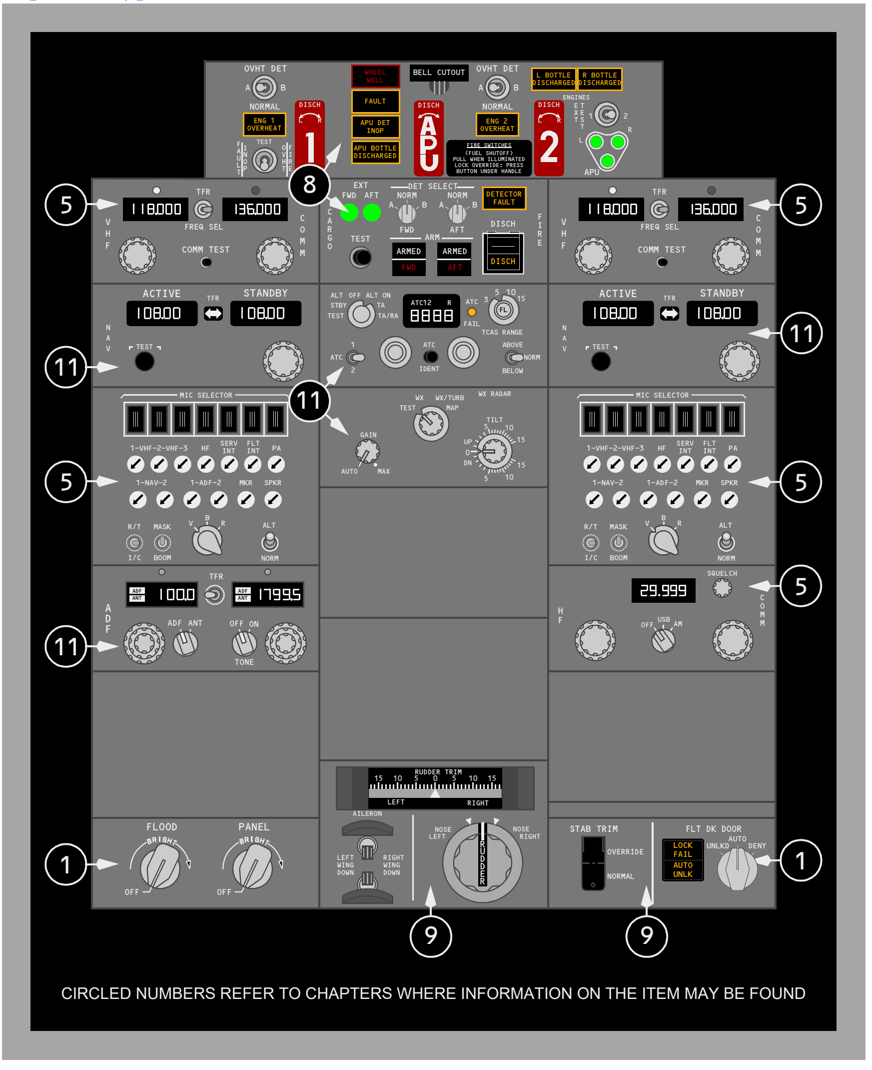


[Option - New Engine Start Levers - After L/N 5605 or by option]



Aft Electronic Panel

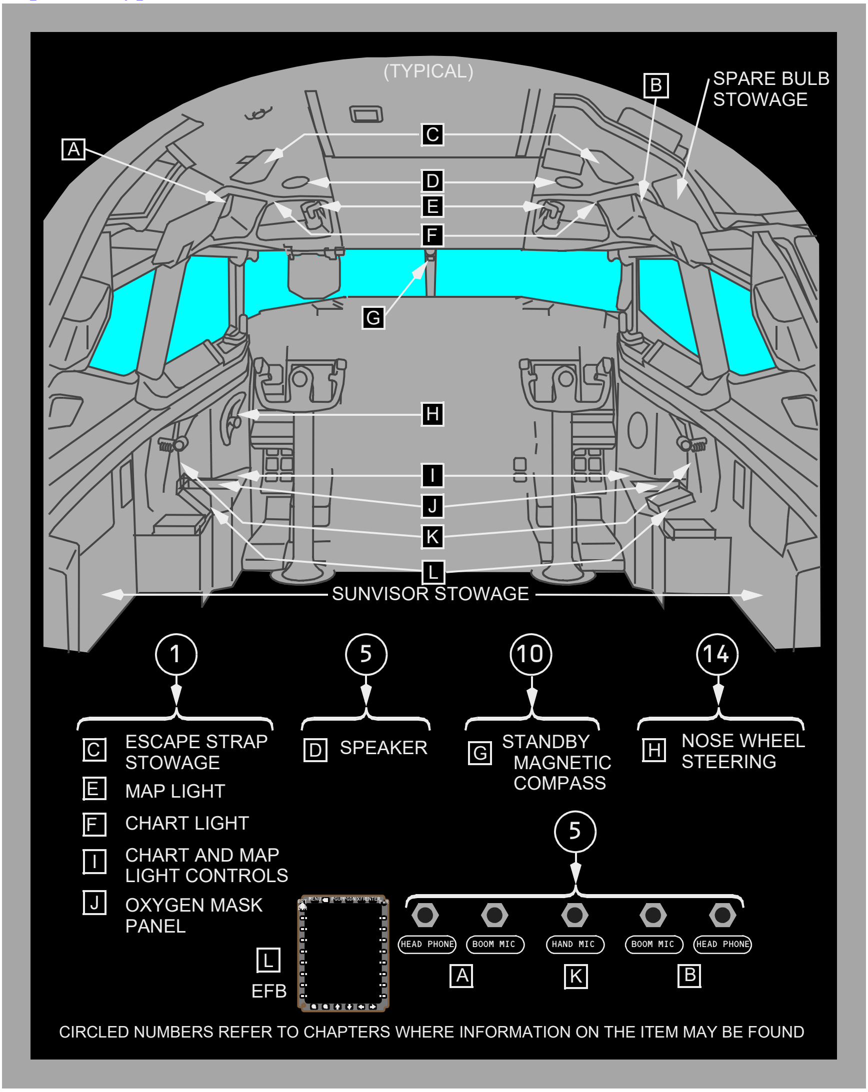
[Option - Typical Aft Electronic Panel]



CIRCLED NUMBERS REFER TO CHAPTERS WHERE INFORMATION ON THE ITEM MAY BE FOUND

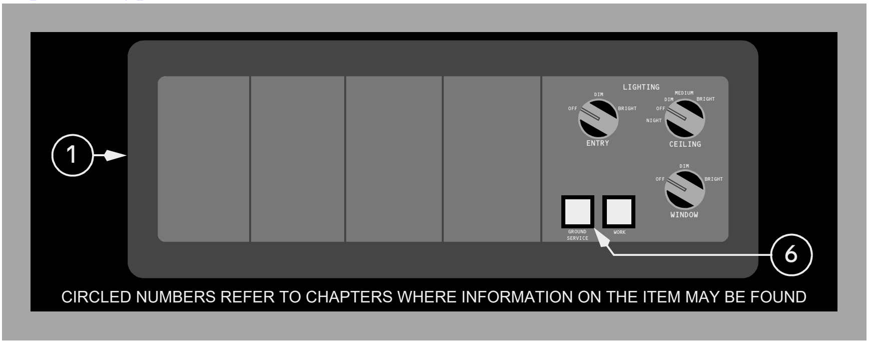
Auxiliary Panels

[Option - Typical with HUD and EFB installed]



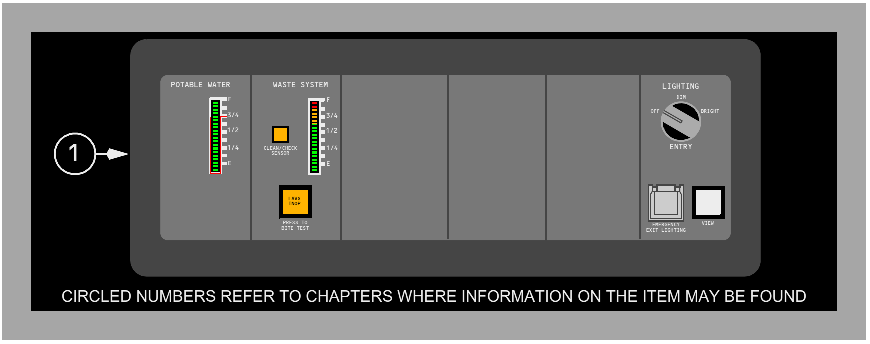
Attendant Panels
Forward Attendant Panel

[Option - Typical]



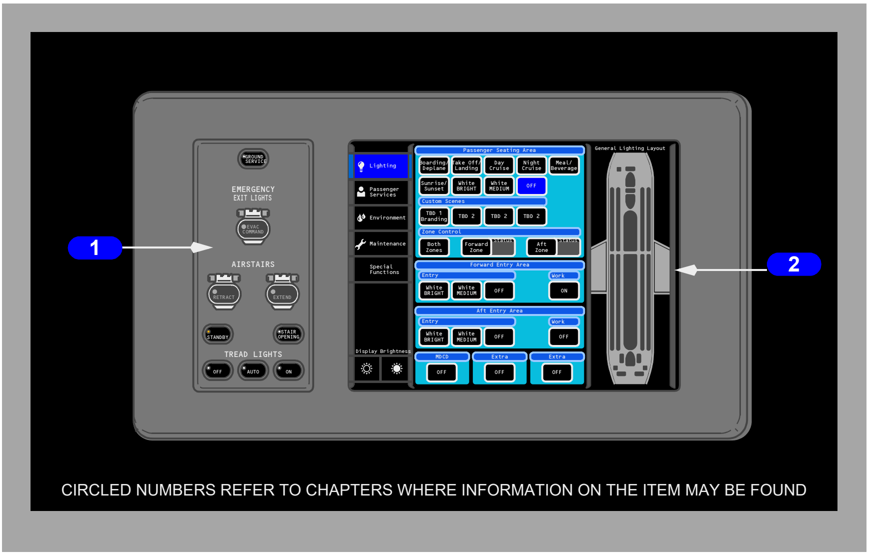
Aft Attendant Panel

[Option - Typical]



Attendant Control Panel

[Option - Sky Interior]



CIRCLED NUMBERS REFER TO CHAPTERS WHERE INFORMATION ON THE ITEM MAY BE FOUND

1 Pushbutton Panel Controls

This is a typical grouping of pushbutton cabin controls.

2 Touch Screen

Touch screen controls various functions such as Lighting, Passenger Services, Environment, Maintenance and Special Functions. A typical Lighting menu is depicted.

Attendant Handset

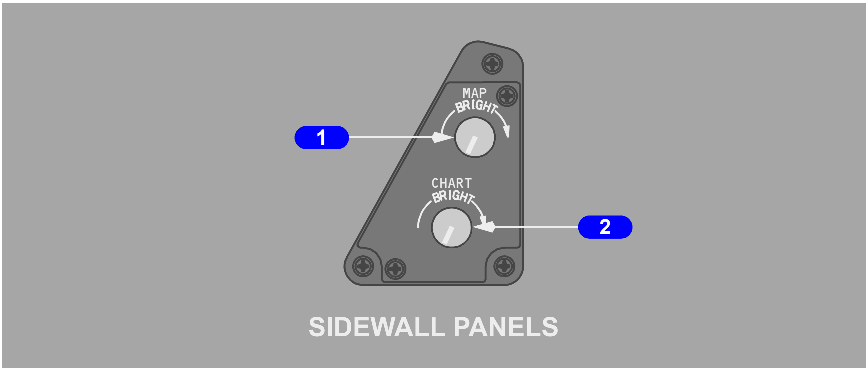
[Option - Typical Handset]

Supernumerary Cabin Handset

[Option - Typical Handset]

Flight Deck Lighting

Map and Chart Light Controls



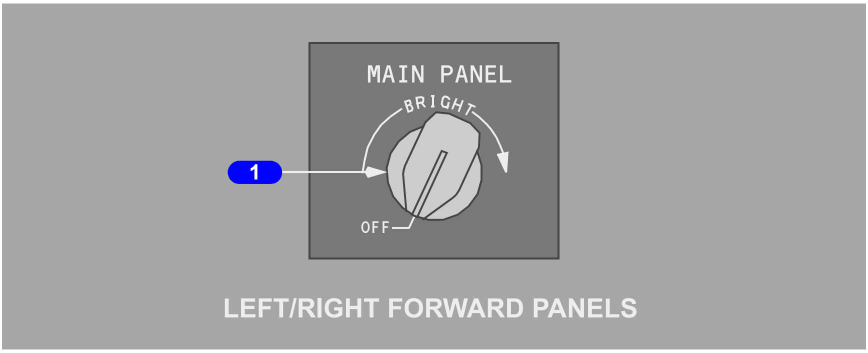
1 MAP Light Control

Rotate – adjusts brightness of Captain/First Officer map lights

2 CHART Light Control

Rotate – adjusts brightness of Captain/First Officer chart lights

Main Panel Lighting

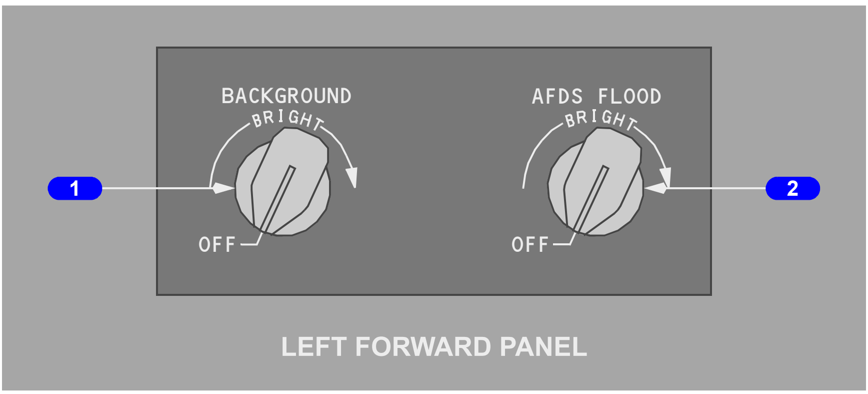


1 MAIN PANEL Light Control

Rotate –

- Captain – controls brightness of Captain’s panel and instrument lighting, center instrument panel, and AFDS panel displays and edge lighting
- First Officer – controls brightness of First Officer’s panel and instrument lighting.

Background and AFDS Flood Light Control



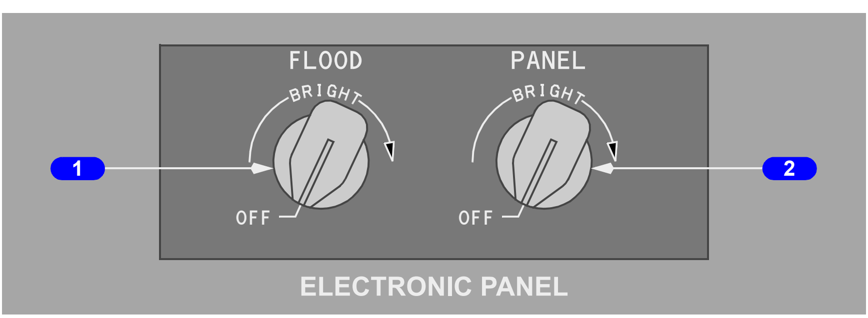
1 BACKGROUND Light Control

Rotate – controls incandescent lighting brightness for Captain’s panel, First Officer’s panel, and center panel.

2 AFDS FLOOD Light Control

Rotate – controls brightness of lighting directed at AFDS panel.

Flood and Aft Electronics Lights Controls



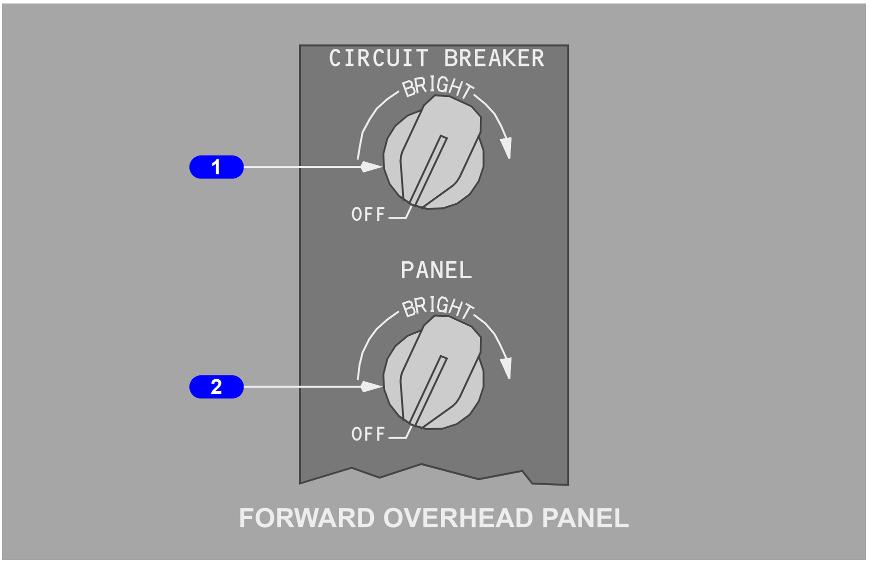
1 FLOOD Light Control

Rotate – controls overhead spotlight brightness directed at the control stand and aft electronic panel.

2 PANEL Light Control

Rotate – controls forward and aft electronic control panel lights brightness.

Overhead/Circuit Breaker Panel Light Controls



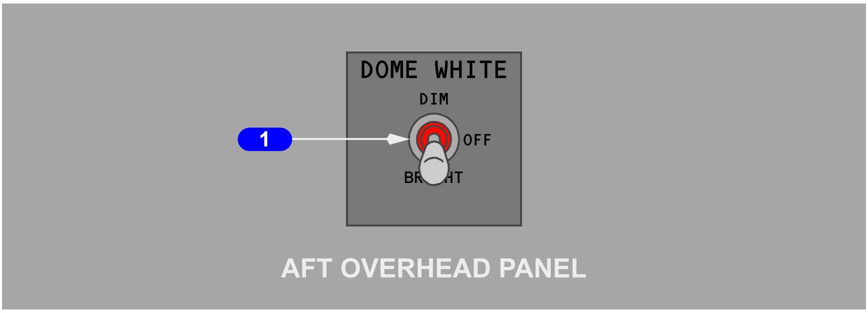
1 CIRCUIT BREAKER Light Control

Rotate – controls P–6 and P–18 circuit breaker panels light brightness.

2 PANEL Light Control

Rotate – controls forward and aft overhead panel lights brightness.

Dome Light Control



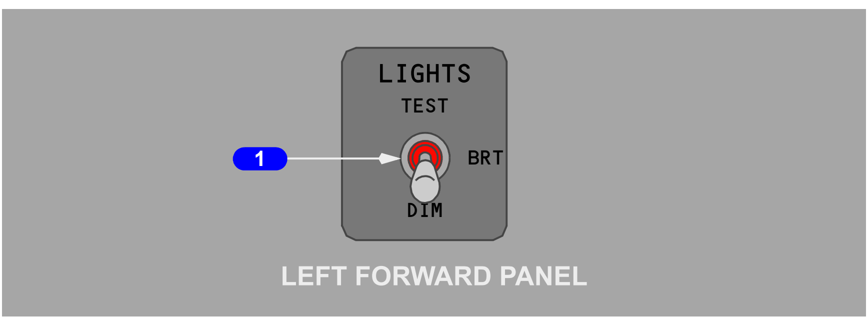
1 DOME Light Control

DIM – sets overhead dome lights to low brightness.

OFF – overhead dome lights are extinguished.

BRIGHT – sets overhead dome lights to full brightness.

Master Lights Test and Dim Switch



1 Master LIGHTS TEST and DIM SWITCH

TEST – illuminates all system lights on forward and aft overhead panels, and some lights on Captain and First Officer instrument panels to full brightness.

BRT (bright) – sets all system lights on forward and aft overhead panels, and some lights on Captain and First Officer panels to full brightness.

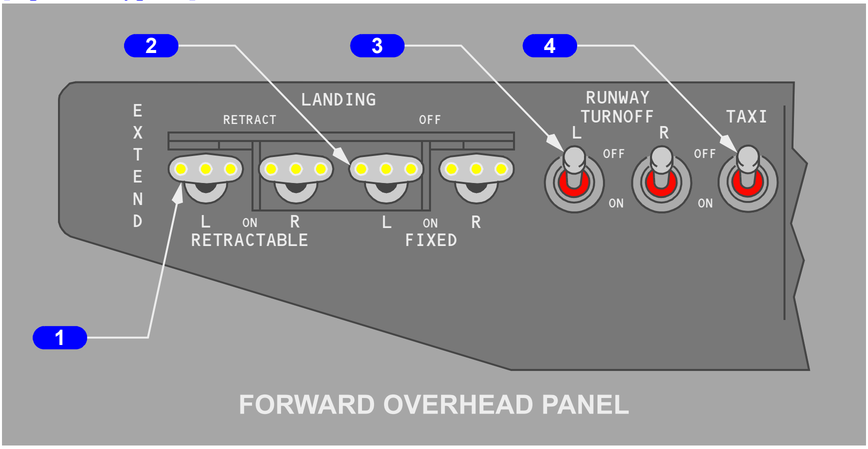
DIM – sets all system lights on forward and aft overhead panels, and some lights on Captain and First Officer panels to low brightness.

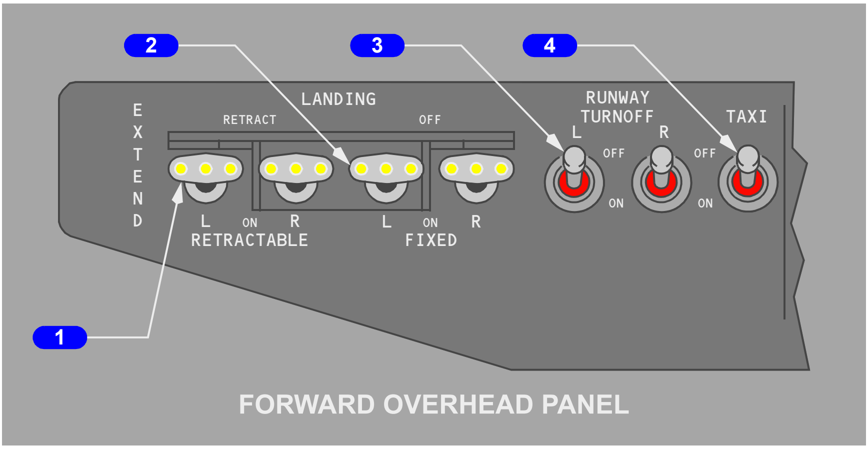
Note: Placing the Master Lights Test and Dim Switch in the TEST position will result in a master caution recall and any stored fault will cause the associated light to remain illuminated when the switch is released.

Exterior Lighting

Landing, Runway Turnoff and Taxi Lights

[Option - Typical]





1 RETRACTABLE LANDING Light Switch

RETRACT – retractable landing lights are retracted and extinguished

EXTEND – retractable landing lights are extended and extinguished

ON – retractable landing lights are extended and illuminated.

2 FIXED LANDING Light Switch

OFF – fixed landing lights are extinguished.

ON – fixed landing lights are illuminated.

3 **RUNWAY TURNOFF Light Switch**

OFF – runway turnoff lights located in leading edge of wing root are extinguished.

ON – runway turnoff lights are illuminated.

4 **TAXI Light Switch**

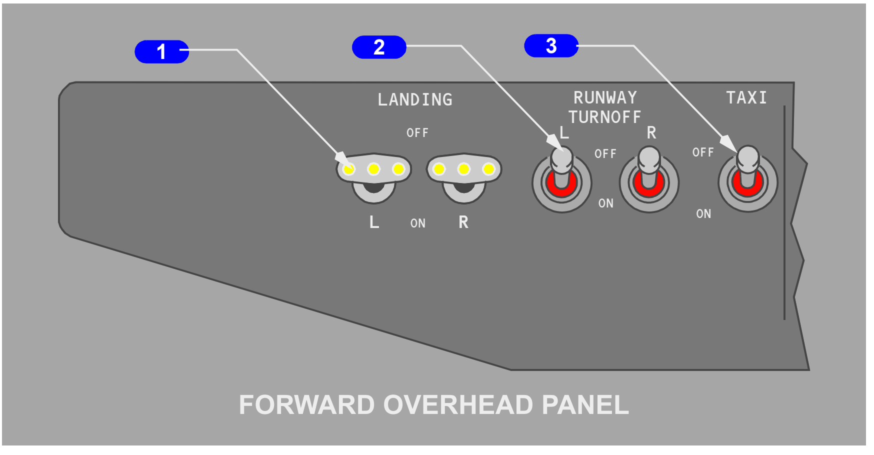
OFF – nose wheel well taxi light extinguished.

ON – nose wheel well taxi light illuminated.

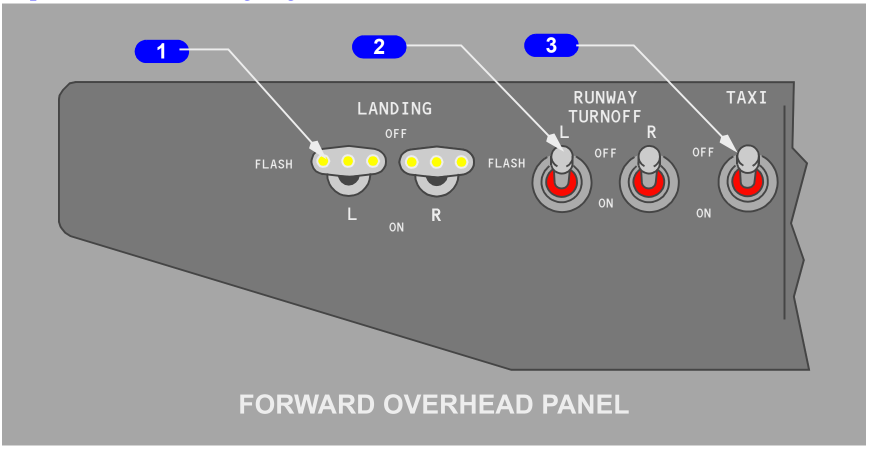
LED - Landing, Taxi and Runway Turnoff Lights

[Option - LED Landing, Taxi and Runway Turnoff Lights]

The Landing, Taxi and Runway Turnoff Lights are located in each wing root strakelet and provide the lighting necessary for airplane operation.



[Option - LED Landing Lights - Alternate Flash]



1 LANDING Light Switch

OFF – fixed landing lights are extinguished.

ON – fixed landing lights are illuminated.

[Option - LED Landing Lights - Alternate Flash]

1 LANDING Light Switch

OFF – fixed landing lights are extinguished.

FLASH – fixed landing lights alternately illuminate at 45 (+/-2) flashes per minute.

ON – fixed landing lights are illuminated.

2 RUNWAY TURNOFF Light Switch

OFF – runway turnoff lights are extinguished.

ON – runway turnoff lights are illuminated.

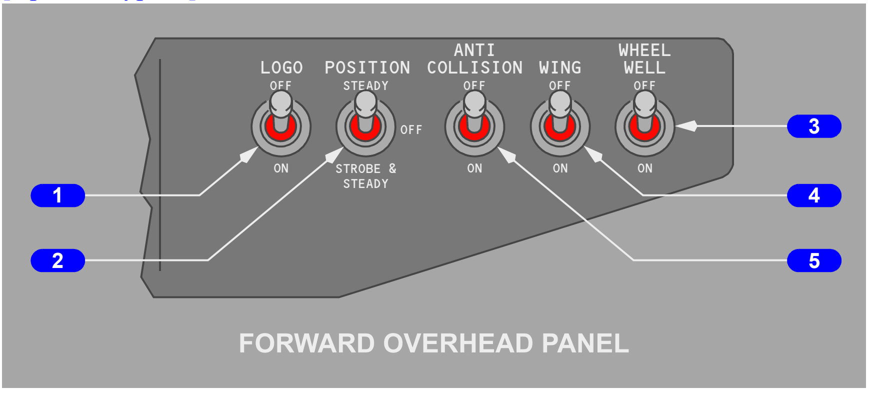
3 TAXI Light Switch

OFF – LED wing strakelet taxi light extinguished.

ON – LED wing strakelet taxi lights are illuminated.

Miscellaneous Exterior Lights

[Option - Typical]



1 LOGO Light Switch

OFF – logo lights on each side of vertical fin extinguished.

ON – logo lights illuminated.

2 POSITION Light Switch

STROBE & STEADY – red and green wingtip position lights, white trailing edge wingtip lights and wingtip and tail strobe lights illuminated.

OFF – red and green wingtip position lights, white trailing edge wingtip lights and wingtip and tail strobe lights extinguished.

STEADY – red and green wingtip position lights and white trailing edge wingtip lights illuminated.

3 WHEEL WELL Light Switch

OFF – three wheel well lights extinguished.

ON – wheel well lights illuminated.

4 WING Illumination Switch

OFF – wing leading edge lights on fuselage forward of wing extinguished.

ON – wing leading edge lights illuminated.

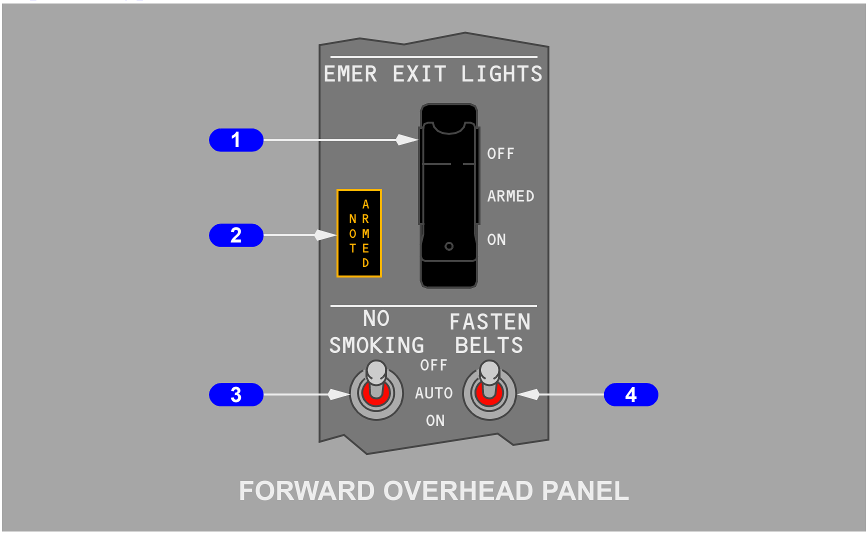
5 ANTI–COLLISION Light Switch

OFF – red strobe/rotating beacon lights on upper and lower fuselage extinguished.

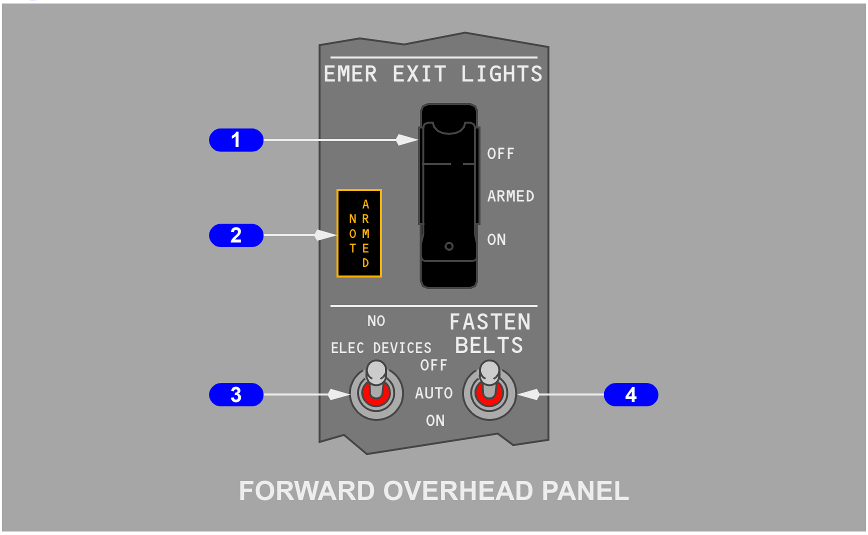
ON – red strobe/rotating beacon lights illuminated.

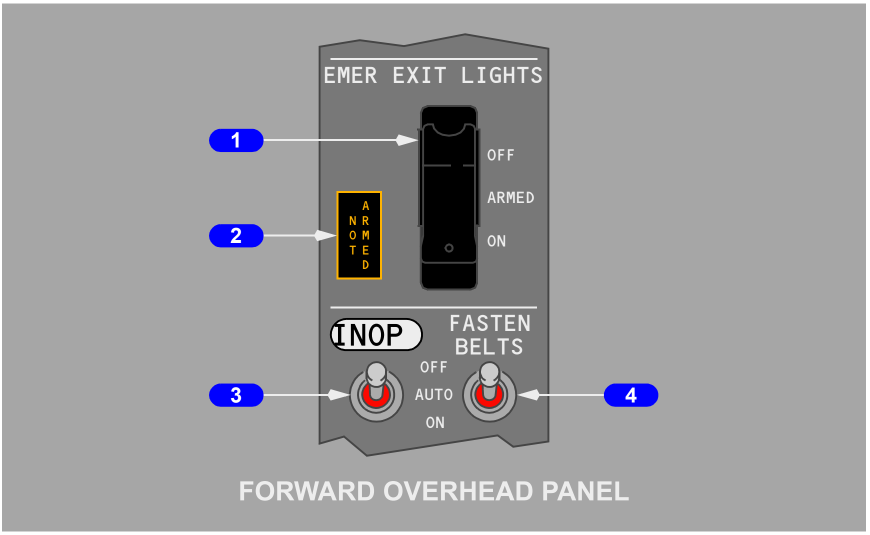
Emergency Lighting and Passenger Signs
Flight Deck

[Option - Typical]



[Option - No Electronic Devices]





1 **Emergency (EMER) EXIT LIGHTS Switch**

OFF – prevents emergency lights system operation if airplane electrical power fails or is turned off.

ARMED – (guarded position) all emergency lights illuminate automatically if airplane electrical power to DC bus No. 1 fails or AC power is turned off.

ON – all emergency lights illuminate.

2 **Emergency (EMER) EXIT LIGHTS NOT ARMED Light**

Illuminated (amber) – EMER EXIT LIGHTS switch not in ARMED position.

3 **NO SMOKING Switch**

OFF – the NO SMOKING signs are not illuminated.

AUTO – the NO SMOKING signs are illuminated or extinguished automatically with reference to airplane configuration (refer to the Lighting System Description section).

ON – the NO SMOKING signs are illuminated.

3 **NO ELECTRONIC DEVICES Switch**

OFF – the NO ELECTRONIC DEVICES signs are not illuminated.

AUTO – the NO ELECTRONIC DEVICES signs are illuminated or extinguished automatically with reference to airplane configuration (refer to the Lighting System Description section).

ON – the NO ELECTRONIC DEVICES signs are illuminated.

3 NO SMOKING Switch

The No Smoking signs are permanently illuminated. The No Smoking switch is placarded INOP.

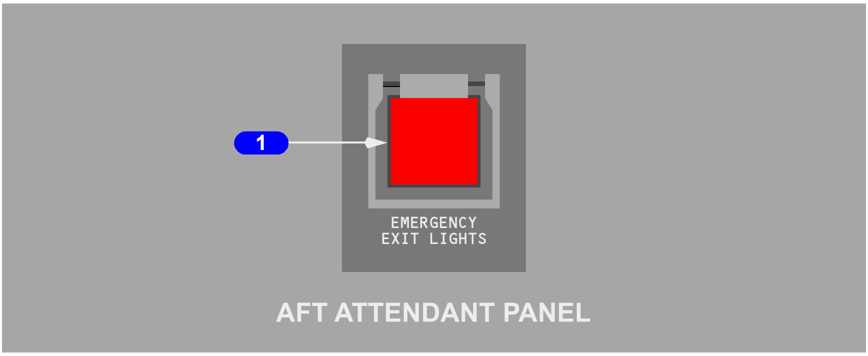
4 FASTEN BELTS Switch

OFF – the FASTEN SEAT BELTS and RETURN TO SEAT signs are not illuminated.

AUTO – the FASTEN SEAT BELTS and RETURN TO SEAT signs are illuminated or extinguished automatically with reference to airplane configuration (refer to the Lighting System Description section).

ON – the FASTEN SEAT BELTS and RETURN TO SEAT signs are illuminated.

Passenger Cabin



1 Passenger Cabin Emergency Lights Switch (guarded)

On – illuminates all emergency lights and bypasses flight deck control.

Emergency Locator Transmitter

[Option - Typical]

1 Emergency Locator Transmitter Light

Illuminated (amber) – ELT has been activated and is simultaneously transmitting on 121.5, 243.0 and 406.0 MHz.

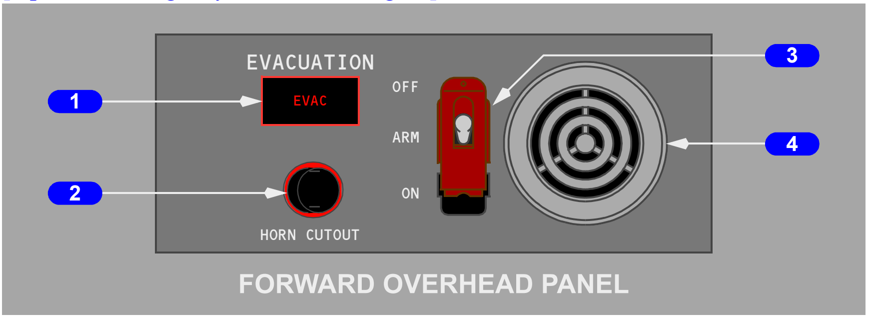
2 Emergency Locator Transmitter Switch

ARM – (guarded position) ELT transmits automatically when it reaches its preset G–Load limit.

ON – manually activates the ELT.

Emergency Evacuation Signal

[Option - Emergency Evacuation Signal]



1 Evacuation (EVAC)Light

Illuminated (red) - Flashes when any activation switch is moved to the ON position.

2 **Horn Cutout**

PUSH - silences the horn at that panel only.

3 **Activation Switch**

OFF - (guarded position) deactivates flight attendant's EMER EVAC switch to initiate evacuation signals. The flight compartment alert light illuminates and a chime will sound if the flight attendant's EMER EVAC switch is activated.

ARM - (guarded position) allows forward or aft flight attendant's EMER EVAC switch to initiate evacuation signal.

ON - activates evacuation signal at all locations.

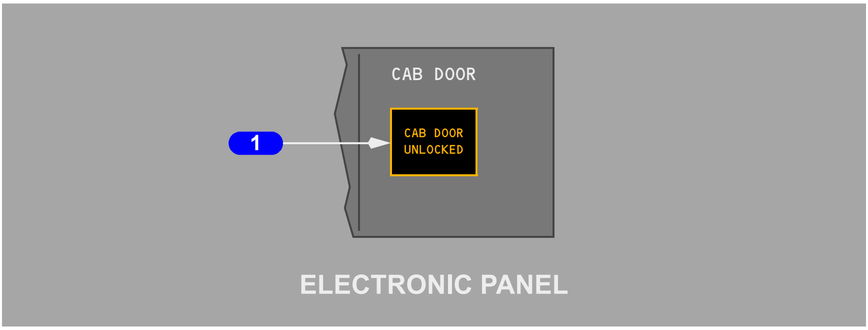
4 **Horn**

Sounds when any activation switch is moved to ON.

Doors

Cabin Door

[Original Flight Deck Door]



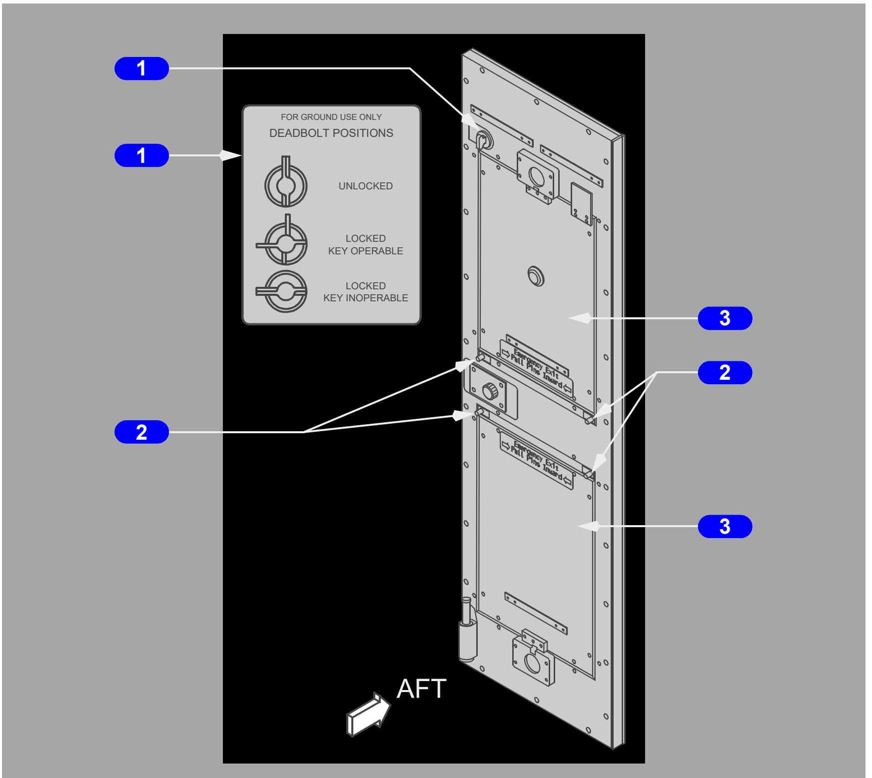
1 **Cabin Door (CAB DOOR) Lock Switch**

Illuminated (amber) – cabin door is unlocked.

Push – with DC power available, locks cabin door

Flight Deck Door

[Flight Deck Security Door]



FLIGHT DECK DOOR

1 Deadbolt and Deadbolt Placard

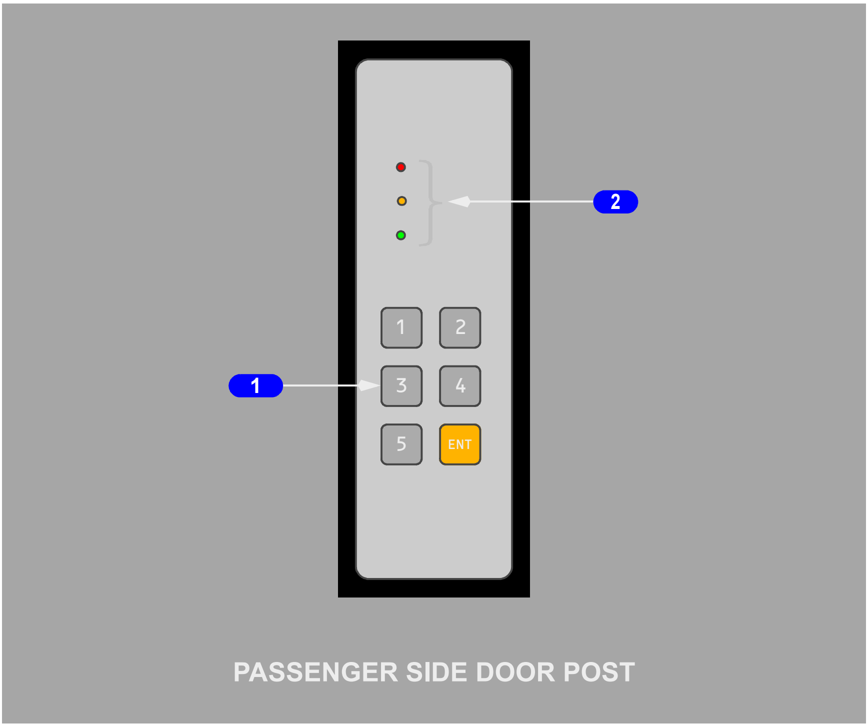
2 Release Pins

Pull pins inward - manually separates decompression panel from a jammed door to allow panel opening and egress.

3 Decompression Panel

Provides emergency egress path and automatically opens during airplane decompression.

Flight Deck Emergency Access Panel



1 Keypad

Push - enters 3 to 8 digit emergency access code by pressing numeric then “ENT” keys. Entry of correct emergency access code sounds flight deck chime.

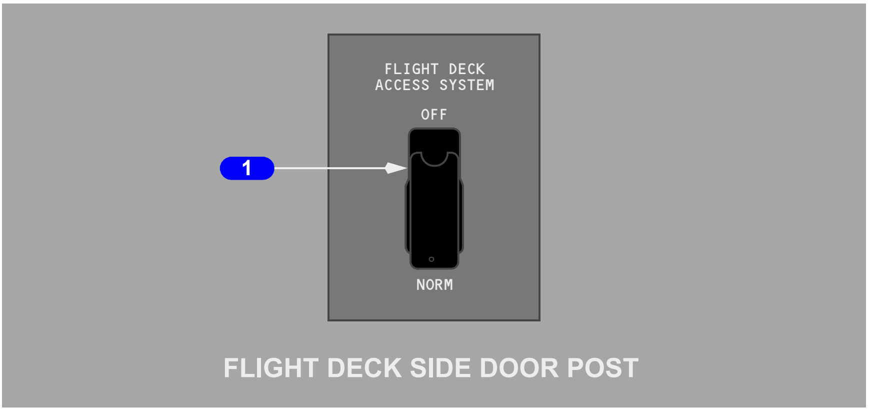
2 Access Lights

Illuminated (red) - door locked or Flight Deck Access System switch OFF.

Illuminated (amber) - correct emergency access code entered.

Illuminated (green) - door unlocked.

Flight Deck Access System Switch

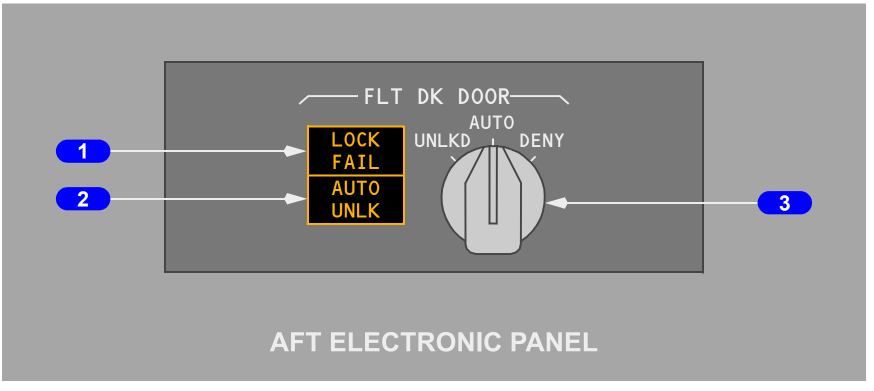


1 Flight Deck Access System Switch

OFF - removes electrical power from door lock.

NORM (Normal) - flight deck access system configured for flight.

Flight Deck Door Lock Panel



1 LOCK FAIL Light

Illuminated (amber) - Flight Deck Door Lock selector in AUTO and door lock has failed or Flight Deck Access System switch is OFF.

2 AUTO Unlock (UNLK) Light

Illuminated (amber) - correct emergency access code entered in keypad. AUTO UNLK light flashes and continuous chime sounds before timer expires and door unlocks.

3 Flight Deck (FLT DK) Door Lock Selector

Spring loaded to AUTO. Selector must be pushed in to rotate from AUTO to UNLKD. Selector must not be pushed in to rotate from AUTO to DENY.

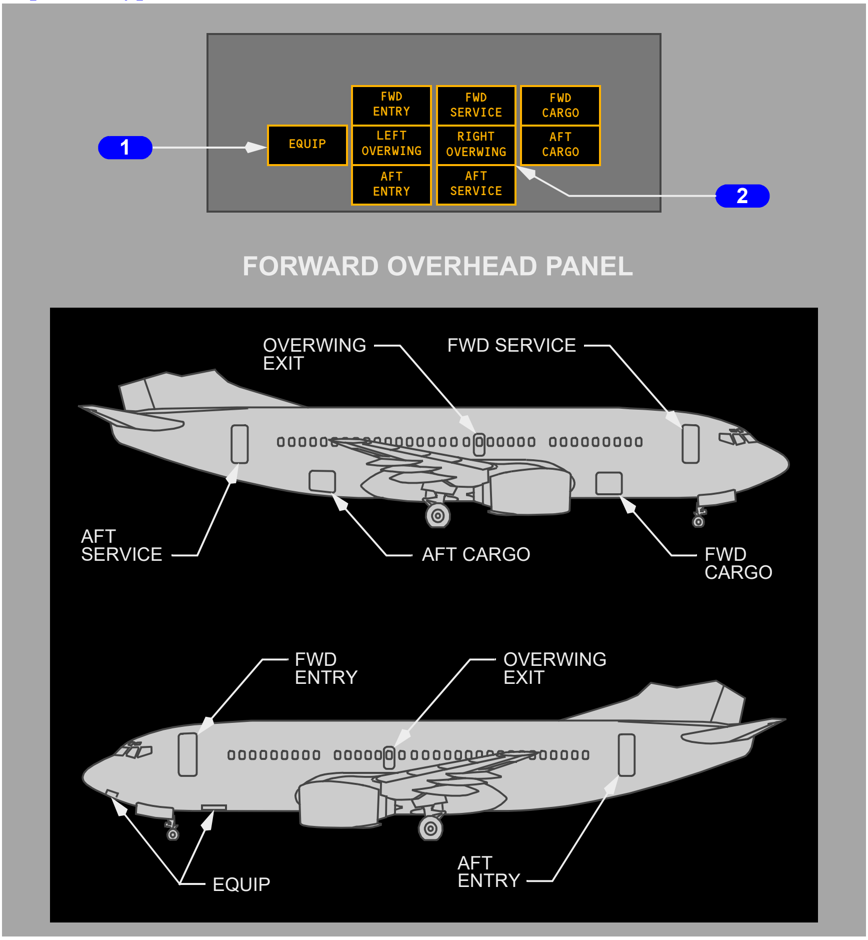
UNLKD - door unlocked while selector in UNLKD.

AUTO - door locked. Allows door to unlock after entry of emergency access code and expiration of timer, unless crew takes action.

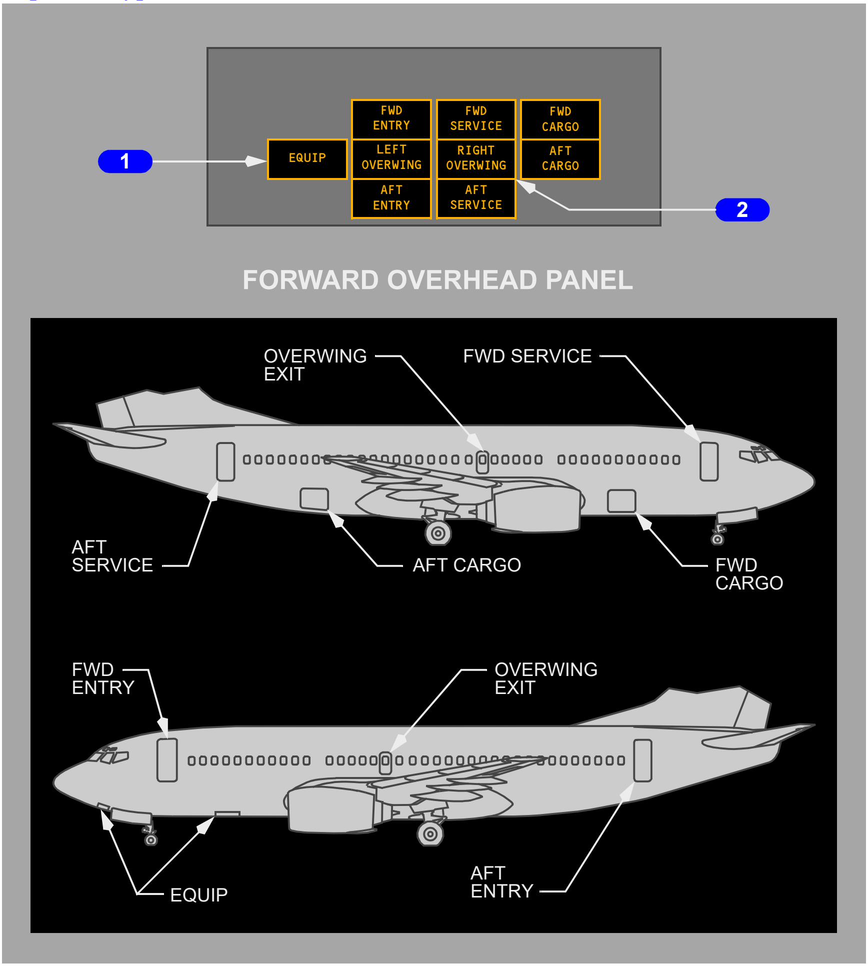
DENY - rejects keypad entry request and prevents further emergency access code entry for a time period.

Exterior Door Annunciator Lights

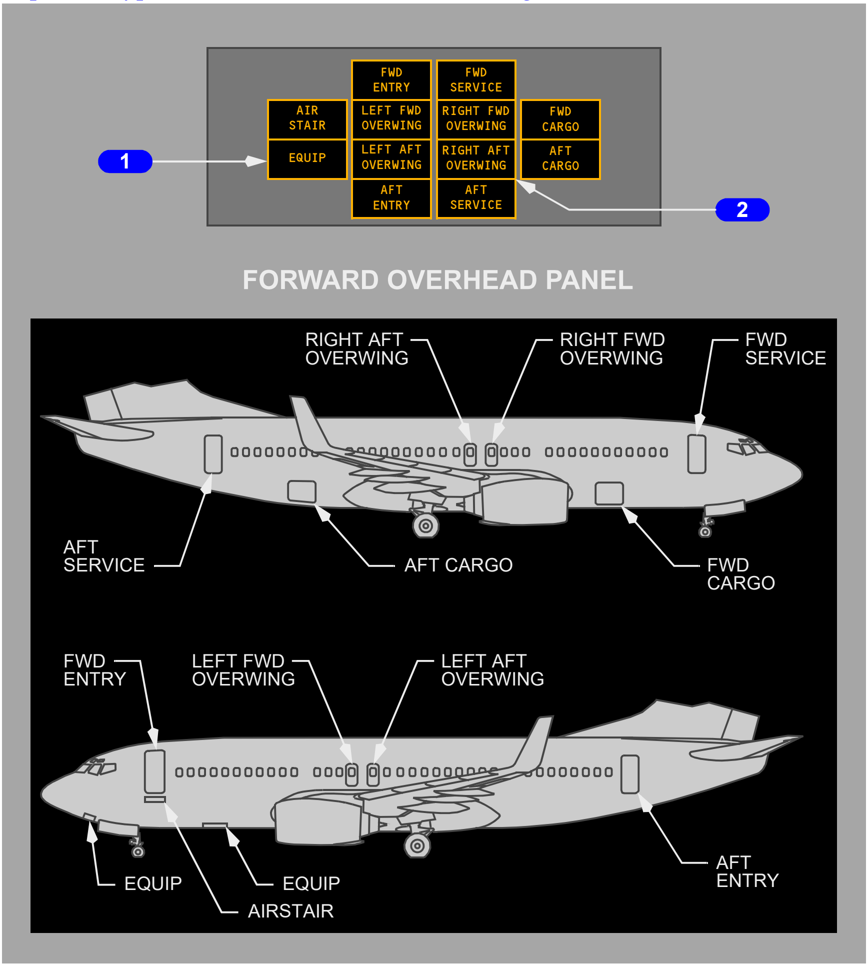
[Option - Typical 737-600 without airstairs]



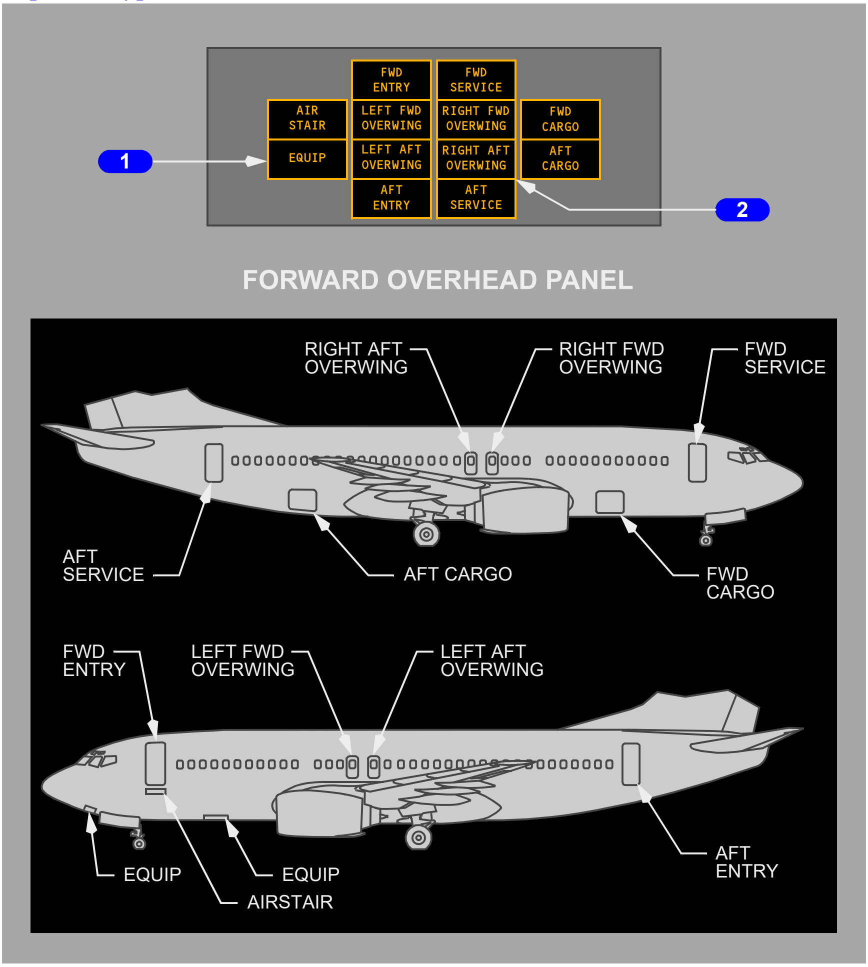
[Option - Typical 737-700 without airstairs]

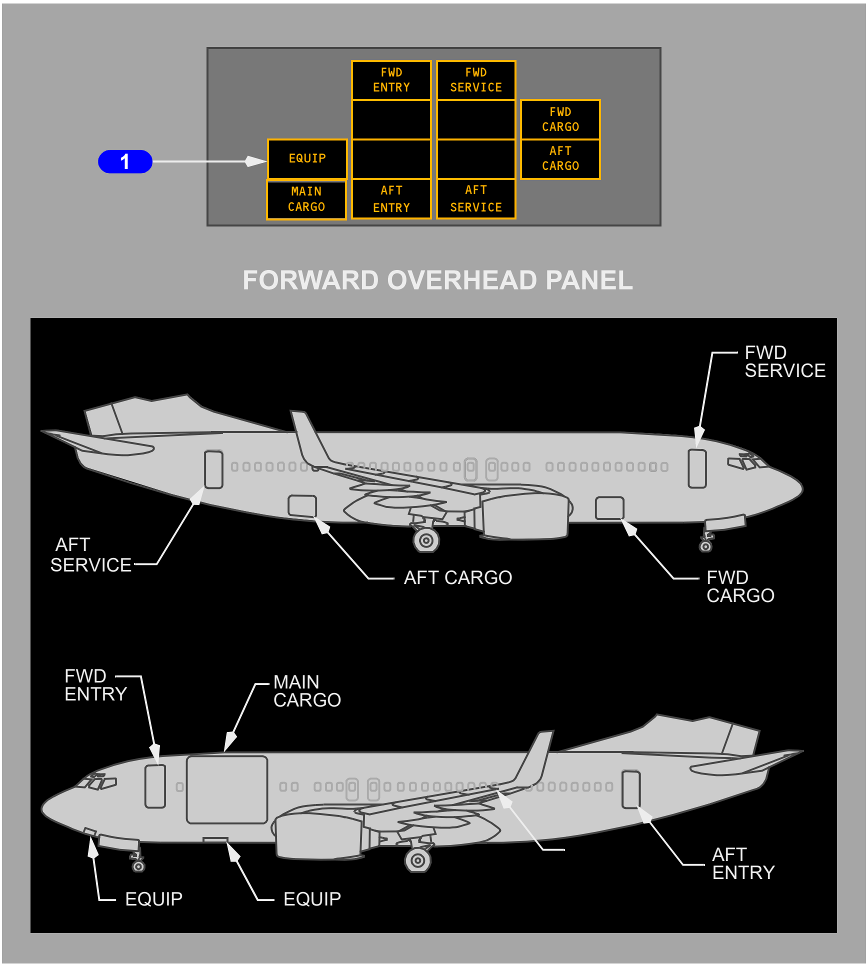


[Option - Typical 737-800 with airstairs and winglets]

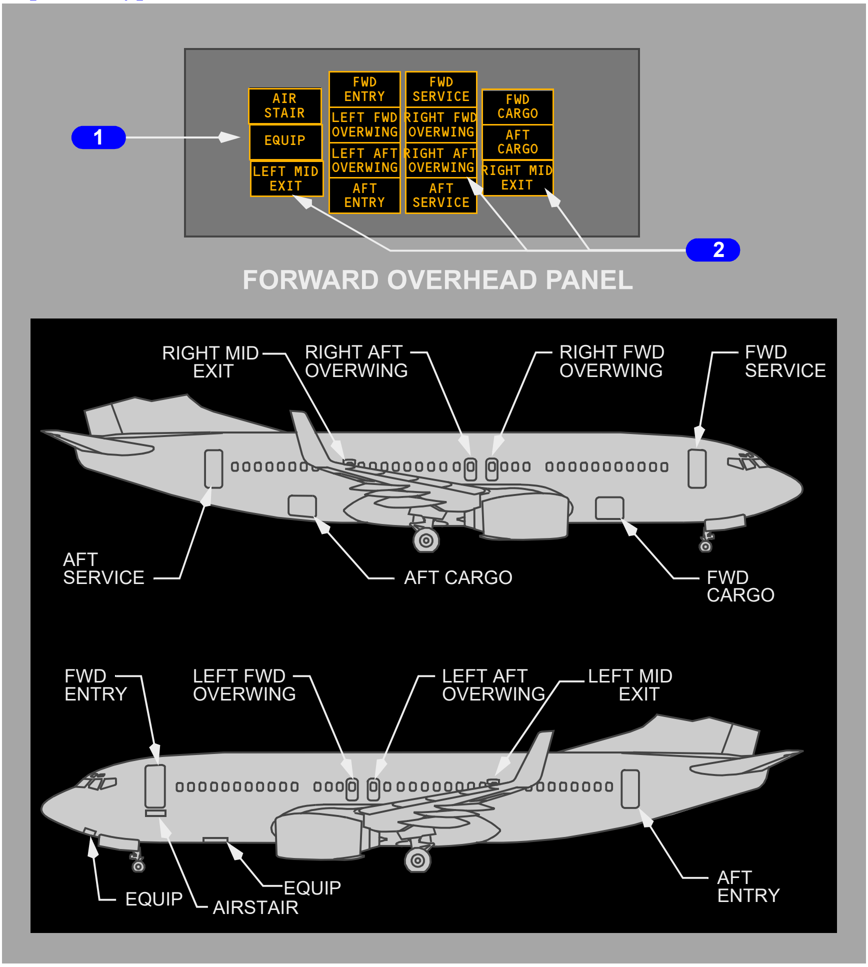


[Option - Typical 737-900 with airstairs]




FWD ENTRY
FWD SERVICE
FWD CARGO
AFT CARGO
1
EQUIP
MAIN CARGO
AFT ENTRY
AFT SERVICE
FORWARD OVERHEAD PANEL
FWD SERVICE
AFT SERVICE
AFT CARGO
FWD CARGO
FWD ENTRY
MAIN CARGO
AFT ENTRY
EQUIP
EQUIP

[Option - Typical 737-900ER with airstairs]



1 Exterior Door Annunciations

Illuminated (amber) – related door is not closed and locked.

1 Exterior Door Annunciations

Illuminated (amber) – related door is not closed and locked. Aft entry and service doors may illuminate during testing of lights but the doors are mechanically deactivated.

2 Overwing Exit Annunciations

Illuminated (amber) –

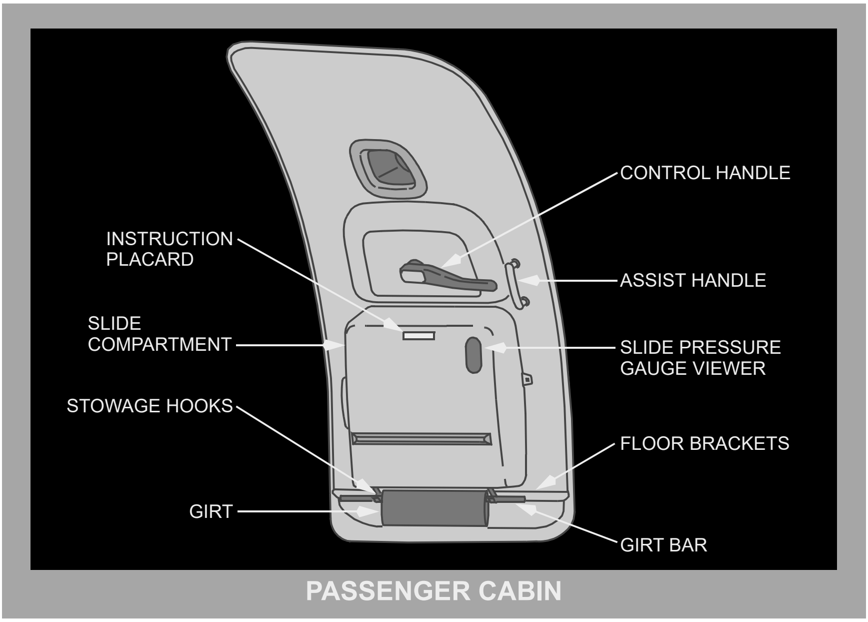
- related overwing exit is not closed and locked
- related flight lock failed to engage when commanded locked.

2 Overwing/Mid Exit Annunciations

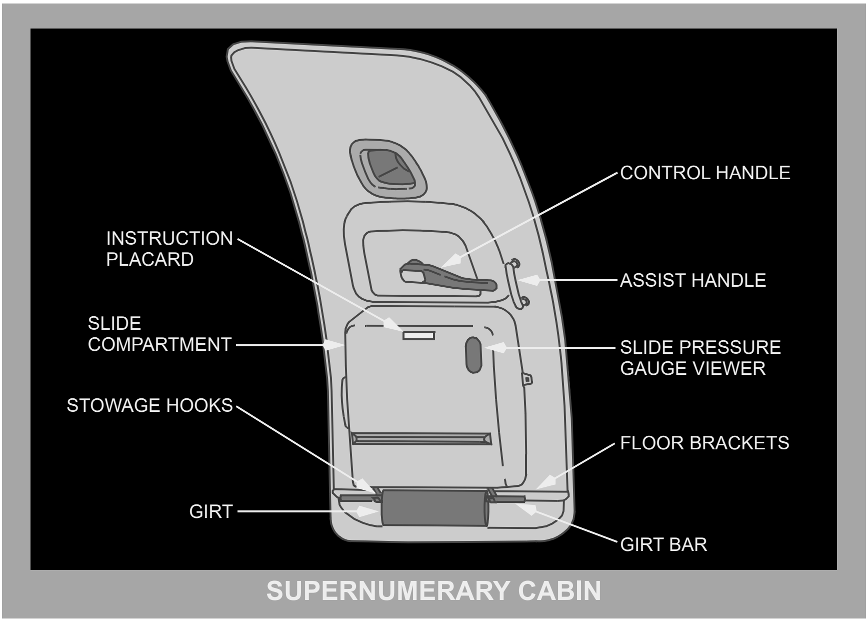
Illuminated (amber) –

- related overwing exit is not closed and locked
- related flight lock failed to engage when commanded locked.

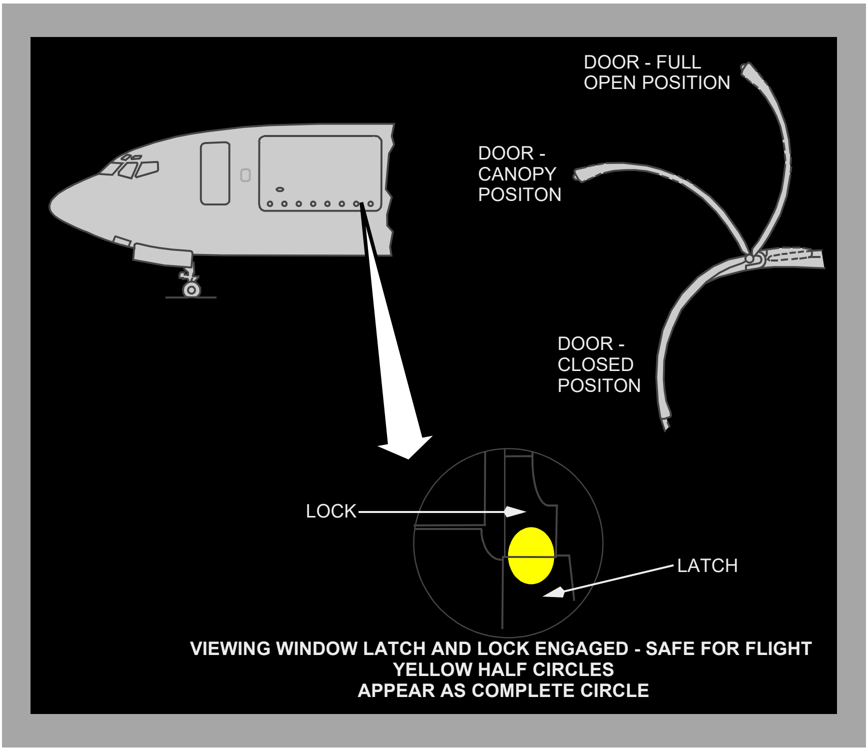
Passenger Entry/Galley Service Doors

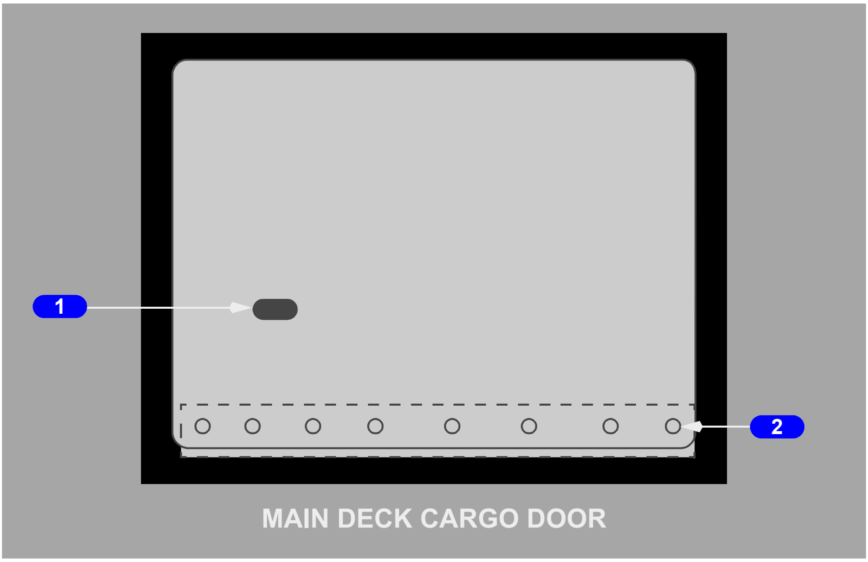


Flight Crew and Supernumerary/Galley Service Doors



Main Deck Cargo Door





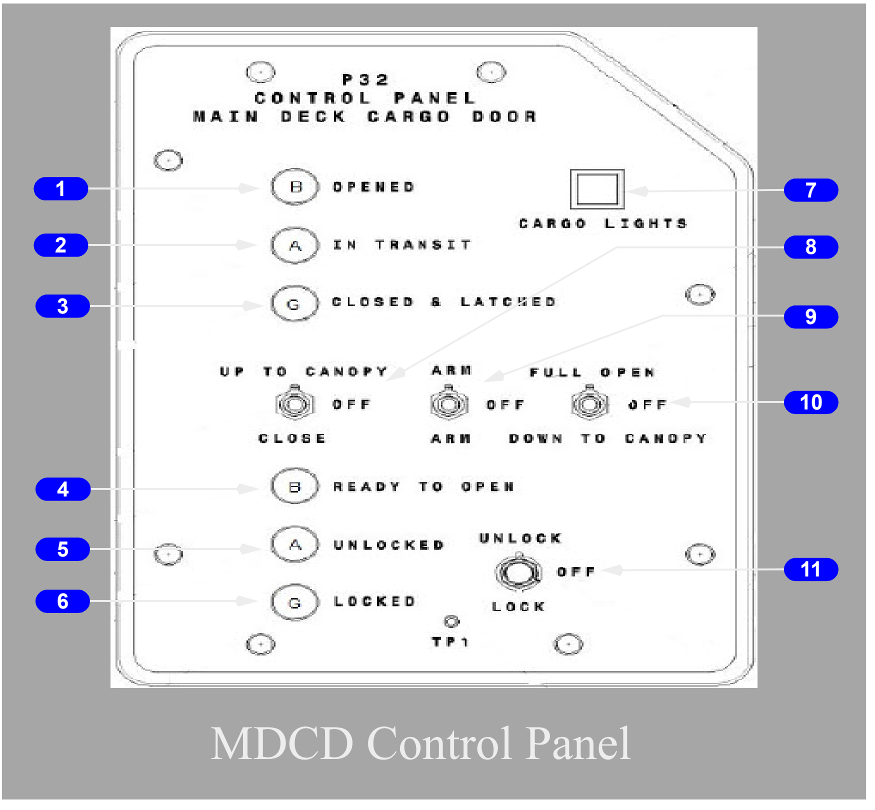
1 **Vent Door**

Prevents pressurization to an unsafe level if the door is not properly locked.

2 **Latch/Lock Viewing Windows**

Allow visual verification that the door is properly latched and locked.

Main Deck Cargo Door Control Panel



MDCD Control Panel

1 **OPENED Light (blue)**

Illuminated when the MDCD is open to either the canopy or full open positions.

2 **IN TRANSIT Light (amber)**

Illuminated when the MDCD is not closed or not latched and has not reached canopy position.

3 **CLOSED & LATCHED Light (green)**

Illuminated when the MDCD is closed and latched.

4 **READY TO OPEN Light (blue)**

Illuminated when the MDCD door is unlocked and ready to be opened.

5 **UNLOCKED Light (amber)**

Illuminated when the MDCD is not locked.

6 **LOCKED Light (green)**

Illuminated when the MDCD door is locked.

7 **CARGO LIGHTS pushbutton switch**

Note: The Cargo Lights switch operates the Sill Lights in flight and on the ground.

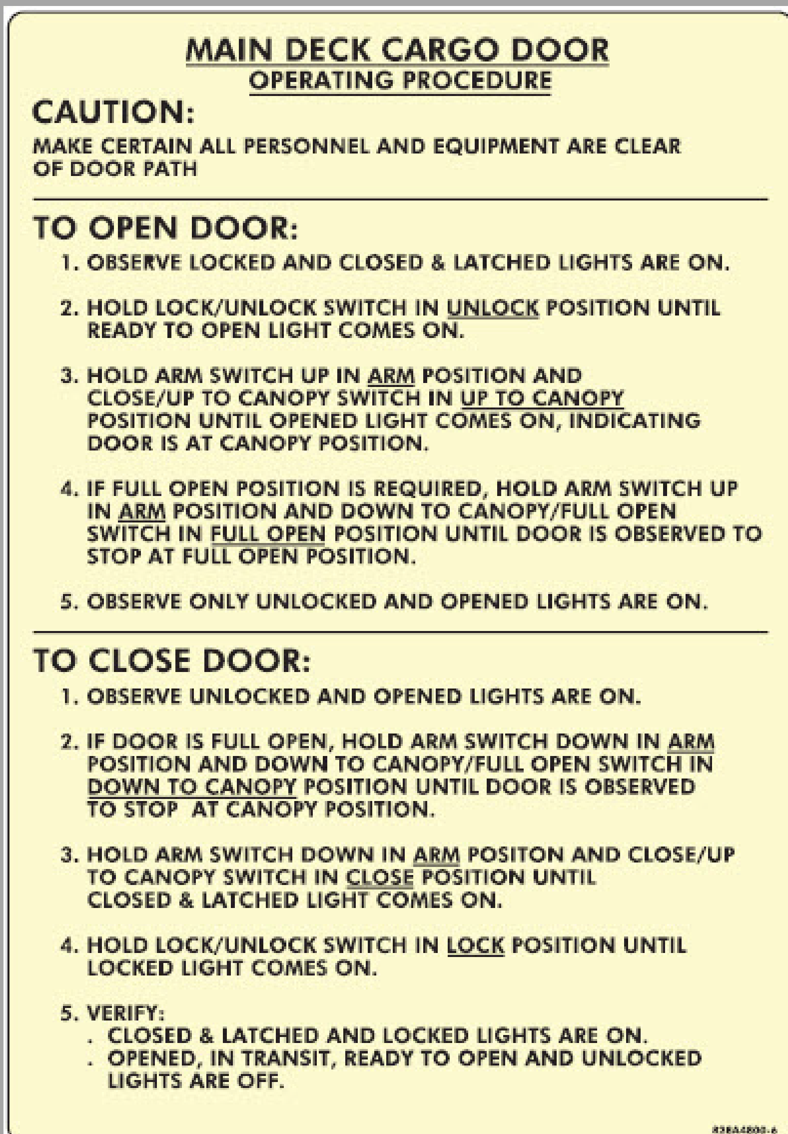
8 **CLOSE/UP TO CANOPY toggle switch**

9 **ARM toggle switch**

10 **DOWN TO CANOPY/FULL OPEN toggle switch**

11 **LOCK/UNLOCK toggle switch**

Cargo Door Operating Instructions Placard



MAIN DECK CARGO DOOR
OPERATING PROCEDURE

CAUTION:
MAKE CERTAIN ALL PERSONNEL AND EQUIPMENT ARE CLEAR OF DOOR PATH

TO OPEN DOOR:

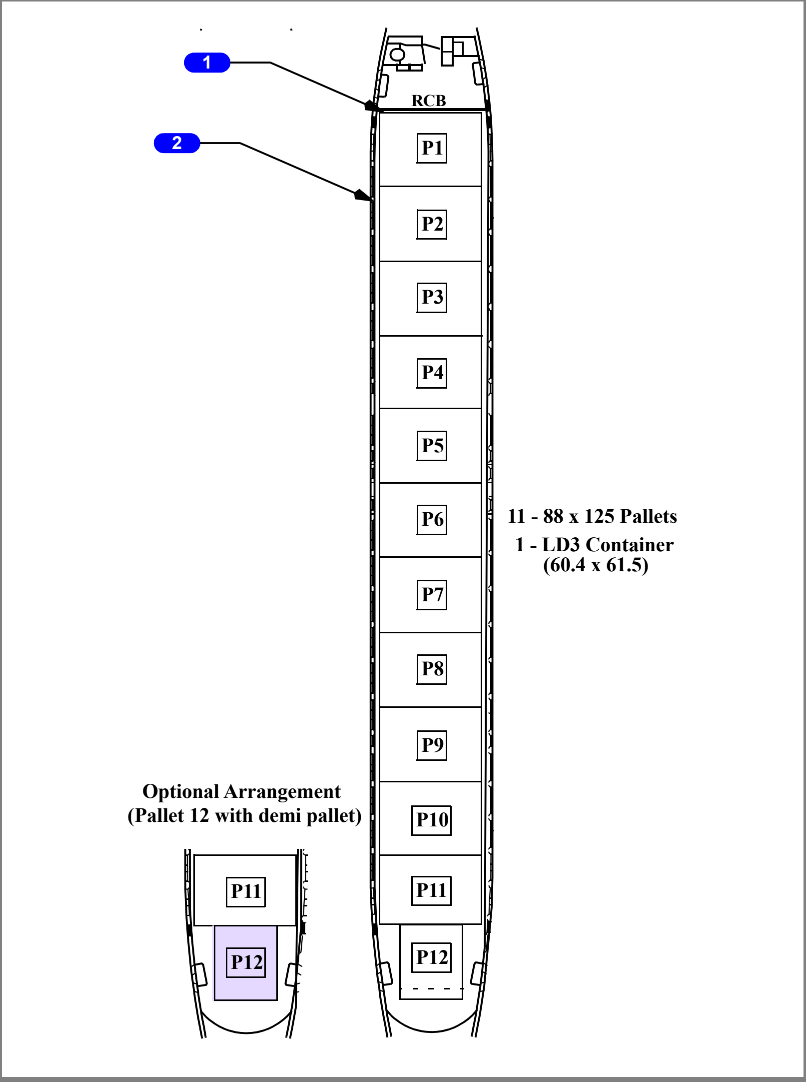
1. OBSERVE LOCKED AND CLOSED & LATCHED LIGHTS ARE ON.
2. HOLD LOCK/UNLOCK SWITCH IN UNLOCK POSITION UNTIL READY TO OPEN LIGHT COMES ON.
3. HOLD ARM SWITCH UP IN ARM POSITION AND CLOSE/UP TO CANOPY SWITCH IN UP TO CANOPY POSITION UNTIL OPENED LIGHT COMES ON, INDICATING DOOR IS AT CANOPY POSITION.
4. IF FULL OPEN POSITION IS REQUIRED, HOLD ARM SWITCH UP IN ARM POSITION AND DOWN TO CANOPY/FULL OPEN SWITCH IN FULL OPEN POSITION UNTIL DOOR IS OBSERVED TO STOP AT FULL OPEN POSITION.
5. OBSERVE ONLY UNLOCKED AND OPENED LIGHTS ARE ON.

TO CLOSE DOOR:

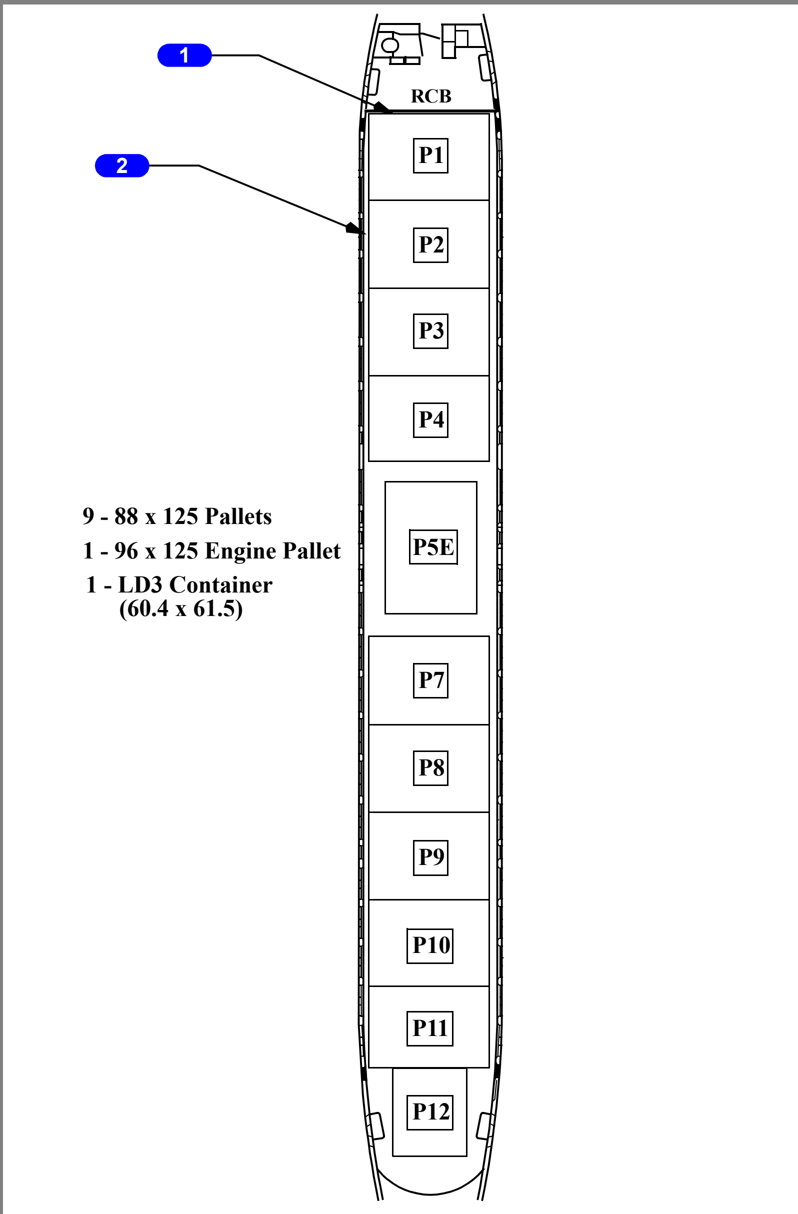
1. OBSERVE UNLOCKED AND OPENED LIGHTS ARE ON.
2. IF DOOR IS FULL OPEN, HOLD ARM SWITCH DOWN IN ARM POSITION AND DOWN TO CANOPY/FULL OPEN SWITCH IN DOWN TO CANOPY POSITION UNTIL DOOR IS OBSERVED TO STOP AT CANOPY POSITION.
3. HOLD ARM SWITCH DOWN IN ARM POSITON AND CLOSE/UP TO CANOPY SWITCH IN CLOSE POSITION UNTIL CLOSED & LATCHED LIGHT COMES ON.
4. HOLD LOCK/UNLOCK SWITCH IN LOCK POSITION UNTIL LOCKED LIGHT COMES ON.
5. VERIFY:
   - CLOSED & LATCHED AND LOCKED LIGHTS ARE ON.
   - OPENED, IN TRANSIT, READY TO OPEN AND UNLOCKED LIGHTS ARE OFF.

Boeing Converted Freighter (BCF) Cargo Configuration

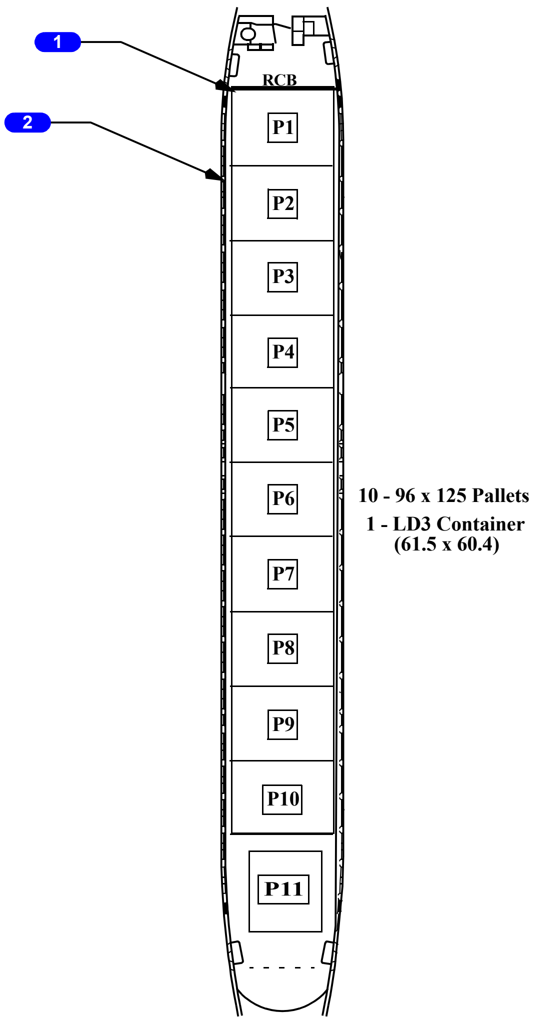
A Rigid Cargo Barrier (RCB) is installed between the Forward Entry area and Cargo area for cargo restraint.



12 Pallet Cargo Arrangement



Optional Cargo Pallet Arrangement w/ Engine Carriage Pallet over the Wing



11 Pallet Cargo Arrangement

1 Rigid Cargo Barrier

Installed in the all-cargo configuration. There is a hatchway to access the cargo area. The MDCD Control Panel is located above the hatchway.

2 **Main Deck Cargo Door**

Top-hinged with eight latches along bottom edge.

Oxygen

Oxygen Panel

[Option - Passenger Chemical Oxygen System]

1 **Flight CREW OXYGEN Pressure Indicator**

Indicates pressure at the crew oxygen cylinder.

2 **Passenger Oxygen (PASS OXYGEN) Switch**

NORMAL – (guarded position) passenger masks drop and passenger oxygen system activated automatically if cabin altitude climbs to 14,000 feet

ON – activates system and drops masks if automatic function fails.

3 **Passenger Oxygen On Light**

Illuminated (amber) – passenger oxygen system is operating and masks have dropped.

Oxygen Panel

[Option - Passenger Gaseous Oxygen System]

1 Oxygen Pressure (OXY PRESS) Indicator

Indicates pressure at the crew or passenger oxygen cylinder.

2 Passenger Oxygen (PASS) Switch

RESET - flow control units are closed electrically if cabin altitude is below 14,650 ft.

NORMAL – (guarded position) passenger masks drop and passenger oxygen system activated automatically if cabin altitude climbs to 14,000 feet

ON – activates system and drops the passenger cabin oxygen masks regardless of cabin altitude.

3 Indication Select (IND SEL) Switch

(spring-loaded to CREW)

PASS - oxygen pressure indicator displays the passenger oxygen supply.

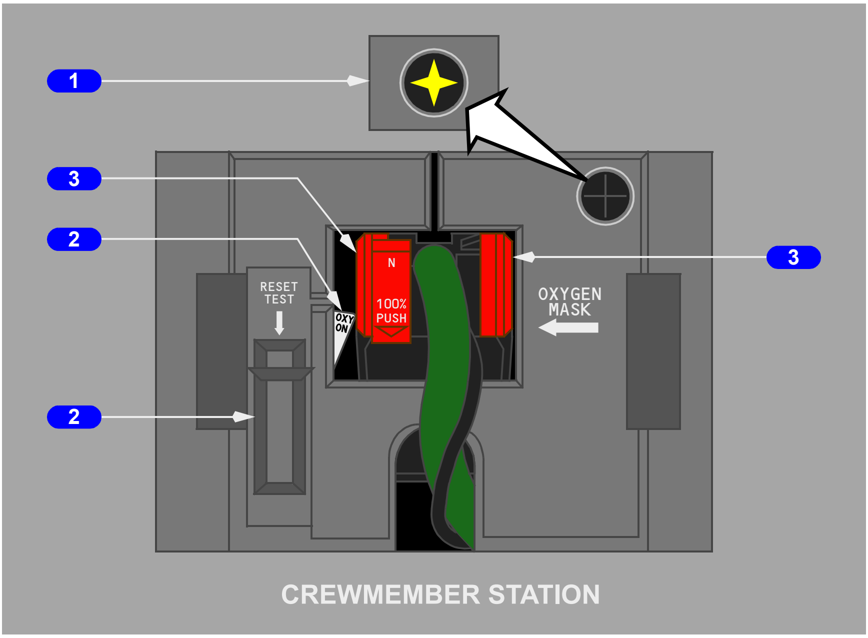
CREW - oxygen pressure indicator displays the flight crew oxygen supply.

4 Passenger Oxygen (PASS OXY) On Light

Illuminated (amber) – passenger oxygen system is operating and masks have dropped.

Oxygen Mask Panel

[Option - Oronasal Oxygen Mask]



1 Oxygen Flow Indicator

Indicates a yellow cross when oxygen is flowing.

2 RESET/TEST Lever

Push –

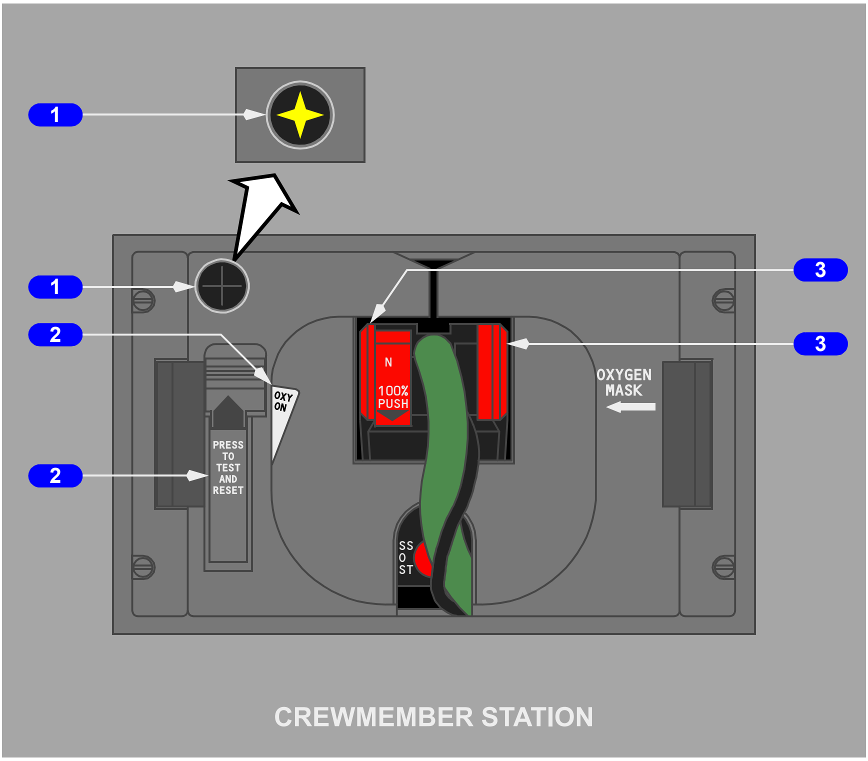
- if mask is stowed, activates oxygen flow momentarily to test regulator
- if mask is not stowed and stowage box doors are closed, retracts OXY ON flag, shuts off oxygen.

3 Oxygen Mask Inflation Lever

Squeeze and pull up –

- releases mask from stowage box
- releases OXY ON flag when stowage box doors open
- initiates oxygen flow
- inflates mask harness when inflation lever is squeezed
- flow indicator shows a yellow cross momentarily as harness inflates.

[Option - Typical Full Face Oxygen Mask]



1 **Oxygen Flow Indicator**

Indicates a yellow cross when oxygen is flowing.

2 **RESET/TEST Lever**

Push –

- if mask is stowed, activates oxygen flow momentarily to test regulator
- if mask is not stowed and stowage box doors are closed, retracts OXY ON flag, shuts off oxygen, and shuts off microphone.

3 **Oxygen Mask Inflation Lever**

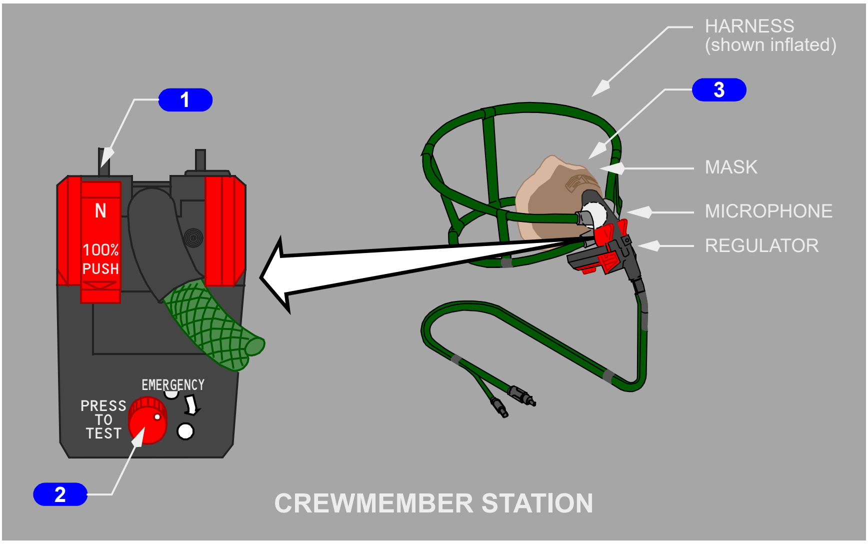
Squeeze and pull up –

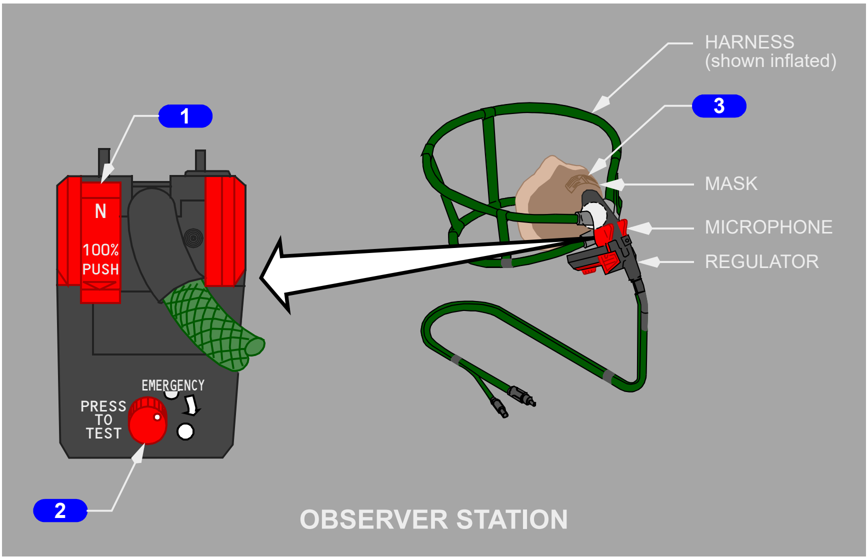
- releases mask from stowage box
- releases OXY ON flag when stowage box doors open
- initiates oxygen flow

- inflates mask harness when inflation lever is squeezed
- flow indicator shows a yellow cross momentarily as harness inflates.

Oxygen Mask and Regulator

[Option - Oronasal Oxygen Mask]





[Option - Oronasal Oxygen Mask]

1 NORMAL/100% Switch

N (normal) – supplies air/oxygen mixture on demand (ratio depends on cabin altitude).

100% – supplies 100% oxygen on demand.

2 Oxygen Mask EMERGENCY/Test Selector (rotary)

Normal (non-emergency) position - supplies air/oxygen mixture or 100% oxygen on demand, depending upon the position of the Regulator Dilution Control. Automatically supplies 100% oxygen under positive pressure when cabin altitude is above a preset value.

EMERGENCY position (rotate in the direction of the arrow) - supplies 100% oxygen under positive pressure at all cabin altitudes (protects against smoke and harmful vapors).

CAUTION: Use of EMER mode depletes oxygen supply at higher rate than 100% or NORM mode. Use EMER mode only as conditions require.

Note: Communications in EMER mode may be difficult. Switch to 100% or NORM if conditions allow.

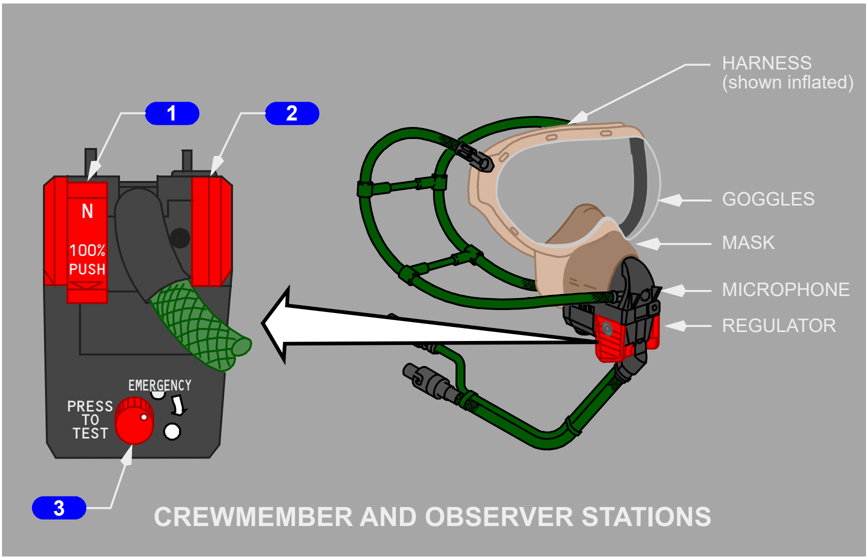
PRESS TO TEST – tests positive pressure supply to regulator.

3 Smoke Vent Valve Selector

Up - vent valve closed.

Down - vent valve open, allowing oxygen flow to smoke goggles.

[Option - Typical Full Face Oxygen Mask]



1 NORMAL/100% Switch

N (normal) – supplies air/oxygen mixture on demand (ratio depends on cabin altitude).

100% – supplies 100% oxygen on demand.

2 Oxygen Mask Inflation Lever

Squeeze –

- inflates mask harness when lever is squeezed
- flow indicator shows a colored cross momentarily as harness inflates.

3 EMERGENCY/PRESS TO TEST Selector

Normal (non-emergency) position - supplies air/oxygen mixture or 100% oxygen on demand, depending upon the position of the Regulator Dilution Control. Automatically supplies 100% oxygen under positive pressure when cabin altitude is above a preset value.

EMERGENCY position (rotate in the direction of the arrow) - supplies 100% oxygen under positive pressure at all cabin altitudes (protects against smoke and harmful vapors). Use to purge contaminants from mask and to remove condensation or fogging from interior of mask lens.

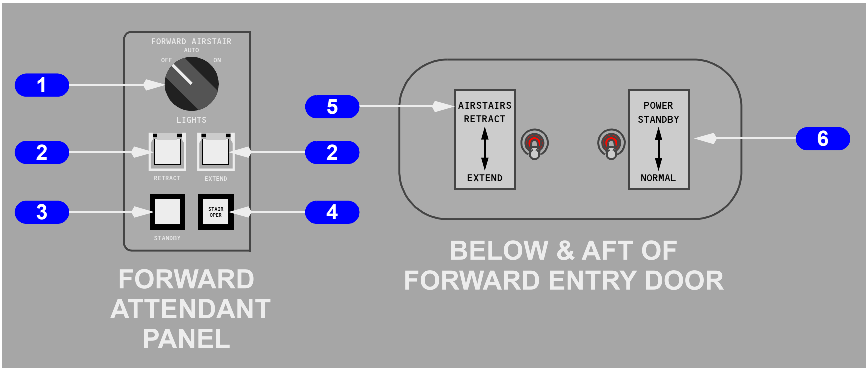
CAUTION: Use of EMER mode depletes oxygen supply at higher rate than 100% or NORM mode. Use EMER mode only as conditions require.

Note: Communications in EMER mode may be difficult. Switch to 100% or NORM if conditions allow.

PRESS TO TEST – tests positive pressure supply to regulator.

Forward Airstairs
Interior and Exterior Controls

[Option - Airstair]



1 LIGHTS Switch

AUTO – the airstair tread lights illuminate automatically upon airstair extension and extinguish upon retraction.

ON – illuminates the airstair tread lights.

2 Normal Control Switches

Note: AC and DC electrical power must be available on airplane.

RETRACT – retracts the airstair. The handrail extensions must be stowed prior to retracting the airstair.

EXTEND – extends the airstair.

3 STANDBY Control Switch

Note: Switch must be held in while using EXTEND or RETRACT. Battery switch must be ON.

EXTEND – extends the airstair.

RETRACT – retracts the airstair.

CAUTION: Use of standby bypasses all safety circuits. Airstair handrail extensions must be stowed or substantial damage could result.

4 STAIRS Operating (OPER) Light

Illuminated (amber) – indicates the airstair is in transit.

5 AIRSTAIRS Control Switch

EXTEND – extends the airstair.

RETRACT – retracts the airstair.

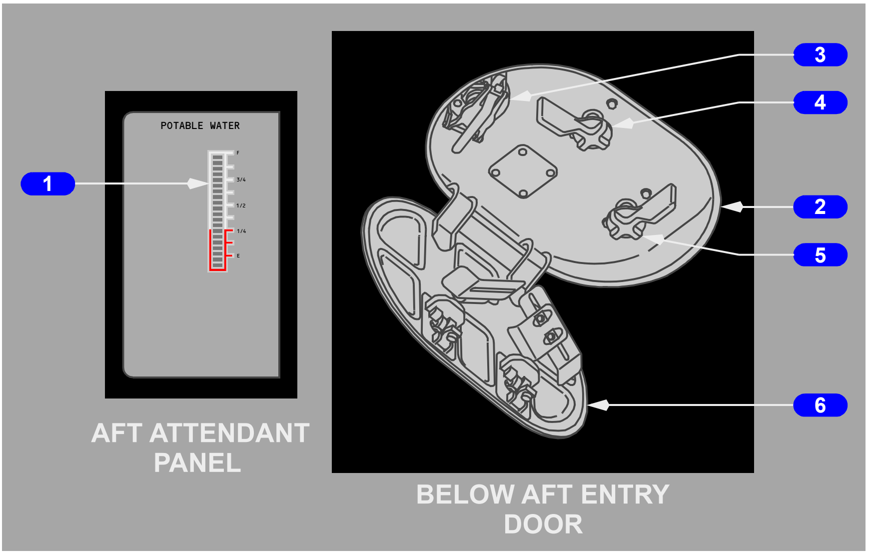
6 POWER Switch

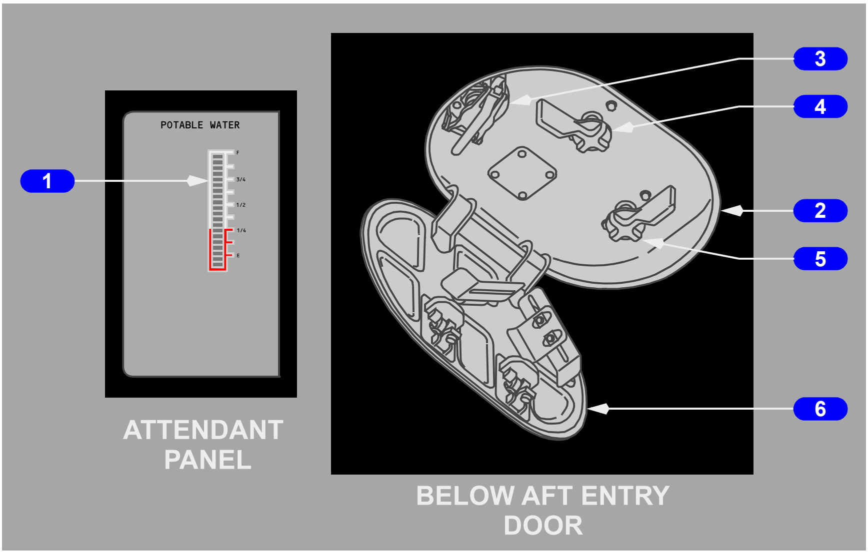
(spring-loaded to NORMAL)

NORMAL – requires both AC and DC power.

STANDBY – requires DC power.

Water System Controls





1 **Water Quantity Indicator**

Indicates quantity of water in reservoir.

2 **Water System Service Panel**

3 **Fill Fitting**

Used to fill tank.

4 **Fill and Overflow Valve Handle**

Open - enables filling or gravity draining water tank.

Closed - normal position.

5 **Tank Drain Valve Handle**

Open - drains water from tank.

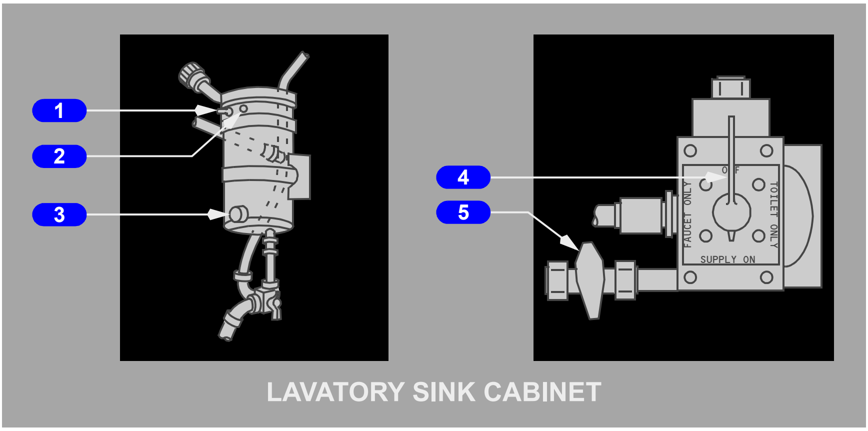
Closed - normal position.

6 **Access Panel**

Cannot be closed unless the Fill and Overflow Valve and Tank Drain Valve Handles are in the closed position.

Lavatory Controls

[Option - Early Airplanes]



1 Water Heater Switch

On – activates the water heater.

2 Water Heater Light

Illuminated - heater operating.

3 Temperature Control Switch

4 Water Supply Selector Valve

SUPPLY ON – provides water to lavatory sink faucets and water heater (normal position).

FAUCET ONLY– water is supplied to faucet only.

OFF – shuts off water to lavatory sink faucets and water heater.

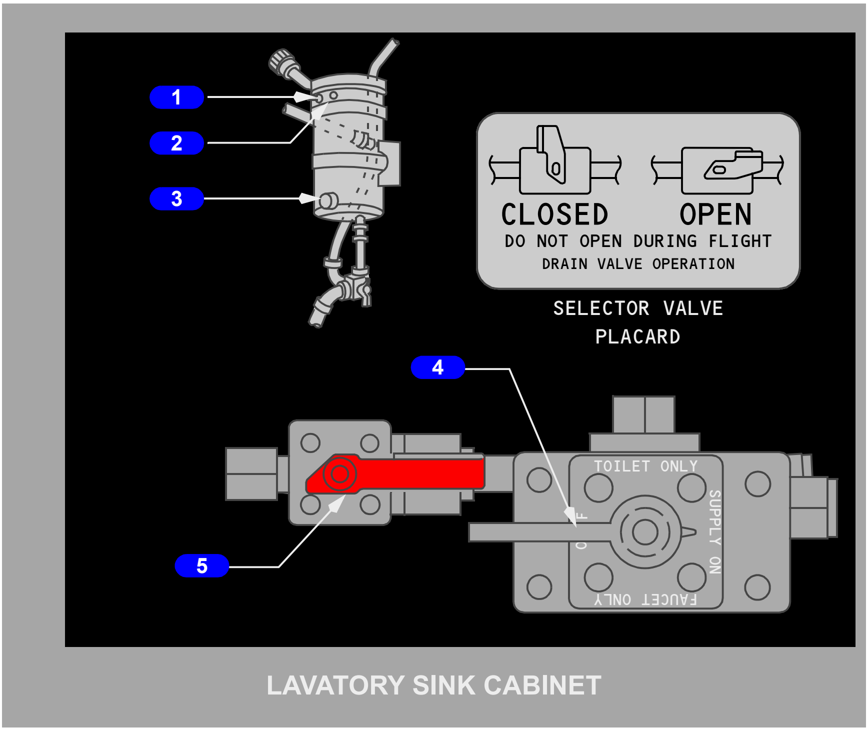
TOILET ONLY– water is supplied to toilet only.

5 Drain Valve

Located in the forward lavatory.

Note: DO NOT OPEN IN FLIGHT.

[Newer airplanes]



1 Water Heater Switch

On – activates the water heater.

2 Water Heater Light

Illuminated - heater operating.

3 Temperature Control Switch

4 Water Supply Selector Valve

Each lavatory has a Water Supply Selector Valve. The Water Supply Selector Valve has four positions, and is located in the cabinet below the sink.

SUPPLY ON – Normal operating position. When the water system is depressurized, all lavatories except “A” will drain. In this lavatory, the drain valve must be opened to drain the lavatory

FAUCET ONLY – In this position, water is supplied to the faucet, but not to the toilet

TOILET ONLY – In this position, water is supplied to the toilet, but not to the faucet

OFF – No water is supplied to the lavatory.

5 Drain Valve Handle (red)

Located in the forward lavatory only.

Airplane General, Emergency Equipment, Doors, Windows — Chapter 1
Systems Description — Section 40

Introduction

[Option - Airstairs installed]
This chapter describes miscellaneous airplane systems, including:

- lighting systems
- oxygen systems
- fire extinguishers
- emergency equipment
- doors and windows
- cargo compartments
- emergency egress
- flight deck seats
- galleys
- water systems
- lavatories
- airstairs.

Lighting Systems

Lighting systems described in this chapter include:

- exterior lighting
- flight deck lighting
- passenger cabin lighting
- emergency lighting.
- emergency lighting.

Exterior Lighting

Exterior lighting consists of these lights:

- landing
- runway turnoff
- taxi
- logo
- position (navigation)
- strobe
- anti–collision
- wing illumination
- wheel well.

Retractable Landing Lights

Retractable landing lights are installed in the lower airplane fuselage. The lights are designed to extend and shine forward, parallel to the waterline of the airplane. The lights may be extended at any speed.

Fixed Landing Lights

Two fixed landing lights are in the wing leading edge. The lights shine forward and down in a fixed position.

Runway Turnoff Lights

Runway turnoff lights are in each wing root. The lights illuminate the area in front of the main gear.

Taxi Lights

The taxi light is mounted on the nose wheel strut and points in the same direction as the nose wheel.

Landing, Taxi, and Runway Turnoff Lights

LED lights are mounted in the wing strakelets and provide all function capability of landing, taxi, and runway turnoff light applications for the airplane. When both the landing and taxi lights are in the ON position, the taxi light function is overridden by the landing light function.

LED Landing Lights - Alternating Flash

LED landing lights alternate flash the left and right landing lights by alternately flashing at approximately 45 (+/-2) flashes per minute (fpm) through a three-position OFF-FLASH-ON switch. When both landing light switches are in the FLASH positions, the left/right landing lights will alternately flash. When both switches are in the ON position, the landing lights operate normally (steady on). If one of the landing light switches (left or right) is in the FLASH position, only that landing light (left or right) will flash at approximately 22 (+/-1) flashes per minute.

Logo Lights

Logo lights are located on the top of each horizontal stabilizer surface to point light on both sides of the vertical stabilizer.

Position Lights

[Option - Non-winglet airplanes]
The navigation lights are the standard red (left forward wingtip), green (right forward wingtip), and white (aft tip of both wings) position lights.

[Option - Winglets]
The navigation lights are the standard red (left forward, at the base of the winglet), green (right forward, at the base of the winglet), and white (trailing edge, at the base of both winglets).

Strobe Lights

[Option - No winglets]
Three high intensity white strobe lights are installed on the left forward wing tip, right forward wing tip, and tail cone.

[Option - Winglets]
Three high intensity white strobe lights are installed on the left forward winglet, right forward winglet, and tail cone.

Anti–collision Lights

Two red anti–collision strobe lights are located on the top and bottom of the fuselage.

Wing Illumination Lights

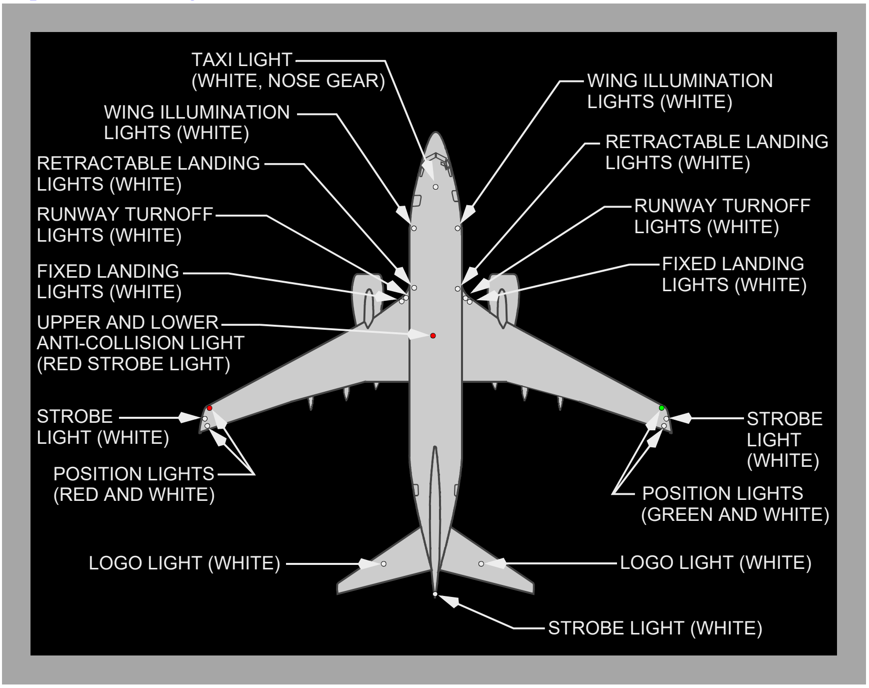
Wing lights are installed on the fuselage and illuminate the leading edge of the wing.

Wheel Well Lights

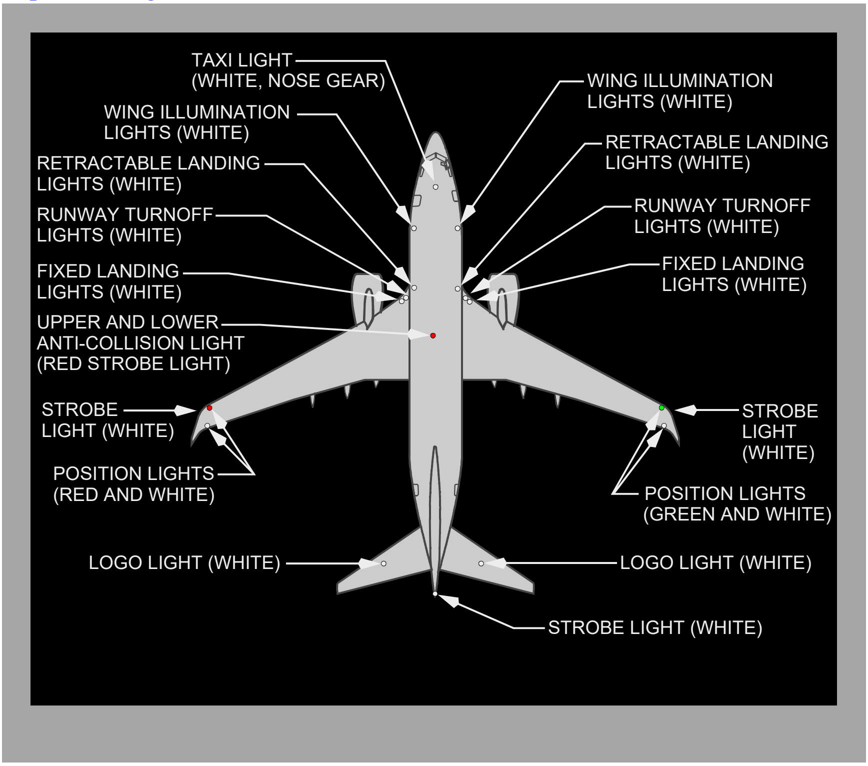
Lights are installed in the wheel well of the nose gear and each main gear.

Exterior Lighting Locations

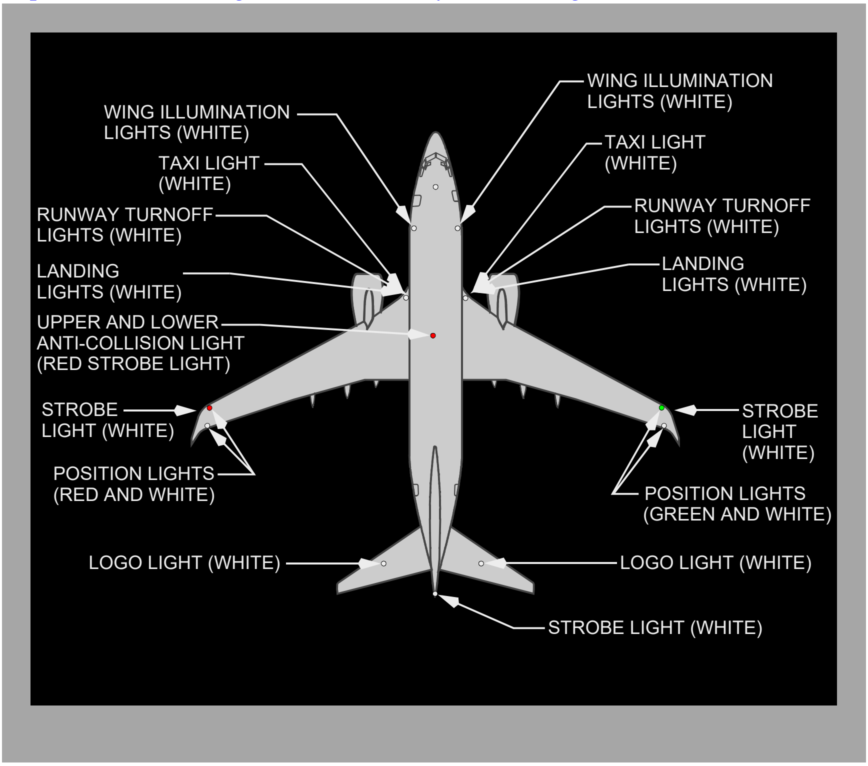
[Option - No winglets]



[Option: Winglets]



[Option: LED Landing, Taxi and Runway Turnoff Lights]



Flight Deck Lighting

Flight deck lighting is provided for panel illumination, area lighting and localized illumination. Dome lights supply general flight deck flood lighting. The glareshield supplies background light for the main instrument panels. Each instrument and instrument panel has its own integral lights. Floodlights are installed for the MCP, electronic panel, and aft circuit breaker panel.

Map lights, chart lights and utility lights are available at the pilot stations, each with individual controls.

If normal electrical power is lost, standby electrical power is automatically provided to the standby compass light, dome lights, instrument flood lights and selected system information and warning lights.

Passenger Cabin Lighting

Passenger cabin lighting is supplied by incandescent and fluorescent lights. General cabin lighting is provided by window lights, ceiling lights, and entry lights. Reading lights are located above each passenger seat in the passenger service unit. Lights are also installed in the lavatories and galleys.

Passenger Cabin Signs

The passenger cabin signs are controlled by a switch on the forward overhead panel. With Auto selected, the signs are controlled automatically by reference to landing gear and flap positions:

FASTEN BELTS and RETURN TO SEAT signs:

- illuminate when flaps or gear are extended
- extinguish when flaps and gear are retracted.

NO ELECTRONIC DEVICES signs:

- illuminate when flaps or gear are extended
- extinguish when flaps and gear are retracted.

NO SMOKING signs:

- illuminate when gear is extended
- extinguish when gear is retracted.

All passenger signs can be controlled manually by positioning the respective switch to ON or OFF.

When the passenger cabin signs illuminate or extinguish, a low tone sounds over the PA system.

Supernumerary Cabin Signs

The supernumerary cabin signs are controlled by switches on the forward overhead panel.

The NO SMOKING and FASTEN BELTS switches are located on the EMER EXIT LIGHTS panel. The PASS OXYGEN switch on the OXYGEN panel controls the DON OXYGEN signs.

NO SMOKING signs are illuminated at all times. Moving the NO SMOKING switch to ON will result in a low chime sounding in the cabin.

The FASTEN SEAT BELTS and RETURN TO SEAT signs can be controlled manually by positioning the FASTEN BELTS switch to ON or OFF.

The PASS OXYGEN switch controls two DON OXYGEN signs in the supernumerary cabin. The panel mounted on the rigid cargo barrier has an illuminated DON OXYGEN sign and an audible horn. The second illuminated DON OXYGEN sign is located above the Galley Service Door.

When the PASS OXYGEN switch is is in the NORMAL position and cabin altitude exceeds 14,000 feet, the DON OXYGEN signs in the supernumerary cabin illuminate automatically, and the audible horn sounds for 30 seconds. The DON OXYGEN sign will remain illuminated until cabin attitude is below 14,000 feet.

When the PASS OXYGEN switch is set to ON, the DON OXYGEN signs illuminate regardless of cabin altitude, and the audible horn sounds for 30 seconds. To extinguish the DON OXYGEN signs, set the Passenger Oxygen Switch to NORMAL.

Emergency Lighting

Exit lights are located throughout the passenger cabin to indicate the approved emergency exit routes. The system is controlled by a switch on the overhead panel. The switch has three positions, OFF, ARMED and ON and is guarded to the ARMED position. With the switch in the ARMED position, the emergency exit lights are normally extinguished. If electrical power to DC bus No. 1 fails or if AC power has been turned off, the emergency exit lights illuminate automatically.

The emergency exit lights may also be illuminated by a switch on the Aft Attendant Panel. Lifting the guard and pushing the switch ON overrides the flight deck control and illuminates the emergency exit lights. Control from this panel is available in the event of failure of the automatic control.

The flight deck aft DOME light contains a separate bulb that is powered by the emergency lighting system to provide for flight deck evacuation.

Interior Emergency Lighting

[Option: Photoluminescent Lighting System]
Interior emergency exit lights are located:

- in the lower inboard corner of stowage bins to illuminate the aisle
- over the entry/service and overwing emergency doors to indicate the door exits

[Option: 737-900ER with mid-exit doors activated]
- over the entry/service and overwing/mid-exit emergency doors to indicate the door exits
- in the ceiling to locate the exits and provide general illumination in the area of the exits.

Self–illuminating exit locator signs are installed at the forward, middle, and aft end of the passenger cabin.

A photoluminescent floor path marking system is installed along the cabin aisle. The photoluminescent material, when excited by light, will glow and provide exit path guidance. At the exit, electrically operated lights and markers provide exit identification.

The photoluminescent strips need to be properly charged. The table below contains charging information and can be used to determine how long the strips remain illuminated. For charging, the cabin ceiling, and sidewall lights need to be on at full intensity, and the strips should not be covered or blocked.

Photoluminescent Lighting systems with strip colors other than blue.

<table>
<tr><th>First Flight of the Day with Bin Doors Closed</th><th>Maximum Duration Allowed (Hours)</th><th>Additional Steps to Follow for charging</th></tr>
<tr><td>5 minute charge</td><td>4.25</td><td rowspan="5">a) Close overhead bin doors during charging.
b) Cabin activity is limited to minor aisle traffic or crew and personnel.
c) Passengers will shadow the system and are not allowed onboard during charging.</td></tr>
<tr><td>10 minute charge</td><td>8.0</td></tr>
<tr><td>15 minute charge</td><td>9.5</td></tr>
<tr><td>30 minute charge</td><td>14.0</td></tr>
<tr><td>45 minute charge</td><td>16.0</td></tr>
</table>

<table>
<tr><th>First Flight of the Day with Bin Doors Open No Passengers</th><th>Maximum Duration Allowed (Hours)</th><th>Additional Steps to Follow for charging</th></tr>
<tr><td>15 minute charge</td><td>5.75</td><td rowspan="2">a) Close overhead bin doors during charging.
b) Cabin activity is limited to minor aisle traffic or crew and personnel.
c) Passengers will shadow the system and are not allowed onboard during charging.</td></tr>
<tr><td>30 minute charge</td><td>7.5</td></tr>
</table>

In-Flight Charging* - All Phases	Maximum Duration Allowed (Hours)	Additional Steps to Follow for charging
15 minute charge	8.0	Charging must begin prior to previous discharge duration ending. Strips are assumed to be shadowed during meal service by galley carts and flight attendants which are stationary for 5 minutes.
30 minute charge	11.25	

In-Flight Charging* - Descent	Maximum Duration Allowed (Hours)	Additional Steps to Follow for charging
10 minute charge	8.0	Charging must begin prior to previous discharge duration ending. Reduced charge time allowed because passengers are seated, meal service ended and little aisle traffic.

In-Flight Charging* - Double Charge at 4 Hours and 8 Hours	Maximum Duration Allowed (Hours)	Additional Steps to Follow for charging
15 minute charge	9.5	Charging must begin prior to previous discharge duration ending. Strips are assumed to be shadowed during meal service by galley carts and flight attendants which are stationary for 5 minutes. In order to get double charging credit, strips must be charged for the first time 4 hours +/- 15 minutes after prior charge. The second charge must take place before 8 hours has elapsed from initial charge.
30 minute charge	12.5	

Continuous Flight	**No limit if lights stay on**	**Flight duration can be extended continuously by having ceiling lights on dim.**
*Taxi Time can be used for charging credit.		

Quick Turn with Bin Doors Open and Passengers in Seats	Maximum Duration Allowed (Hours)	Additional Steps to Follow for charging
15 minute charge	6.75	a) Charging must begin prior to previous discharge duration ending b) Bin doors can be open during charging c) Passenger loading and unloading periods can not be included in the charge time. Passengers can be seated on the airplane.
30 minute charge	9.0	

Quick Turn with Bin Doors Open and No Passengers in Seats	Maximum Duration Allowed (Hours)	Additional Steps to Follow for charging
15 minute charge	7.5	a) Close overhead bin doors during charging b) Cabin activity is limited to minor aisle traffic or crew and personnel c) Passengers will shadow the system and are not allowed onboard during charging.
30 minute charge	10.0	

Photoluminescent Lighting systems with blue strips.

First Flight of the Day with Bin Doors Closed	Maximum Duration Allowed (Hours)	Additional Steps to Follow for charging
5 minute charge	4.0	a) Close overhead bin doors during charging. b) Cabin activity is limited to minor aisle traffic or crew and personnel. c) Passengers will shadow the system and are not allowed onboard during charging.
10 minute charge	6.0	
15 minute charge	8.0	
30 minute charge	10.0	
45 minute charge	11.5	

First Flight of the Day with Bin Doors Open No Passengers	Maximum Duration Allowed (Hours)	Additional Steps to Follow for charging
15 minute charge	5.0	a) Close overhead bin doors during charging. b) Cabin activity is limited to minor aisle traffic or crew and personnel. c) Passengers will shadow the system and are not allowed onboard during charging.
30 minute charge	6.0	

In-Flight Charging* - All Phases	Maximum Duration Allowed (Hours)	Additional Steps to Follow for charging
15 minute charge	8.0	Charging must begin prior to previous discharge duration ending. Strips are assumed to be shadowed during meal service by galley carts and flight attendants which are stationary for 5 minutes.
30 minute charge	11.5	

In-Flight Charging* - Descent	Maximum Duration Allowed (Hours)	Additional Steps to Follow for charging
10 minute charge	8.0	Charging must begin prior to previous discharge duration ending. Reduced charge time allowed because passengers are seated, meal service ended and little aisle traffic.

In-Flight Charging* - Double Charge at 4 Hours and 8 Hours	Maximum Duration Allowed (Hours)	Additional Steps to Follow for charging
15 minute charge	9.5	Charging must begin prior to previous discharge duration ending. Strips are assumed to be shadowed during meal service by galley carts and flight attendants which are stationary for 5 minutes. In order to get double charging credit, strips must be charged for the first time 4 hours +/- 15 minutes after prior charge. The second charge must take place before 8 hours has elapsed from initial charge.
30 minute charge	12.5	

Continuous Flight	**No limit if lights stay on**	**Flight duration can be extended continuously by having ceiling lights on dim.**
*Taxi Time can be used for charging credit.		

Quick Turn with Bin Doors Open and Passengers in Seats	Maximum Duration Allowed (Hours)	Additional Steps to Follow for charging
15 minute charge	6.75	a) Charging must begin prior to previous discharge duration ending b) Bin doors can be open during charging c) Passenger loading and unloading periods can not be included in the charge time. Passengers can be seated on the airplane.
30 minute charge	9.0	

Quick Turn with Bin Doors Open and No Passengers in Seats	Maximum Duration Allowed (Hours)	Additional Steps to Follow for charging
15 minute charge	7.5	a) Close overhead bin doors during charging b) Cabin activity is limited to minor aisle traffic or crew and personnel c) Passengers will shadow the system and are not allowed onboard during charging.
30 minute charge	10.0	

Sky Interior and Photoluminescent Lighting systems Standard Width and Narrow Strips (Blue or Patternmatch only)

First Flight of the Day with Bin Doors Closed (White BRIGHT)	Maximum Duration Allowed (Hours)	Additional Steps to Follow for charging
5 minute charge	3.5	a) Close overhead bin doors during charging. b) Cabin activity is limited to minor aisle traffic or crew and personnel.
10 minute charge	5	
15 minute charge	7.5	

First Flight of the Day with Bin Doors Closed (Crossbin/COS/Direct W1/W2 High)	Maximum Duration Allowed (Hours)	Additional Steps to Follow for charging
15 minute charge	7.0	a) Close overhead bin doors during charging. b) Cabin activity is limited to minor aisle traffic or crew and personnel. c) Passengers will shadow the system and are not allowed on board during charging.

First Flight of the Day with Bin Doors Open No Passengers (White BRIGHT)	Maximum Duration Allowed (Hours)	Additional Steps to Follow for charging
10 minute charge	5	a) Bin doors can be open during charging. b) Cabin activity is limited to minor aisle traffic or crew and personnel.
15 minute charge	7.5	

Quick Turn with Bin Doors Open and Passengers in Seats (White BRIGHT)	Maximum Duration Allowed (Hours)	Additional Steps to Follow for charging
10 minute charge	5	a) Charging must begin prior to previous discharge duration ending b) Bin doors can be open during charging c) Passenger loading and unloading periods can not be included in the charge time. Passengers can be seated on the airplane.
15 minute charge	7.5	

Quick Turn with Bin Doors Closed (Crossbin/COS/Direct W1/W2 High)	Maximum Duration Allowed (Hours)	Additional Steps to Follow for charging
15 minute charge	7.0	a) Close overhead bin doors during charging. b) Cabin activity is limited to minor aisle traffic or crew and personnel. c) Passengers will shadow the system and are not allowed on board during charging.

In-Flight Charging	Maximum Duration Allowed (Hours)	Additional Steps to Follow for charging
Taxi/Take off 10 minute charge	2.5	Charging must begin prior to previous discharge duration ending. Strips are assumed to be shadowed during meal service by galley cart and flight attendants which are stationary for 5 minutes.
Meal/Beverage 15 minute charge	3.5	
Day Cruise 15 minute charge	3.5	
Crossbin/COS/Direct W1/W2 Medium 15 minute charge	3.5	
Crossbin/COS/Direct W1/W2 High 15 minute charge	5.0	

Continuous Flight	Maximum Duration Allowed (Hours)	Additional Steps to Follow for charging
	No limit if ceiling and sidewall light stays on	If the Attendant Control Panel loses communication with the ceiling and sidewall lights these lights will change to a default medium white. Flight duration can be extended continuously.

Sky Interior and Photoluminescent Lighting systems with Standard Width Strips (except Blue or Patternmatch)

First Flight of the Day with Bin Doors Closed (White BRIGHT)	Maximum Duration Allowed (Hours)	Additional Steps to Follow for charging
5 minute charge	8	a) Close overhead bin doors during charging. b) Cabin activity is limited to minor aisle traffic or crew and personnel.
10 minute charge	9.5	
15 minute charge	12.5	

First Flight of the Day with Bin Doors Open No Passengers (White BRIGHT)	Maximum Duration Allowed (Hours)	Additional Steps to Follow for charging
10 minute charge	9.5	a) Close overhead bin doors during charging. b) Cabin activity is limited to minor aisle traffic or crew and personnel.
15 minute charge	12.5	

Quick Turn with Bin Doors Open and Passengers in Seats (White BRIGHT)	Maximum Duration Allowed (Hours)	Additional Steps to Follow for charging
10 minute charge	9.5	a) Charging must begin prior to previous discharge duration ending b) Bin doors can be open during charging c) Passenger loading and unloading periods can not be included in the charge time. Passengers can be seated on the airplane.
15 minute charge	12.5	

In-Flight Charging	Maximum Duration Allowed (Hours)	Additional Steps to Follow for charging
Taxi/Take off 10 minute charge	3.5	Charging must begin prior to previous discharge duration ending. Strips are assumed to be shadowed during meal service by galley cart and flight attendants which are stationary for 5 minutes.
Meal/Beverage 15 minute charge	5	
Day Cruise 15 minute charge	5	

In-Flight Charging* - Double Charge at 3 Hours and 6.5 Hours	Maximum Duration Allowed (Hours)	Additional Steps to Follow for charging
Meal/Beverage 15 minute charge	7.5	Charging must begin prior to previous discharge duration ending. Strips are assumed to be shadowed during meal service by galley carts and flight attendants which are stationary for 5 minutes. In order to get double charging credit, strips must be charged for the first time 4 hours +/- 15 minutes after prior charge. The second charge must take place before 8 hours has elapsed from initial charge.
Day Cruise 15 minute charge	7.5	

Continuous Flight	Maximum Duration Allowed (Hours)	Additional Steps to Follow for charging
	No limit if ceiling and sidewall light stays on	If the Attendant Control Panel loses communication with the ceiling and sidewall lights these lights will change to a default medium white. Flight duration can be extended continuously.

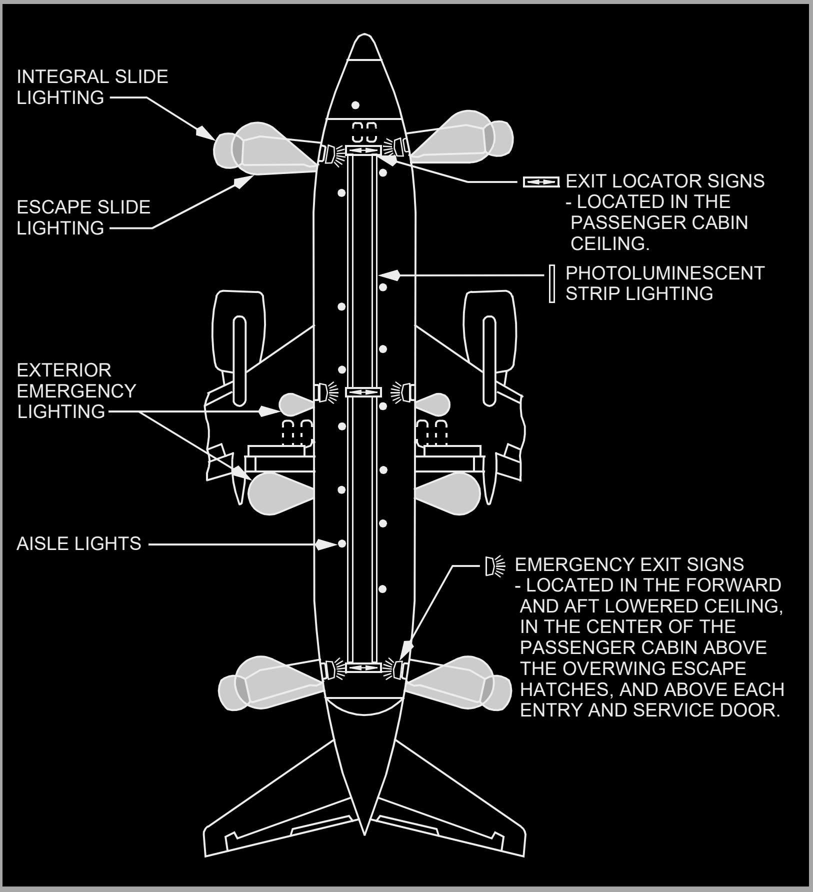
Exterior Emergency Lighting

[Option - 737-600/700/800/900]
Exterior emergency lights illuminate the escape slides. The fuselage installed escape slide lights are adjacent to the forward and aft service and entry doors. Lights are also installed on the fuselage to illuminate the overwing escape routes and ground contact area.

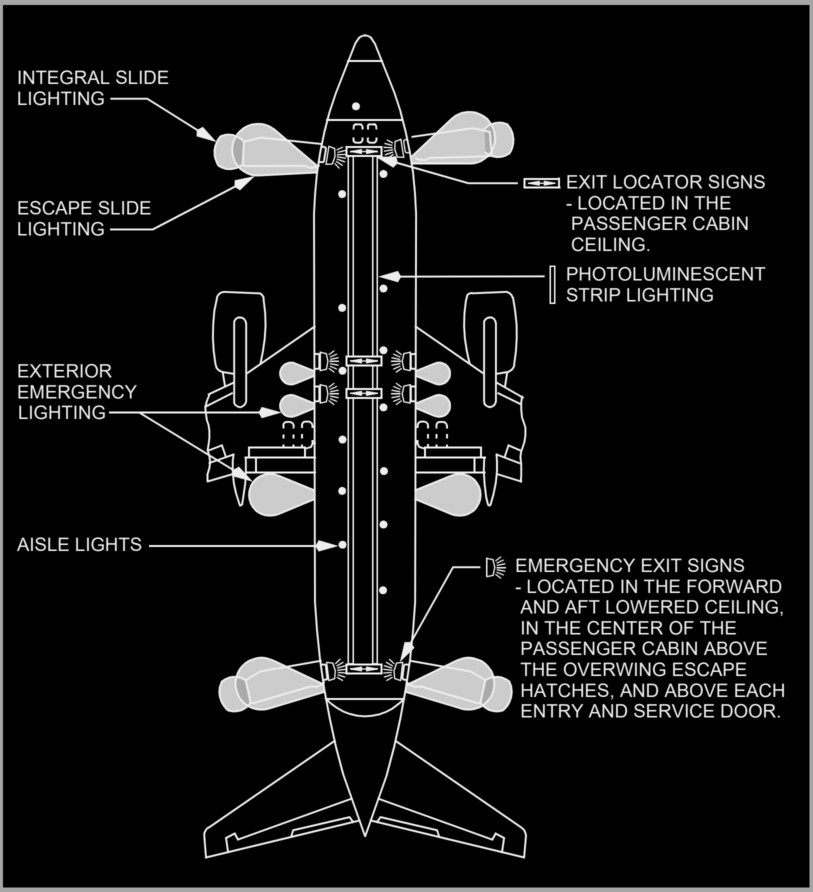
[Option - 737-900ER]
Exterior emergency lights illuminate the escape slides. The fuselage installed escape slide lights are adjacent to the forward and aft service and entry doors. Lights are also installed on the fuselage to illuminate the overwing and mid-exit escape routes and ground contact area.

Emergency Exit Lighting

[Option - 737-600/700 with Photoluminescent Lighting]



[Option - 737-800/900/BBJ2/BBJ3 with Photoluminescent Lighting]



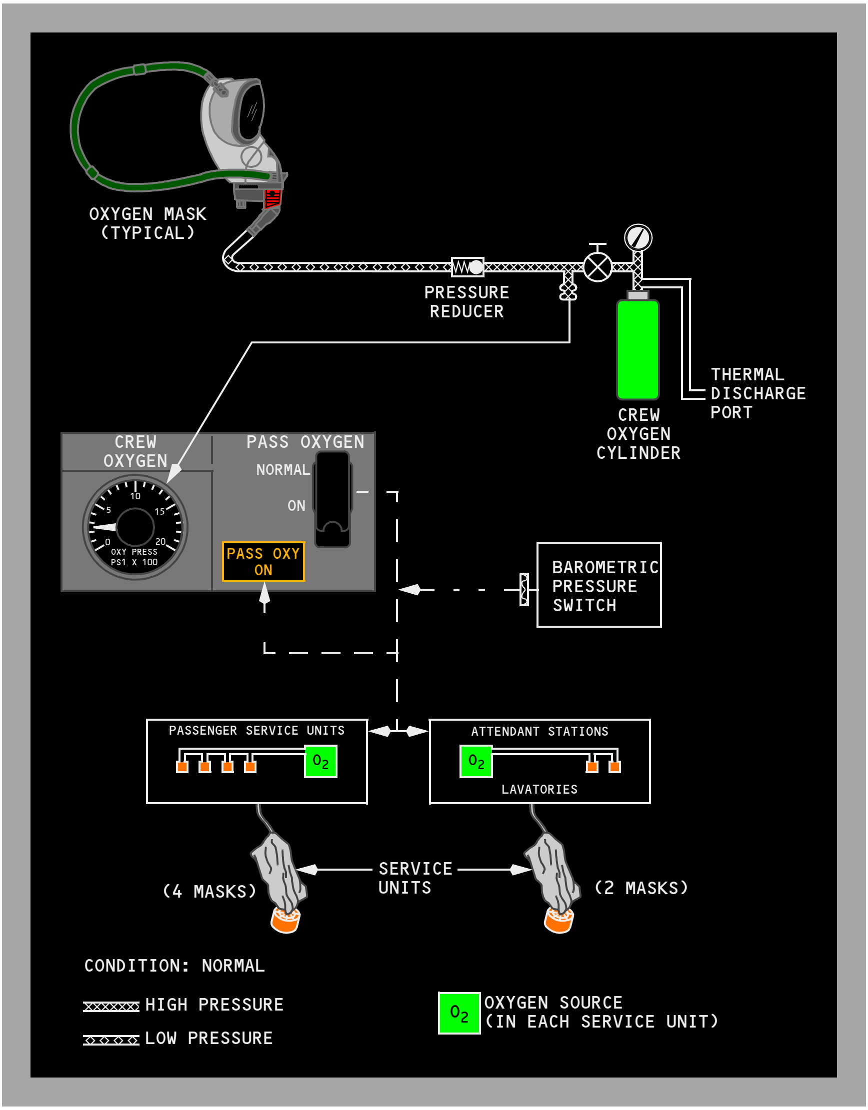
Oxygen Systems

Two independent oxygen systems are provided, one for the flight crew and one for the passengers. Portable oxygen cylinders can be located throughout the airplane for emergency use. These cylinders are normally found in the forward and aft areas of the passenger cabin.

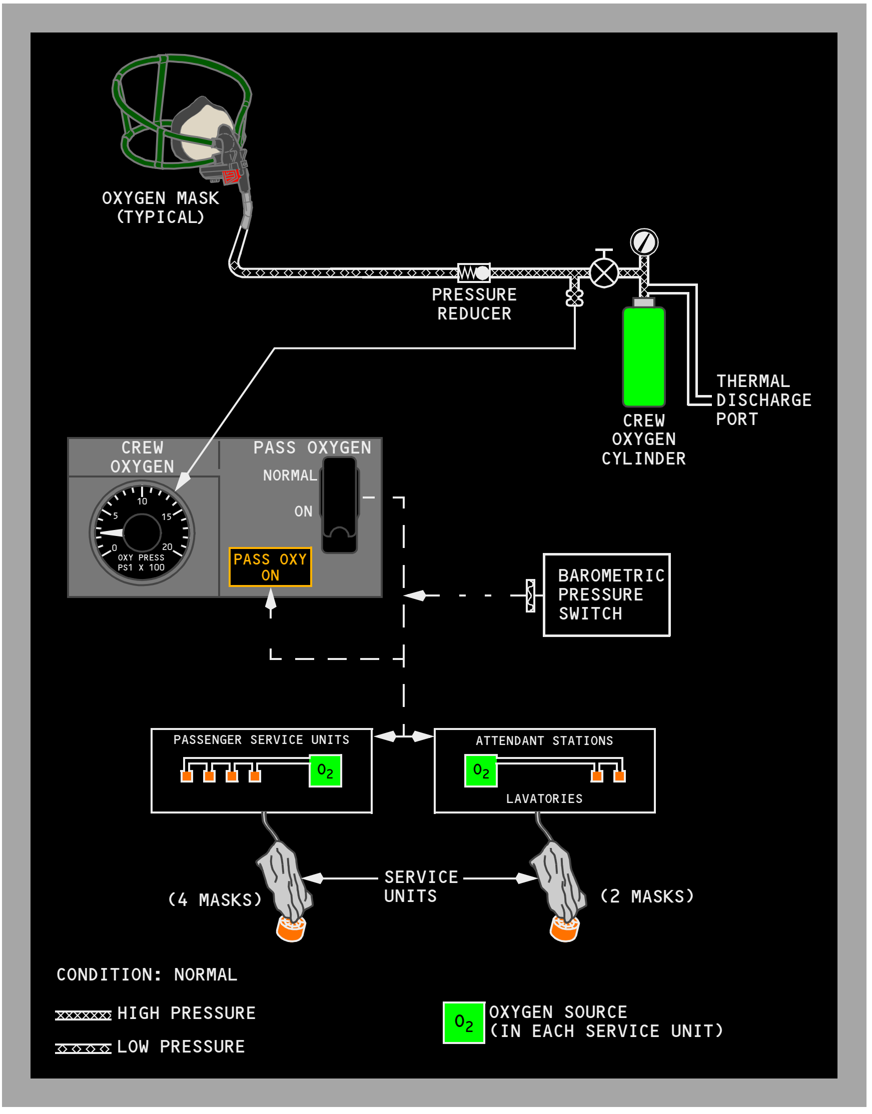
An oxygen system is provided to the flight crew and supernumerary cabin via oxygen cylinders located on the rigid cargo barrier wall in the supernumerary cabin. Individual oxygen masks are located next to each seat in the cabin. An aural horn and "Don Oxygen Mask" lighted sign will reset automatically after the aural horn and lighted sign pulsing times out. The PASS OXYGEN switch located on the P5 panel can be used by the flight crew to initiate the signal for the aural horn and lighted sign. Portable oxygen cylinders are located in the supernumerary cabin for emergency use.

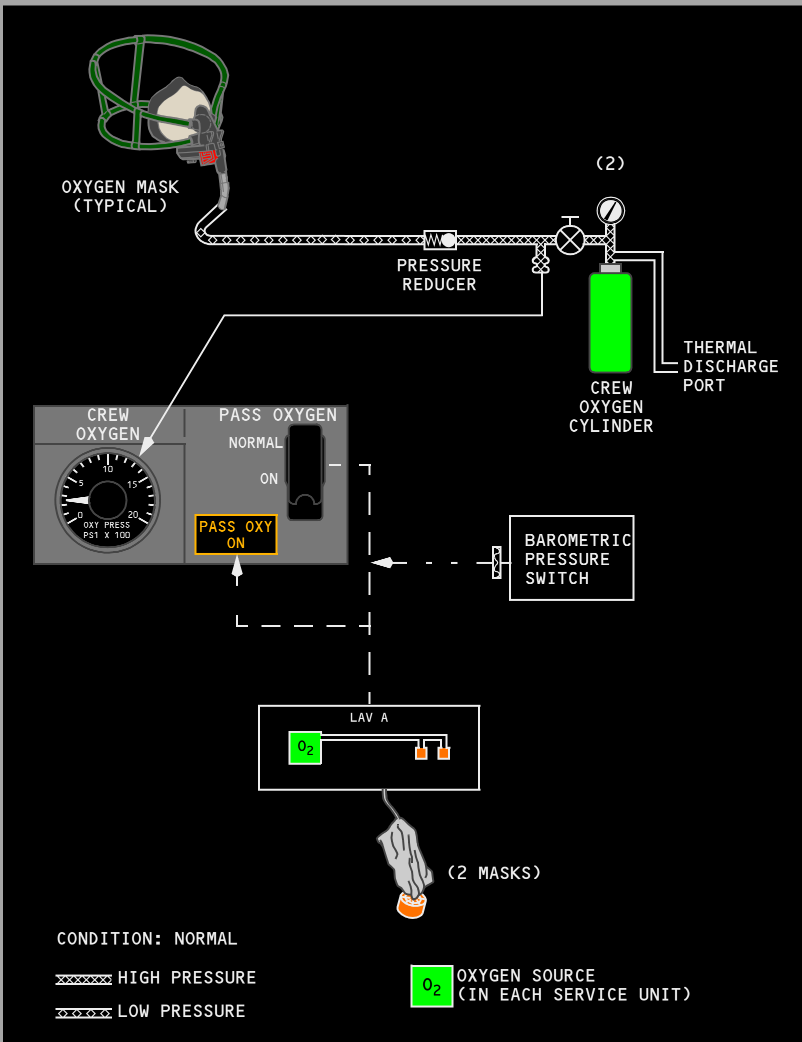
Oxygen System Schematic

[Option - Typical Full Face Oxygen Mask]



[Option - Oronasal Oxygen Mask]




OXYGEN MASK
(TYPICAL)
PRESSURE
REDUCER
(2)
THERMAL
DISCHARGE
PORT
CREW
OXYGEN
CYLINDER
CREW
OXYGEN
10
5
15
0
20
OXY PRESS
PSI X 100
PASS OXYGEN
NORMAL
ON
PASS OXY
ON
BAROMETRIC
PRESSURE
SWITCH
LAV A
(2 MASKS)
CONDITION: NORMAL
HIGH PRESSURE
LOW PRESSURE
OXYGEN SOURCE
(IN EACH SERVICE UNIT)

Flight Crew Oxygen System

The flight crew oxygen system uses quick-donning, diluter-demand masks/regulators located at each crew station. Oxygen is supplied by a single cylinder. Oxygen pressure is displayed on the Oxygen Pressure indicator located on the aft overhead panel when the battery switch is ON. Oxygen flow is controlled through an in-line, pressure-reducing regulator to supply low-pressure oxygen to the regulator on the mask. System pressure may be as high as 1850 psi.

The flight crew oxygen system uses quick-donning, diluter-demand masks/regulators located at each crew station. Oxygen is supplied by cylinder(s) located on the Rigid Cargo Barrier (RCB) in the Supernumerary Area. Oxygen pressure is displayed on the Oxygen Pressure indicator located on the aft overhead panel when the battery switch is ON. Oxygen flow is controlled through an in-line, pressure-reducing regulator to supply low-pressure oxygen to the regulator on the mask. System pressure may be as high as 1850 psi.

Oxygen flow is controlled by a regulator mounted on the oxygen mask. By pushing the Regulator Dilution Control lever, the regulator is adjusted from the air/oxygen mixture to 100% oxygen. By rotating the EMERGENCY/TEST selector, the regulator is adjusted to supply oxygen under pressure.

Flight Crew Oxygen Mask Usage

Donning Instructions

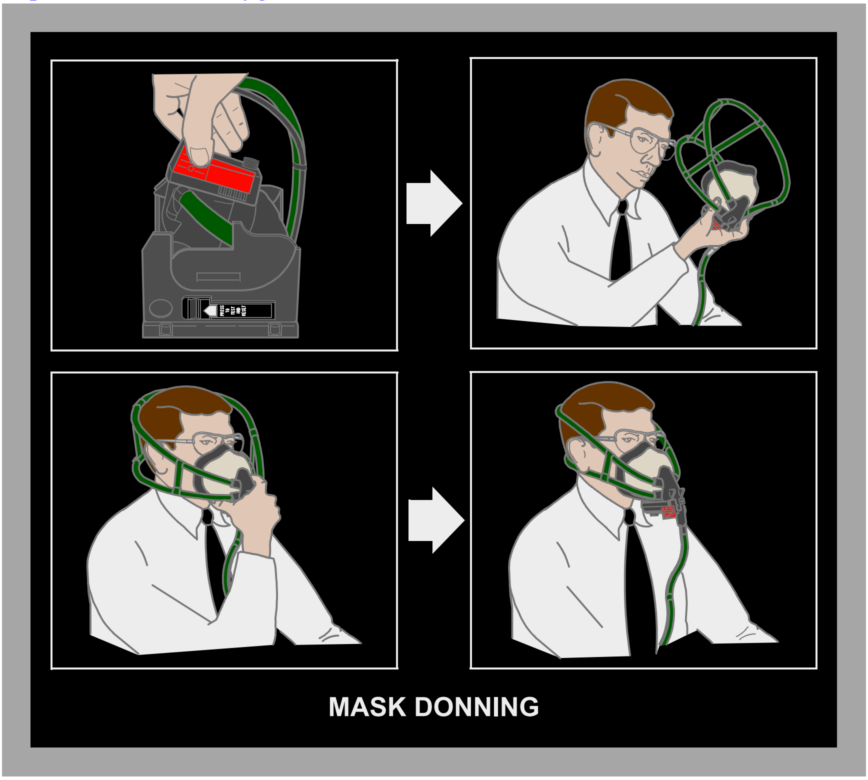
[Option - Oronasal Oxygen Mask]

To don the mask, grasp the regulator with the thumb and forefinger and remove from stowage. Squeezing the inflation levers and removing from the box:

- inflates the mask harness
- momentarily displays a colored oxygen flow indicator.
- Place the mask over the head and release the levers. The harness contracts to fit the mask to head and face.

The observer's oxygen mask, regulator, and harness unit is the same as the pilots'.

[Option - Oronasal Oxygen Mask]

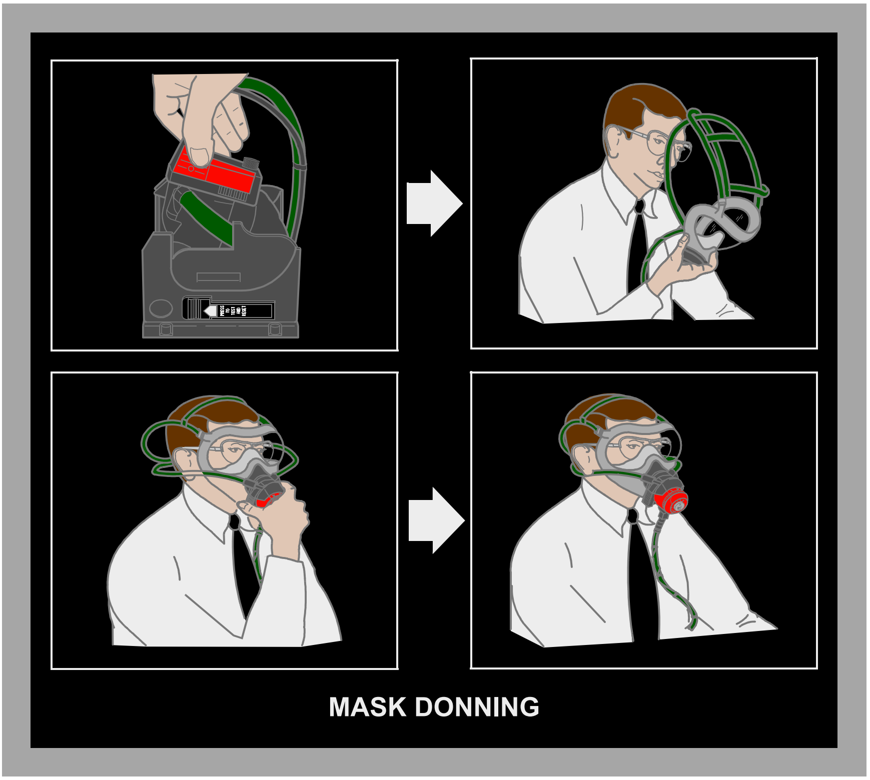


Donning Instructions

[Option - Typical Full Face Oxygen Mask]

To don the oxygen mask accomplish the following:

- Grasp the regulator by the red inflation levers with the hand nearest the stowage box.
- Squeeze the inflation levers while pulling the mask from the box.
- Pull the mask across in front of you, toward the center of the airplane (to ensure ample hose extension) while rolling the mask face-up.
- Lean slightly toward the center of the airplane and bring the mask toward your face so that the lower portion of the mask contacts your chin first. Roll the top of the mask toward your forehead so the harness goes over and behind your head.
- Release the inflation levers so the harness holds the mask in place.



MASK DONNING

Stowing Instructions

[Option - Oronasal Oxygen Mask with MXP400 or MXP800 Series Storage Box]

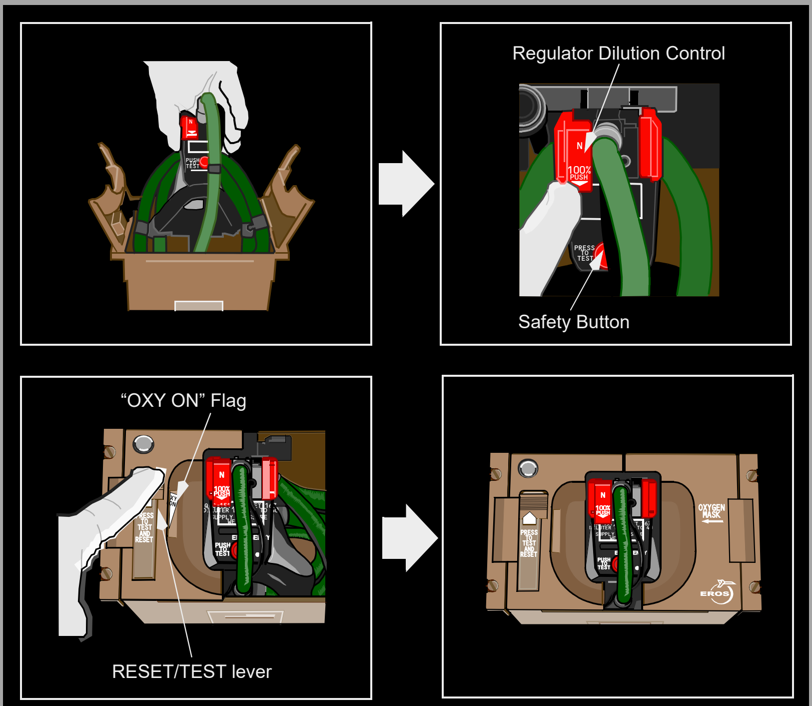
WARNING: Throughout this procedure, do not push the red inflation lever on the demand regulator. Doing this will inflate the harness and prevent the correct stowing of the mask. Should this occur, release the inflation lever to vent the oxygen and restart the stowage procedure.

To stow the oxygen mask accomplish the following:

- Coil the supply hose into the bottom of the stowage box, making the largest diameter possible. Ensure that the harness is completely deflated.
- Hold the assembly by the regulator, with the mask down facing toward you as shown below.
- Grasp the harness and pull it downward so the harness is below the mask. Allow the excess harness to hang downward.

CAUTION: Do not push the harness into or behind the mask. Doing this may cause the harness to hang up on the mask during inflation.

- Insert the mask-regulator assembly into the stowage box, beginning with the harness (regulator up).
- Press down on the assembly until the mask-regulator is fully seated against the stop in the stowage box.
- Set the Regulator Dilution Control to 100% (toggle pushed down) and set the Safety Button to Normal.
- Close the left-hand door. The “OXY ON” flag will slide into view at the center of the door.
- Press, then release the “RESET/TEST” lever on the left-hand door. Ensure that the “OXY ON” flag disappears when the control lever is released.
- Close the right-hand door, ensuring not to pinch the hose.



MASK STOWING

Stowing Instructions

[Option - Typical Full Face Oxygen Mask]

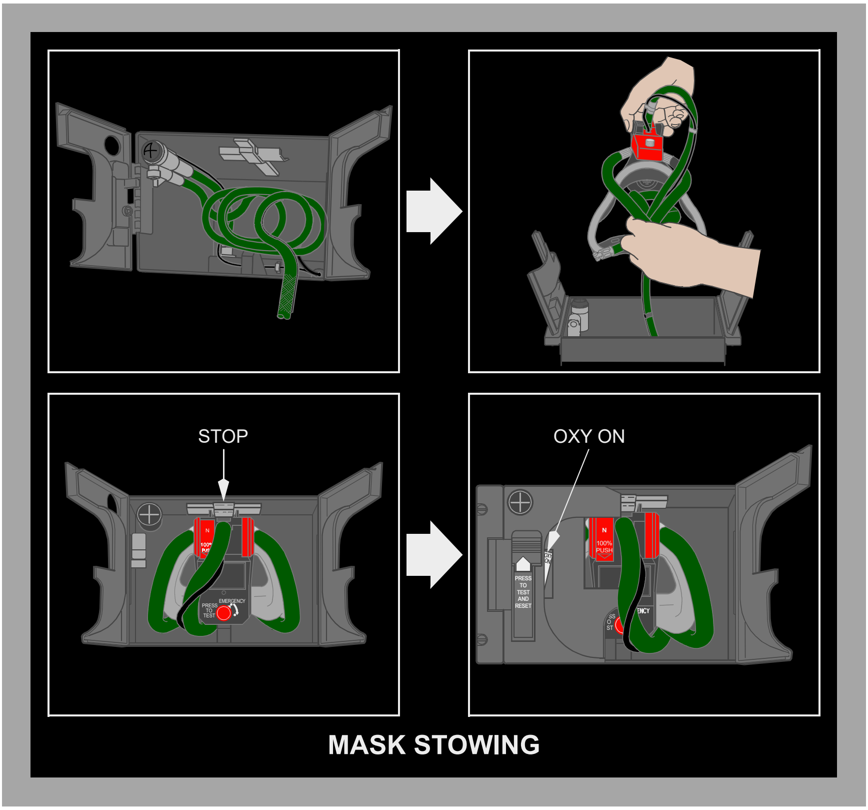
To stow the oxygen mask accomplish the following:

- Set the “N/100%” regulator control to “100%.”
- Ensure that the “EMERGENCY” oxygen control knob is off.
- Coil the supply hose into the bottom of the stowage box, making the largest diameter possible.
- Ensure that the harness is completely deflated.
- Hold the mask by the regulator, with the facepiece down and the inside of the mask toward you.
- Grasp the harness and pull it downward so the cross straps are below the facepiece. Allow the excess harness to hang downward.

CAUTION: Do not push the harness cross straps into or behind the nose piece. Doing this may cause the cross straps to hang up on the mask during inflation.

- Position the supply hose down the center of the facepiece.
- Insert the mask-regulator assembly into the stowage box, beginning with the harness (regulator up).
- Press down on the assembly until the mask-regulator is fully seated against the stop in the stowage box.
- Close the left-hand door. The “OXY ON” flag will slide into view at the center of the door
- Close the right-hand door, ensuring not to pinch the hose
- Press, then release the “TEST AND RESET” control lever on the left-hand door. Ensure that the “OXY ON” flag disappears when the control lever is released.

WARNING: Do not squeeze the red inflation levers during stowing. Doing this will inflate the harness and prevent the correct stowing of the mask.



Portable Protective Breathing Equipment

Protective Breathing Equipment (PBE/Smoke Hood) devices for crew use (for combating fires and/or entering areas of smoke or fume accumulation) may be stowed throughout the airplane; however, they are normally found in the forward and aft sections of the passenger cabin. The device is placed over the head and, when activated, provides approximately 15 to over 20 minutes of oxygen depending upon the device used. Manufacturer's operating instructions are placarded on the container.

Passenger Oxygen System

The passenger oxygen system is supplied by an individual oxygen source located at each Passenger Service Unit (PSU). Four continuous flow masks are connected to each oxygen source. An oxygen source with two masks is located above each attendant station and in each lavatory.

[Option - Oxygen System]
The passenger oxygen system is supplied by an oxygen source. The oxygen is supplied by an oxygen source located in the aft cargo compartment to the oxygen masks located in the passenger service units. An oxygen source with two oxygen masks is provided in each lavatory service unit and in each attendants' service unit. The passenger oxygen system is normally inactive.

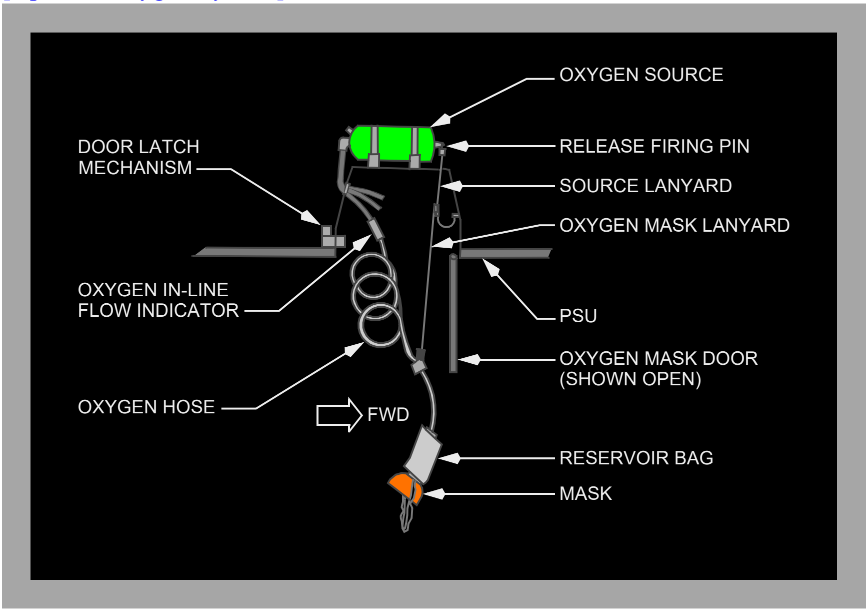
The system is activated automatically by a pressure switch at a cabin altitude of 14,000 feet or when the Passenger Oxygen Switch on the aft overhead panel is positioned to ON. When the system is activated, the PASS OXY ON light illuminates and OVERHEAD illuminates on the Master Caution System.

[Option - Oxygen System]
Activating the system causes the masks to drop from the stowage compartments. The oxygen source is activated when any mask in the unit is pulled down. Pulling one mask down causes all masks in that unit to come down and 100% oxygen flows to all masks. A green in–line flow indicator is visible in the transparent oxygen hose whenever oxygen is flowing to the mask. Oxygen flows for approximately 12 minutes and cannot be shut off. If the passenger oxygen is activated and a PSU oxygen mask compartment does not open, the masks may be dropped manually.

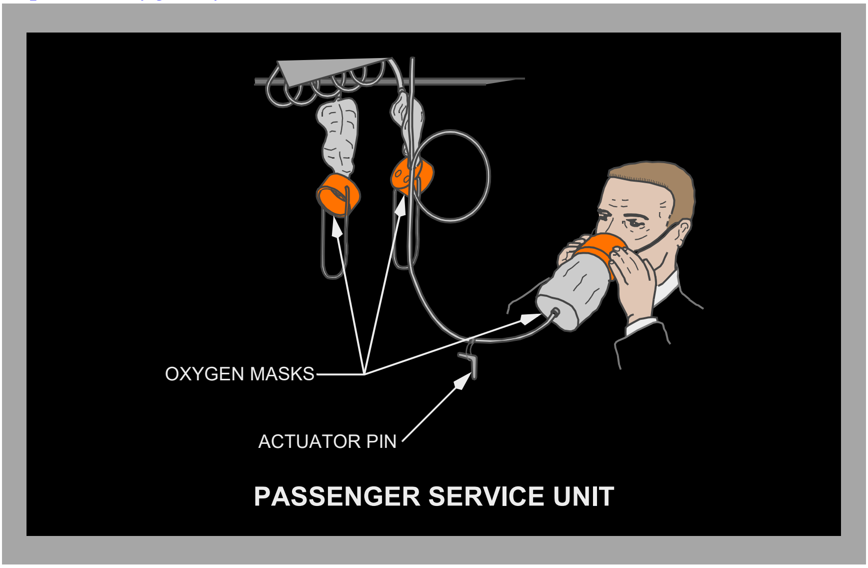
[Option - High Altitude Oxygen System]
Activating the system causes the masks to drop from the stowage compartments. The oxygen flows when any mask in the unit is pulled down. Pulling one mask down causes all masks in that unit to come down and 100% oxygen flows to all masks. A green in–line flow indicator is visible in the transparent oxygen hose whenever oxygen is flowing to the mask. Oxygen quantity is sufficient to provide for the passengers during an emergency descent to an altitude where supplementary oxygen is no longer required. If the passenger oxygen is activated and a PSU oxygen mask compartment does not open, the masks may be dropped manually.

PSU Oxygen Mask Compartment

[Option - Oxygen System]



[Option - Oxygen System]



WARNING: When using passenger oxygen, the "NO SMOKING" sign should be strictly observed. Once the oxygen source is activated, the flow of oxygen is constant, whether or not the mask is being worn.

WARNING: Do not use passenger oxygen with cabin altitude below 14,000 feet when smoke or an abnormal heat source is present. The use of passenger oxygen does not prevent the passengers from inhaling smoke. Air inhaled is a mixture of oxygen and cabin air.

Passenger Portable Oxygen

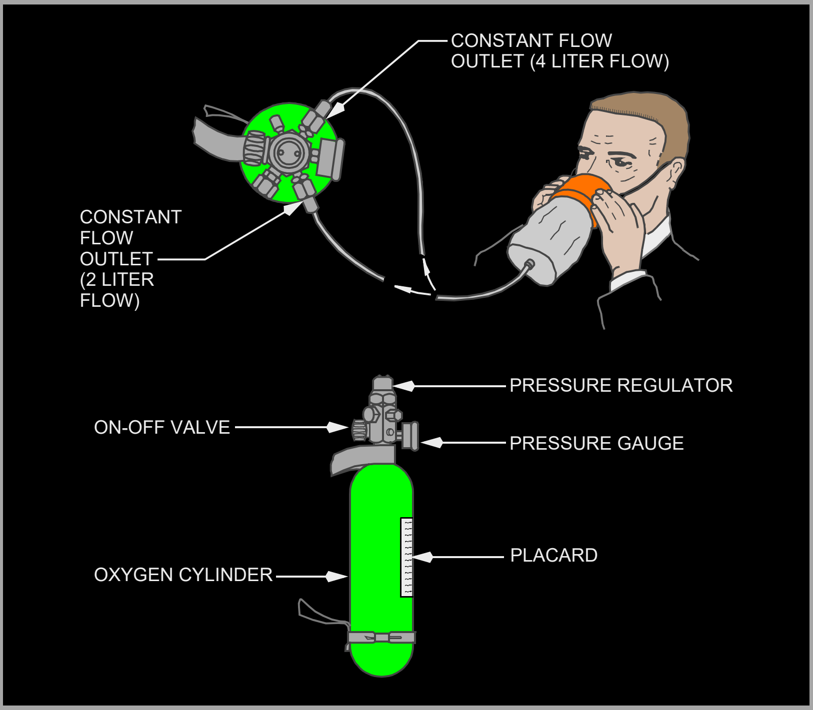
First aid and supplemental portable oxygen cylinders are installed at suitable locations in the passenger cabin. The cylinders are fitted with a pressure gauge, pressure regulator and on–off valve. The cylinders are pressurized to 1800 psi. At this pressure and a temperature of 70 degrees Fahrenheit, (21 degrees Celsius) the cylinders have a capacity of 4.25 cubic feet (120 liters) of free oxygen. Two continuous flow outlets are provided on each cylinder, one regulates flow at two liters per minute for walk–around; the second outlet provides flow at four liters per minute. The four–liter flow is used for first aid.

Duration can be determined by dividing capacity by outflow (120 liters divided by 4 liters/minute = 30 minutes).

Supernumerary Cabin Portable Oxygen

First aid and supplemental portable oxygen cylinders are installed in the supernumerary cabin. The cylinders are fitted with a pressure gauge, pressure regulator and on–off valve. The cylinders are pressurized to 1800 psi. At this pressure and a temperature of 70 degrees Fahrenheit, (21 degrees Celsius) the cylinders have a capacity of 11 cubic feet (311 liters) of free oxygen. Two continuous flow outlets are provided on each cylinder, one regulates flow at two liters per minute for walk–around; the second outlet provides flow at four liters per minute. The four–liter flow is used for first aid.

Passenger Portable Oxygen Schematic



Fire Extinguishers

Fire extinguishers are located in the flight deck and passenger cabin.

Fire extinguishers are located in the flight deck and supernumerary cabin.

Water Fire Extinguishers

Water fire extinguishers contain a solution of water mixed with antifreeze. The container is pressurized by a CO2 cartridge when the extinguisher handle is rotated fully clockwise. The extinguisher should be used on fabric, paper or wood fires only.

To use the water fire extinguisher:

- remove from stowage
- rotate handle fully clockwise
- aim at base of fire and press trigger.

CAUTION: Do not use on electrical or grease type fires.

Chemical Fire Extinguishers

Chemical fire extinguishers (Halon or equivalent) contain a liquefied gas agent under pressure. The pressure indicator shows an acceptable pressure range, a recharge range, and an overcharged range. A safety pin with a pull ring prevents accidental trigger movement. When released the liquefied gas agent vaporizes and extinguishes the fire. The extinguisher is effective on all types of fires, but primarily on electrical, fuel and grease fires.

Direction for use of the fire extinguisher is printed on the extinguisher.

Fire Extinguisher Usage

Each class of fire calls for specialized action. Using the wrong extinguisher may do more harm than good. For your own protection, you should know these basic types, how to use them, and why. These are the fire classification codes:

UNITED STATES CLASS OF FIRES There are three common classes of fire:	EXTINGUISHER TYPE
CLASS A — COMBUSTIBLE MATERIALS paper, wood, fabric, rubber, certain plastics, etc., where quenching by water is effective.	TYPE A — Water (H2O) saturates material and prevents rekindling
CLASS B — FLAMMABLE LIQUIDS gasoline, oils, greases, solvents, paints, burning liquids, cooking fats, etc., where smothering action is required.	TYPE B — Halon or equivalent
CLASS C — LIVE ELECTRICAL fires started by short circuit or faulty wiring in electrical, electronic equipment or fires in motors, switches, galley equipment, etc., where a nonconducting extinguisher agent is required. NOTE: Whenever possible, electrical equipment should be de-energized before attacking a class C fire.	TYPE C — Halon or equivalent

WARNING: THE WRONG EXTINGUISHER ON A FIRE COULD DO MORE HARM THAN GOOD. FOR EXAMPLE, A B C RATED EXTINGUISHER IS NOT AS EFFECTIVE AS H2O ON A CLASS A FIRE. WATER ON FLAMMABLE LIQUID FIRES SPREADS THE FIRE. WATER ON A LIVE ELECTRICAL FIRE COULD CAUSE SEVERE SHOCK OR DEATH.

EUROPEAN/AUSTRALIAN CLASS OF FIRES There are three common classes of fire:		EXTINGUISHER TYPE	
CLASS A	COMBUSTIBLE MATERIALS paper, wood, fabric, rubber, certain plastics, etc., where quenching by water is effective.	TYPE A	Water (H2O) saturates material and prevents rekindling
CLASS B	FLAMMABLE LIQUIDS gasoline, oils, greases, solvents, paints, burning liquids, cooking fats, etc., where smothering action is required.	TYPE B	Halon or equivalent
CLASS E	LIVE ELECTRICAL fires started by short circuit or faulty wiring in electrical, electronic equipment or fires in motors, switches, galley equipment, etc., where a nonconducting extinguisher agent is required. NOTE: Whenever possible, electrical equipment should be de-energized before attacking a class E fire.	TYPE E	Halon or equivalent

WARNING: THE WRONG EXTINGUISHER ON A FIRE COULD DO MORE HARM THAN GOOD. FOR EXAMPLE, A B E RATED EXTINGUISHER IS NOT AS EFFECTIVE AS H2O ON A CLASS A FIRE. WATER ON FLAMMABLE LIQUID FIRES SPREADS THE FIRE. WATER ON A LIVE ELECTRICAL FIRE COULD CAUSE SEVERE SHOCK OR DEATH.

WARNING: If a Halon bottle or equivalent fire extinguisher is to be discharged on the flight deck, all crewmembers in the flight deck must wear oxygen masks and use 100% oxygen with emergency selected.

WARNING: The concentrated agent, and the by-products created by the heat of the fire, are toxic. Unprotected exposure to high concentrations of agent or by-products can result in dizziness, difficulty breathing, as well as eye and nose irritation. After discharge of an entire fire extinguisher, it can take up to 7 minutes for agent to dissipate. Signs of smoke should be clear and agent dissipated before removal of oxygen masks or protective breathing equipment.

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Emergency Equipment Symbols

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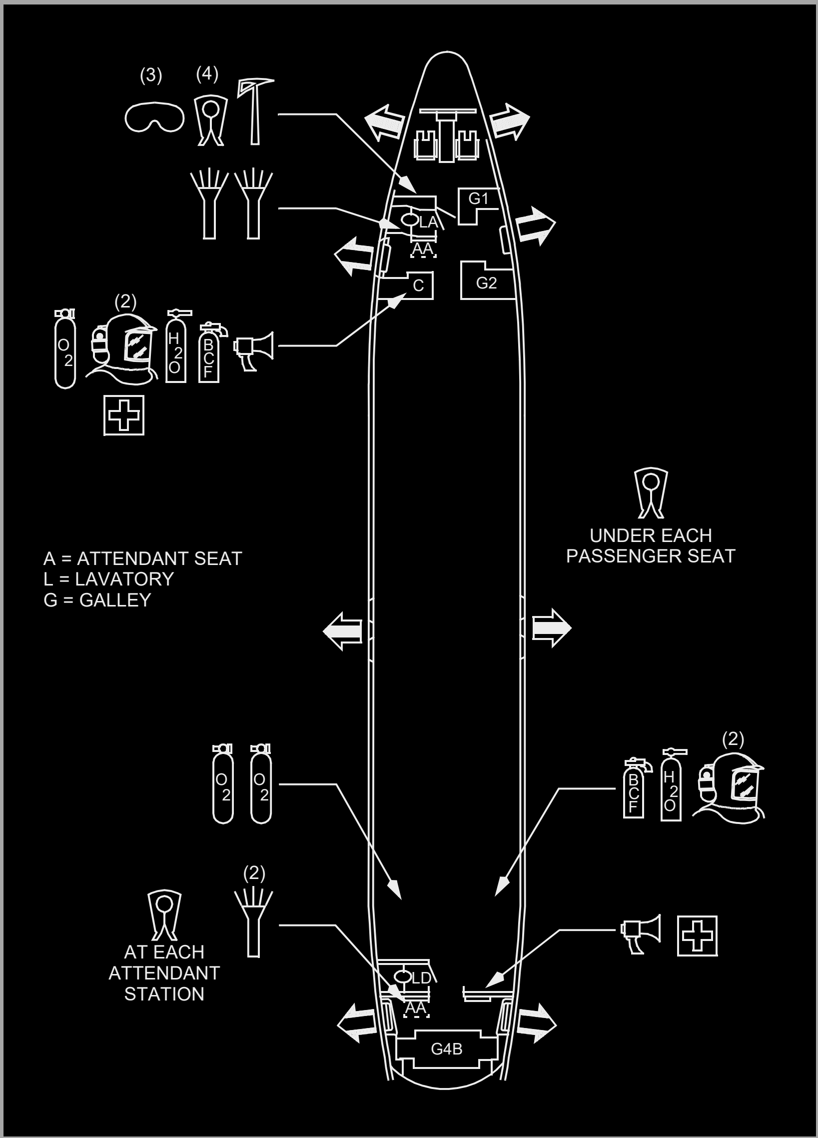
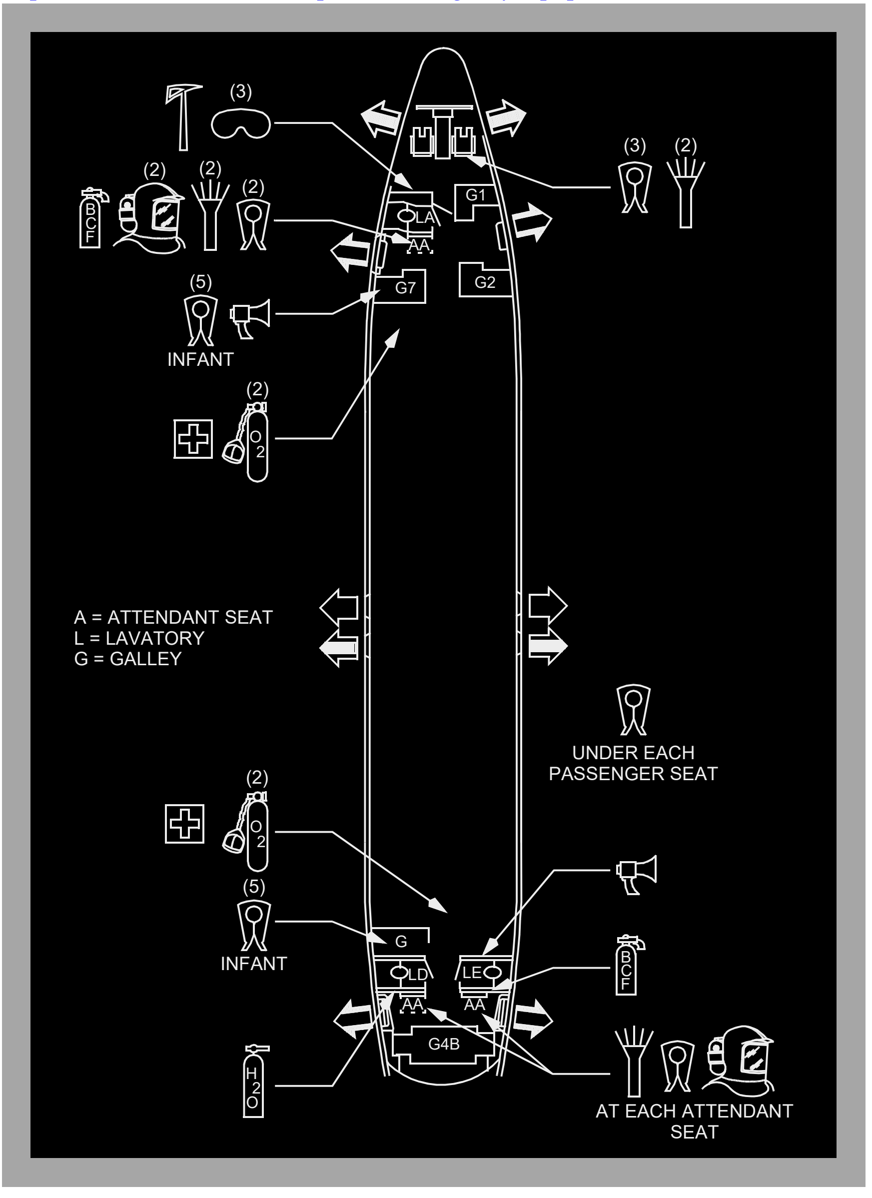
Emergency Equipment Locations

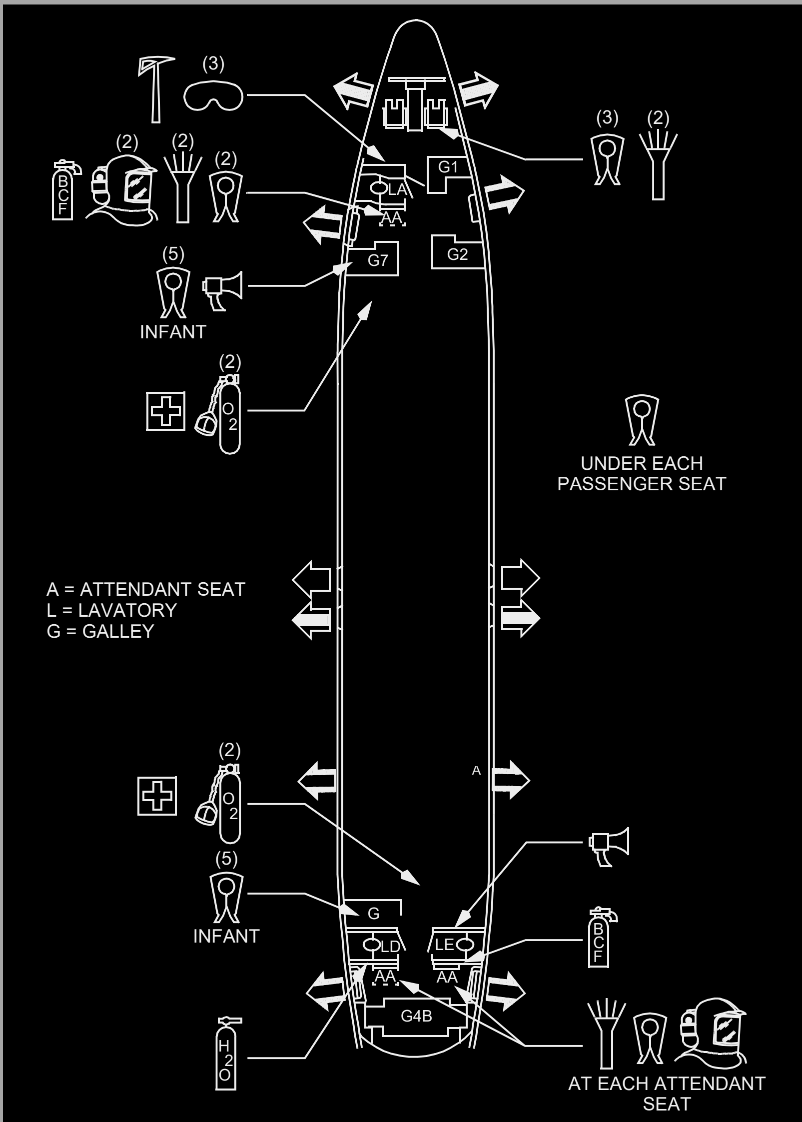
[Option - Typical 737-600/700 with optional emergency equipment]



[Option - 737-800/900 with optional emergency equipment]



[Option - 737-900ER with optional emergency equipment and Mid-Exit Doors activated]



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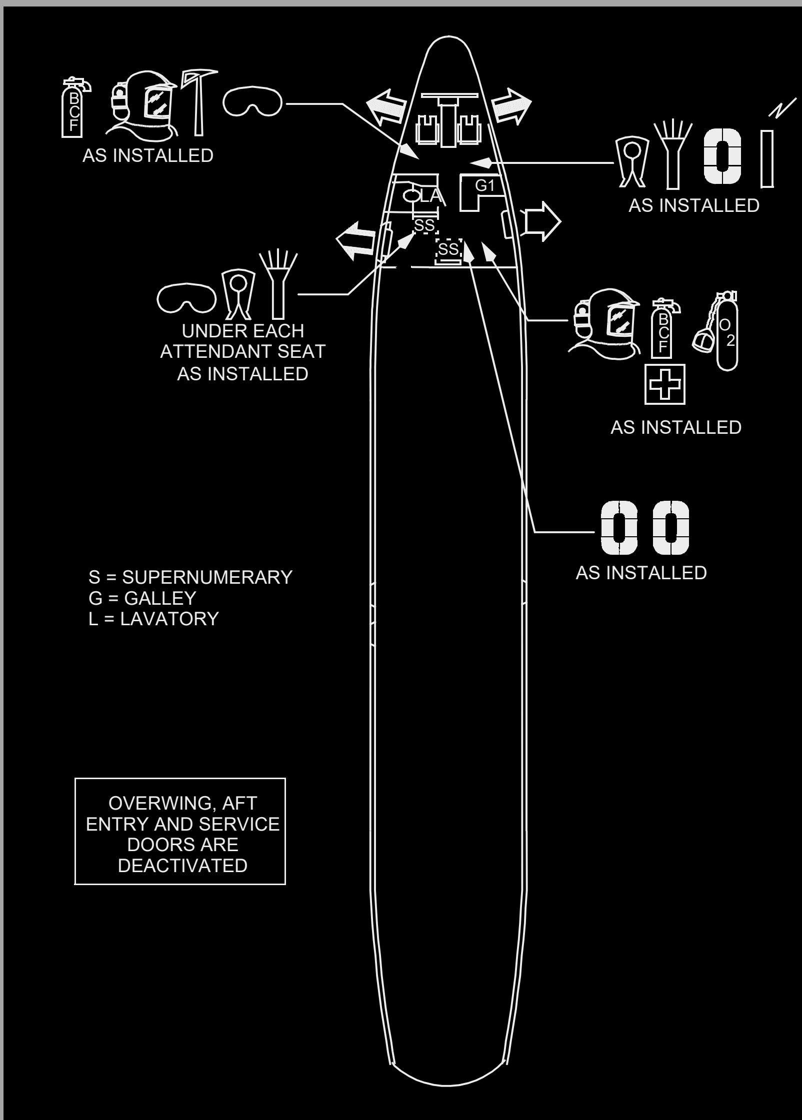
Emergency Equipment Locations
Converted Freighter



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Doors and Windows

The airplane has two passenger entry doors, one cabin door (the flight deck/passenger cabin entry), two service doors and two cargo doors. There is also a center electrical and electronic (E/E) equipment access door and an equipment compartment access door on the bottom of the airplane.

[Option - 737-900ER with Mid-Exit Doors activated]
The airplane has two passenger entry doors, one cabin door (the flight deck/passenger cabin entry), two service doors, two mid-exit doors and two cargo doors. There is also a center electrical and electronic (E/E) equipment access door and an equipment compartment access door on the bottom of the airplane.

The airplane has one crew entry door, one service door and three cargo doors. There is also a center electrical and electronic (E/E) equipment access door and an equipment compartment access door on the bottom of the airplane.

The flight deck number two windows, one on the left and one on the right, can be opened by the flight crew.

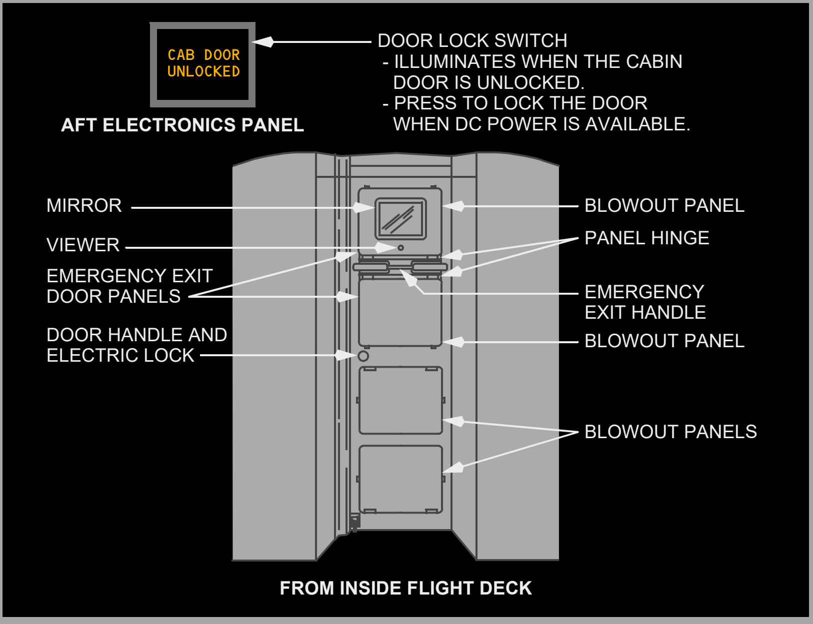
CAUTION: Do not operate the entry or service doors in winds of more than 40 knots. Do not let the doors stay open in wind gusts that are more than 65 knots. Strong winds can cause damage to the structure of the airplane.

Cabin Door

[Original Flight Deck Door]
An electrical and keyed lock permits the door to be opened, closed and locked from either side. With 28 Volt DC power available, the door may be electrically locked or unlocked by pressing the door lock switch on the control stand; entrance from the passenger cabin requires a key when the door is electrically locked. The door cannot be locked without electrical power.

There are four blowout panels located in the cabin door. In the event of a sudden depressurization of the flight deck, the blowout panels hinge out from the door. This uncovers openings in the door and allows the air pressure in the flight deck and passenger cabin to equalize.

An emergency exit feature is also provided which permits the release and removal of the two upper blowout panels from the door. To operate, pull on the release handle while pressing on the panel below the release handle. Panel will not release unless both ends of handle have been pulled away from their locked position.



CABIN DOOR

Flight Deck Door

[Flight Deck Security Door]

The flight deck door meets requirements for resistance to ballistic penetration and intruder entrance. The door opens into the passenger cabin. When closed, the door locks when electrical power is available and unlocks when electrical power is removed. A viewing lens in the door allows observation of the passenger cabin. The door can be manually opened from the flight deck by turning the door handle.

The door incorporates a deadbolt with a key lock on the passenger cabin side. Rotating both concentric deadbolt levers to the locked (horizontal) position prevents the passenger cabin key from unlocking the door. Rotating only the forward deadbolt lever to locked allows the key to unlock the door.

The flight deck access system consists of an emergency access panel, chime module, three position Door Lock selector, two indicator lights, and an Access System switch. The emergency access panel includes a six button keypad for entering the numeric emergency access code along with red, amber, and green lights. The red light illuminates to indicate the door is locked. When the correct emergency access code is entered, the amber light illuminates. The green light illuminates to indicate the door is unlocked.

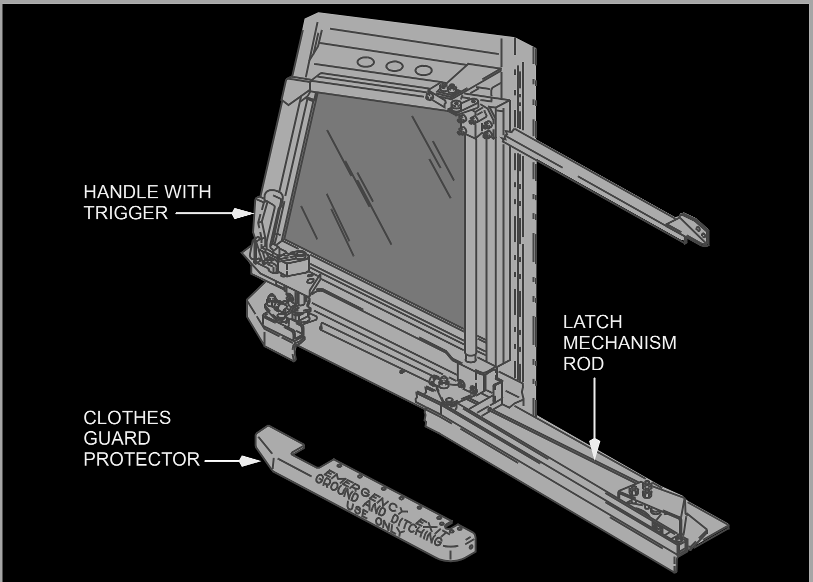
Two indicator lights and a three position Door Lock selector are located on the Electronic Panel. Illumination of the amber LOCK FAIL light indicates the door lock has failed or the Access System switch is in the OFF position.

The emergency access code is used to gain access to the flight deck in case of pilot incapacitation. A flight deck chime and illumination of the amber AUTO UNLK light indicates the correct emergency access code has been entered and the door is programmed to unlock after a time delay. Selecting the DENY position on the Door Lock selector denies entry and prevents further keypad entry for several minutes. To allow entry, the selector is turned to the UNLKD position which unlocks the door while held in that position. If the emergency access code is entered and the pilot takes no action, the door unlocks after expiration of the time delay. Before the door unlocks, the chime sounds continuously and the AUTO UNLK light flashes.

By pressing “1” then “ENT” keys on the emergency access panel, the flight deck chime will sound (if programmed).

The door incorporates two pressure sensors that unlock the decompression panels in the event pressurization is lost. The decompression panels have manual release pins. Pulling the pins frees the panels allowing egress in the event the door is jammed.

Flight Deck Number Two Windows



FLIGHT COMPARTMENT WINDOW NO. 2
(RIGHT SIDE SHOWN)

The flight deck number two windows can be opened on the ground or in flight and can be used for emergency evacuation. To open the window, depress the trigger and turn the handle back and inboard. After the window moves inboard, move it back until it locks in the open position.

To close the window, it must first be unlocked. Pull forward on the latch mechanism rod to unlock the window. Depress the trigger and move the window forward until the handle can be turned forward and outboard. When the trigger is released, the window latches.

Only the first officer's number two window can be opened from outside the airplane.

Lower Cargo Compartments

The lower cargo compartments are designed and constructed to satisfy FAA category Class C compartment requirements. This means the compartments are designed to completely confine a fire without endangering the safety of the airplane or its occupants. The compartments are sealed and pressurized but do not have fresh air circulation and temperature control as do the upper passenger compartments.

There are two cargo compartment doors on the lower right side of the fuselage. Both are plug type, inward opening pressure doors, hinged at their upper edges and operated manually from either inside or outside the airplane. Except for slight difference in shape, both doors are similar in design and operation. The door is locked closed by two latches. Each door has a balance mechanism which creates door–open force slightly more than equal to the weight of the door. The door can therefore, with little effort, be swung open. The door can be closed easily by pulling a lanyard attached to the door, grasping the handle and closing the door.

A pressure equalization valve is in the aft bulkhead of each compartment. The valves let only enough air flow into or out of the cargo compartments to keep the pressures nearly the same as the cabin pressure.

Blowout panels in the lower cargo compartments provide pressure relief at a greater rate than the pressure equalization valve in case the airplane pressurization is lost.

Main Deck Cargo Door

Closure of the main deck cargo door is accomplished from the Main Deck Cargo Door (MDCD) panel located above the main deck hatchway in the supernumerary cabin. The door cannot be locked until it is properly closed and latched.

WARNING: All persons and foreign objects must be clear of the MDCD when it is being opened and closed. Injury to personnel or damage to the MDCD may result.

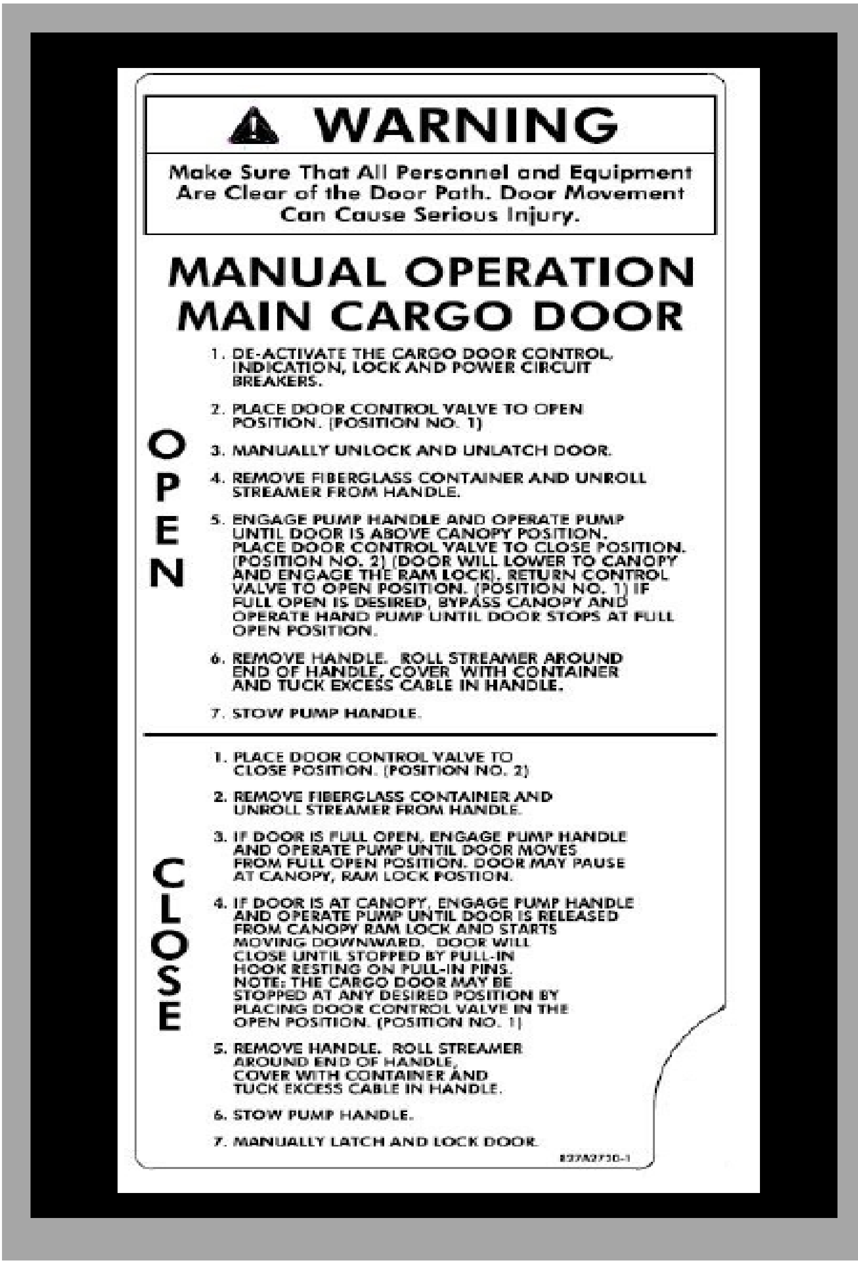
CAUTION: Do not operate the MDCD in winds more than 40 knots. Strong winds can cause damage to the structure of the aircraft.

The main cargo door is opened with a hydraulic actuator powered from hydraulic system A. Hydraulic power may be supplied using either a hydraulic ground cart or the aircraft’s electric motor pump. The cargo door may also be opened using a manual pump to supply hydraulic pressure for the actuator. The latching mechanism is installed along the lower portion of the door. The latch mechanism consists of eight mechanical latches which pull the door to latch sectors on the fuselage door sill. The lock mechanism consists of eight locking sectors with interconnection mechanism. The locking sectors prevent the latch mechanism from operating until the door is unlocked.

WARNING: Do not leave the MDCD open in the canopy position unattended when using a hydraulic ground cart. The MDCD should be lowered to the close position prior to leaving the aircraft unattended.

CAUTION: Do not operate system A and B electric pumps more than 2 minutes unless the No. 1 and No. 2 Fuel Tank contains at least 1675 pounds or 760 kilograms of fuel.

After the main cargo door is electrically unlocked using the MDCD panel, the cargo door is then electrically unlatched and hydraulically opened. Hydraulic system pressure for operation of the main cargo door actuator is controlled from the MDCD panel. The panel contains two cargo door position switches, blue open and amber in-transit lights and a green closed and latched lights. One switch raises the cargo door to the canopy position and closes the door. The second switch raises the door from the canopy position to the full open position and back to the canopy position. The ARM switch must first be selected in the direction the door will travel in order to power the door control switches. Releasing a control switch while the door is in transit causes the door to stop in the interim position. If the switch is operated again, the door will continue to raise or lower, depending on the position of the switch. A lift actuator internal ram lock will hold the door in the canopy position (approximately 88 degrees). The main cargo door must be commanded to close in order to release the ram lock.


WARNING
Make Sure That All Personnel and Equipment Are Clear of the Door Path. Door Movement Can Cause Serious Injury.
MANUAL OPERATION
MAIN CARGO DOOR
OPEN
1. DE-ACTIVATE THE CARGO DOOR CONTROL, INDICATION, LOCK AND POWER CIRCUIT BREAKERS.
2. PLACE DOOR CONTROL VALVE TO OPEN POSITION. (POSITION NO. 1)
3. MANUALLY UNLOCK AND UNLATCH DOOR.
4. REMOVE FIBERGLASS CONTAINER AND UNROLL STREAMER FROM HANDLE.
5. ENGAGE PUMP HANDLE AND OPERATE PUMP UNTIL DOOR IS ABOVE CANOPY POSITION. PLACE DOOR CONTROL VALVE TO CLOSE POSITION. (POSITION NO. 2) (DOOR WILL LOWER TO CANOPY AND ENGAGE THE RAM LOCK). RETURN CONTROL VALVE TO OPEN POSITION. (POSITION NO. 1) IF FULL OPEN IS DESIRED, BYPASS CANOPY AND OPERATE HAND PUMP UNTIL DOOR STOPS AT FULL OPEN POSITION.
6. REMOVE HANDLE. ROLL STREAMER AROUND END OF HANDLE, COVER WITH CONTAINER AND TUCK EXCESS CABLE IN HANDLE.
7. STOW PUMP HANDLE.
CLOSE
1. PLACE DOOR CONTROL VALVE TO CLOSE POSITION. (POSITION NO. 2)
2. REMOVE FIBERGLASS CONTAINER AND UNROLL STREAMER FROM HANDLE.
3. IF DOOR IS FULL OPEN, ENGAGE PUMP HANDLE AND OPERATE PUMP UNTIL DOOR MOVES FROM FULL OPEN POSITION. DOOR MAY PAUSE AT CANOPY, RAM LOCK POSTION.
4. IF DOOR IS AT CANOPY, ENGAGE PUMP HANDLE AND OPERATE PUMP UNTIL DOOR IS RELEASED FROM CANOPY RAM LOCK AND STARTS MOVING DOWNWARD. DOOR WILL CLOSE UNTIL STOPPED BY PULL-IN HOOK RESTING ON PULL-IN PINS. NOTE: THE CARGO DOOR MAY BE STOPPED AT ANY DESIRED POSITION BY PLACING DOOR CONTROL VALVE IN THE OPEN POSITION. (POSITION NO. 1)
5. REMOVE HANDLE. ROLL STREAMER AROUND END OF HANDLE, COVER WITH CONTAINER AND TUCK EXCESS CABLE IN HANDLE.
6. STOW PUMP HANDLE.
7. MANUALLY LATCH AND LOCK DOOR.

MDCD LOCK MANUAL DRIVE OPERATION

MDCD LATCH AND HOOK MANUAL DRIVE OPERATION

Detail Indication Light Logic

Four micro-switches monitor the closed and locked status of the main deck cargo door. In addition, two proximity switches monitor the latched status of the door. The PSEU continuously monitors switch outputs to determine door status, and also compares switch outputs when the door is cycled open or closed to determine if any switches have failed. If the PSEU detects a latent switch failure subsequent to door operation, the Master Caution lights, OVERHEAD system annunciator light, and PSEU amber light display following Master Caution Recall.

Fault Condition	Fault Occurs On Ground (prior to takeoff thrust set or 30 seconds after landing)	Fault Occurs On Ground (after takeoff thrust set on one engine)	Fault Occurs On Ground (after takeoff thrust set on both engines)	Fault Occurs in Flight (in air mode until 30 seconds after transition to ground mode)
Any combination of single switches in a closed, latched or locked pair (A or B but not both in a pair) indicates door not secure	Master Caution DOORS MAIN CARGO*	Master Caution DOORS MAIN CARGO*	No indications for new faults	No indications for new faults
Both switches in any closed, latched or locked pair (A & B) indicate door not secure	Master Caution DOORS MAIN CARGO*	Master Caution DOORS MAIN CARGO* Takeoff Configuration Warning	Master Caution DOORS MAIN CARGO* Takeoff Configuration Warning	Master Caution DOORS MAIN CARGO*
Any combination of single switches in a closed, latched or locked pair (A or B but not both in a pair) falsely indicate the door is secure	Master Caution OVERHEAD ** PSEU***	N/A	N/A	N/A

* Once MAIN CARGO is illuminated, the light remains illuminated.

** The dispatchable PSEU and OVERHEAD lights will illuminate during Master Caution Recall prior to takeoff.

*** Only detected during door operation (i.e., cycling from closed to open).

Visual confirmation of the lock sectors is provided by eight viewing windows on the lower outside edge of the cargo door. A complete yellow circle indicates the MDCD is properly and securely closed.

When the airplane is on the ground and the door is not closed, latched, or locked, the Master Caution lights, DOORS system annunciator light, and MAIN CARGO amber light display. Once the master Caution is canceled, the MAIN CARGO light remains illuminated until the door is secured for flight. If the MAIN CARGO light fails to extinguish following configuration of the door for flight, the airplane cannot be flown until the door is verified closed, latched and locked and the MAIN CARGO light extinguishes.

Emergency Escape

Emergency escape information included in this chapter includes:

- emergency evacuation routes
- flight deck windows
- escape slides
- escape straps
- emergency exit doors

Emergency Evacuation Routes

[Option - 737-600/700]
Emergency evacuation may be accomplished through four entry/service doors and two overwing escape hatches. Flight deck crewmembers may evacuate the airplane through two sliding flight deck windows.

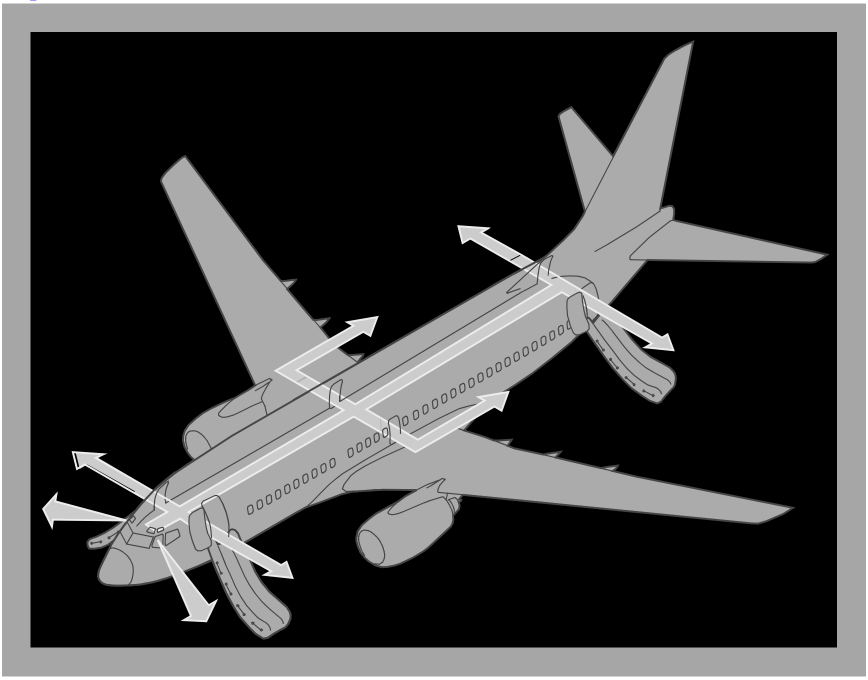
[Option - 737-800/900]
Emergency evacuation may be accomplished through four entry/service doors and four overwing escape hatches. Flight deck crewmembers may evacuate the airplane through two sliding flight deck windows.

[Option - 737-800BCF]
Emergency evacuation may be accomplished through the forward entry and service doors. The aft entry and service doors as well as all four Type III overwing emergency exits are deactivated and not available for use. Flight deck crewmembers may evacuate the airplane through two sliding flight deck windows.

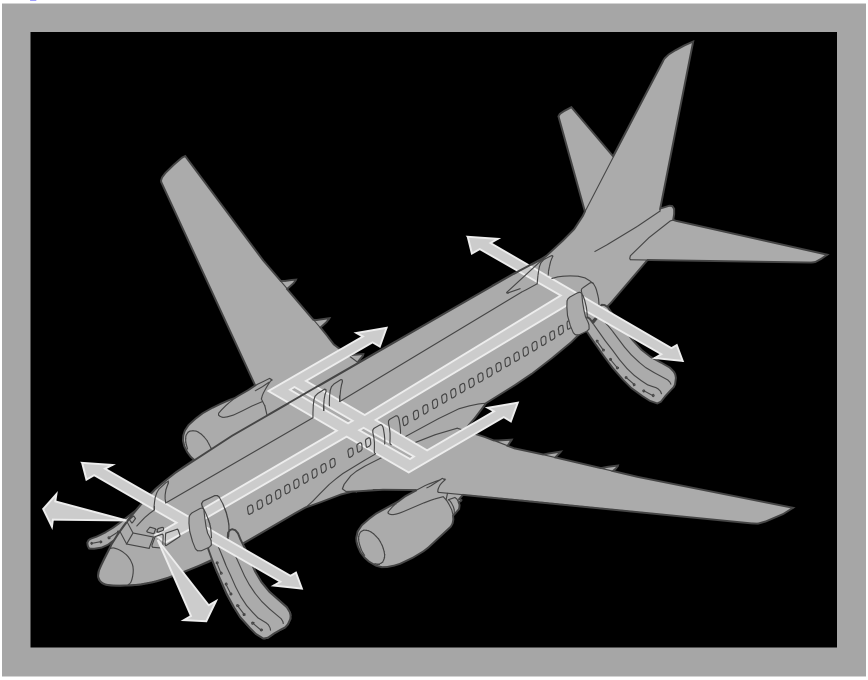
[Option - 737-900ER with Mid-Exit Doors activated]
Emergency evacuation may be accomplished through four entry/service doors, four overwing escape hatches, and two mid-exit doors. Flight deck crewmembers may evacuate the airplane through two sliding flight deck windows.

Emergency Evacuation Routes

[Option - 737-600/700]

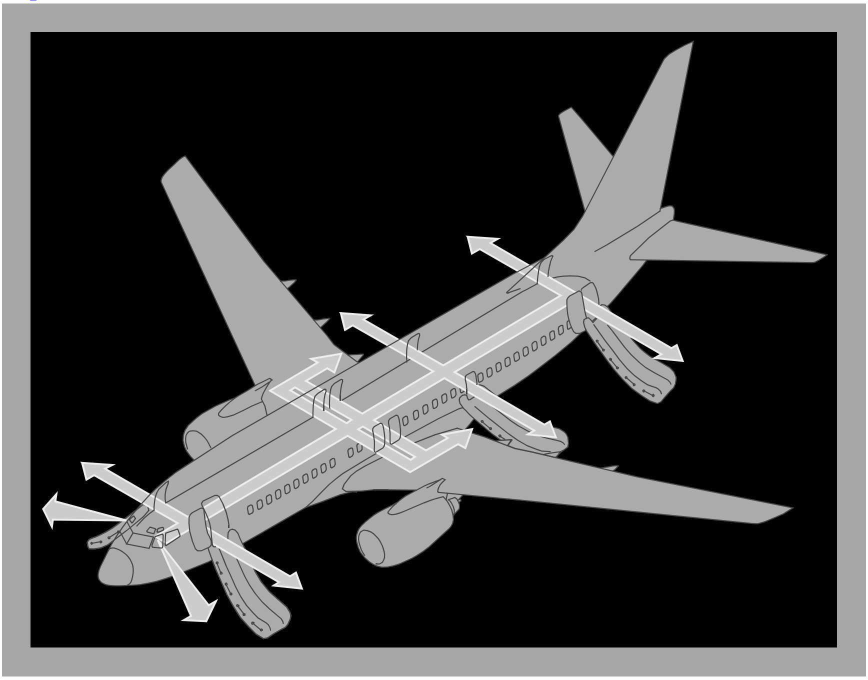


[Option - 737-800/900]



[Option - 737-800BCF]

[Option - 737-900ER with Mid-Exit Doors activated]

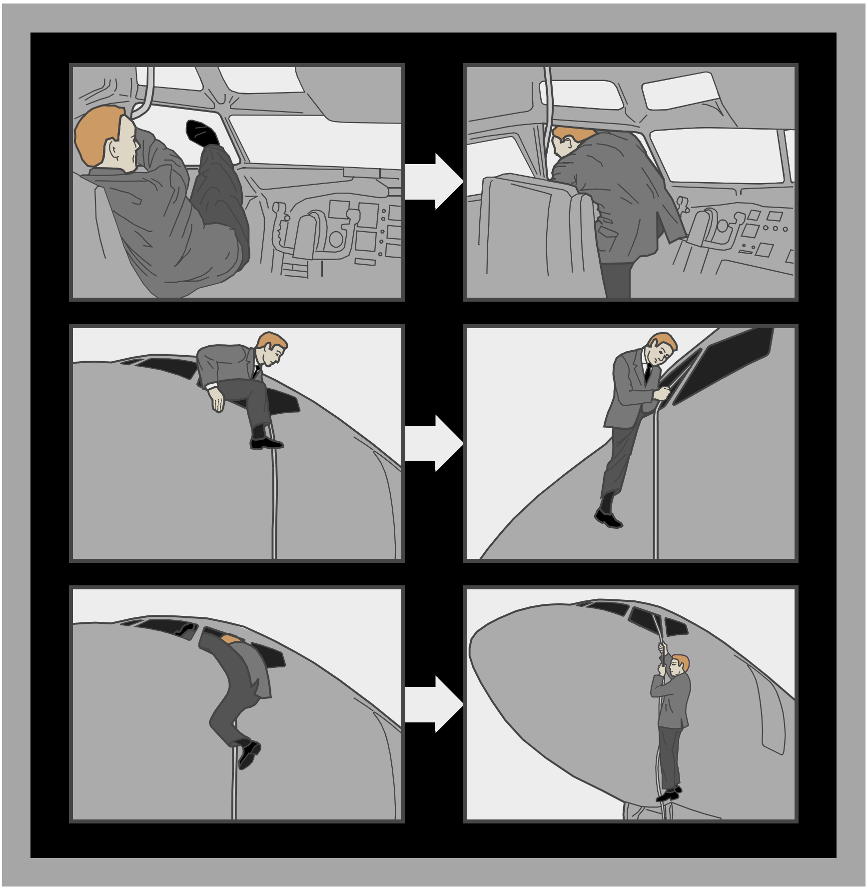


Flight Deck Window Emergency Egress

If the flight deck number two windows must be used for emergency egress, use the following procedure:

- open the window
- open the escape strap compartment (above and aft of window)
- pull on the escape strap to ensure it is securely attached
- throw the strap out the window
- sit on the window sill with upper body outside
- exit in accordance with the following illustration.

CAUTION: Ensure the escape strap is securely fastened to the airplane.

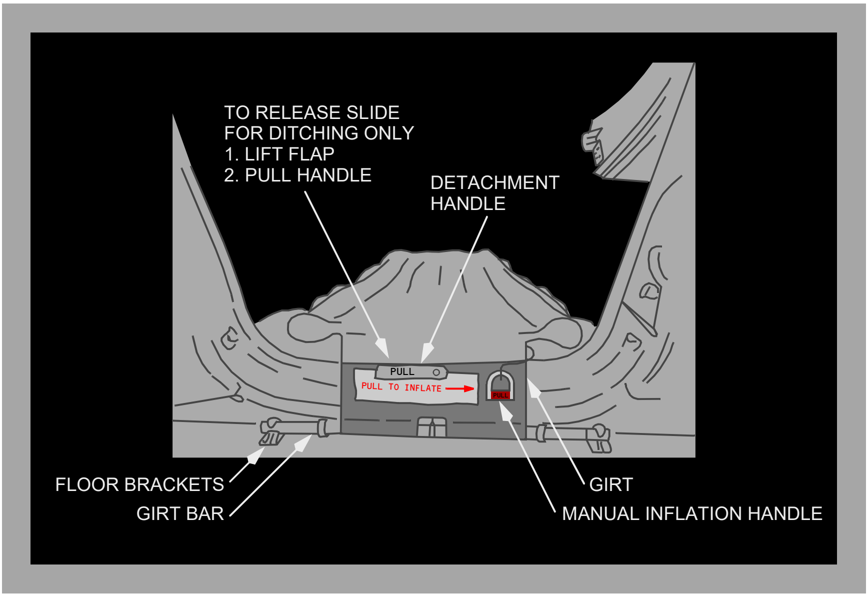


The above illustrated method of departure would probably be the easiest for most crewmembers. This technique is difficult and should be used only in extreme emergency.

Escape Slide Detachment Handle

The slide has not been certified to be part of the water landing emergency equipment. In a water environment, the slide may not properly inflate when deployed. If the deployed slide is recognized to be a potential obstruction to egress, a detachment handle is provided near the top of the slide. This handle is protected by a cover and is placarded. The escape slide is detached from the airplane by pulling the detachment handle. Once detached from the door sill, the slide is tethered to the door sill by a lanyard. A properly inflated slide could be buoyant, and useful as a flotation device for passengers in the water. Hand grips are positioned along the sides of the slide.

Escape Slide Detachment Handle

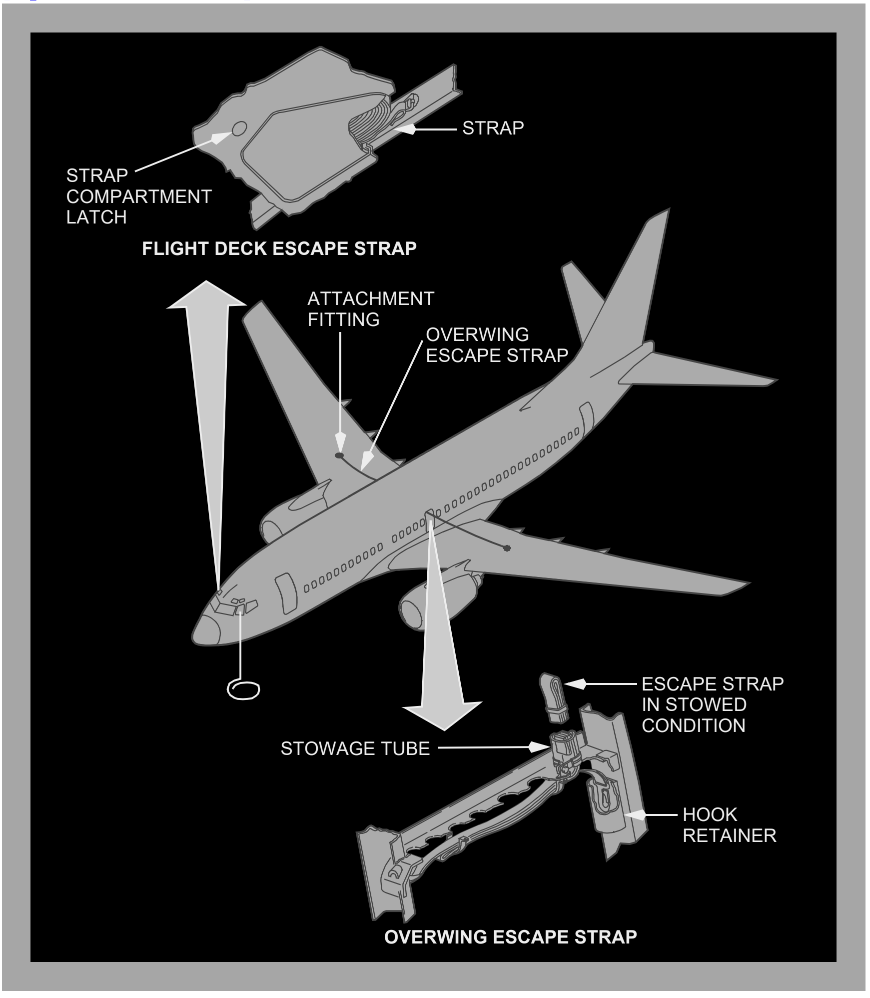


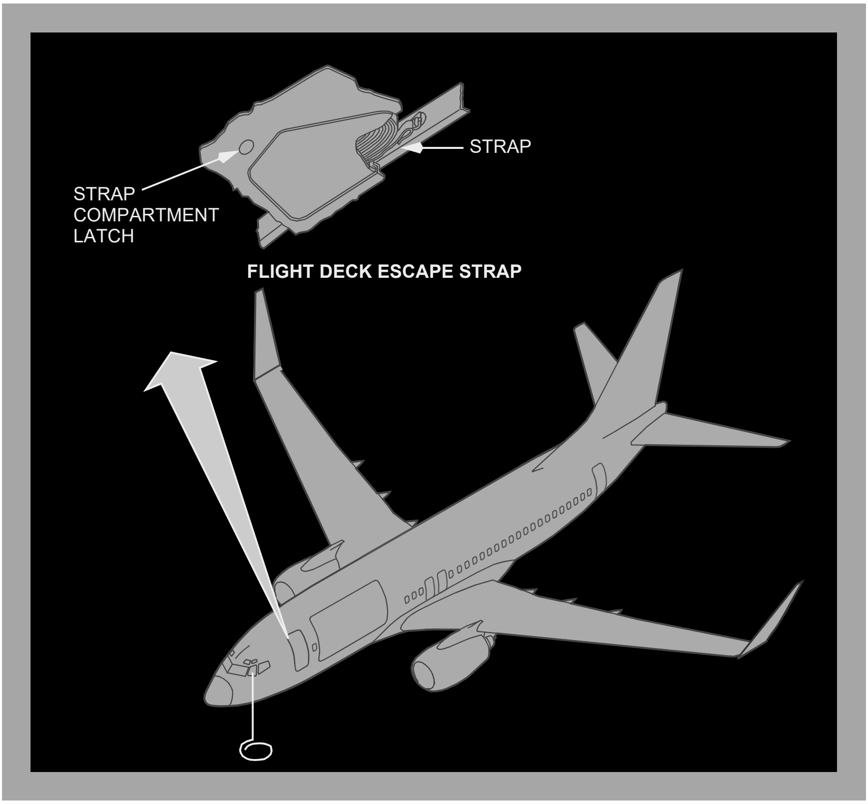
Escape Straps

[Option - 737-600/700]
Escape straps are installed above each emergency exit door frame. The escape doors must be opened to expose the straps. One end of the strap is attached to the door frame. The remainder of the strap is stowed in a tube extending into the cabin ceiling. To use, the strap is pulled free from its stowage and attached to a ring on the top surface of the wing. The escape strap can be used as a hand hold in a ditching emergency for passengers to walk out on the wing and step into a life raft.

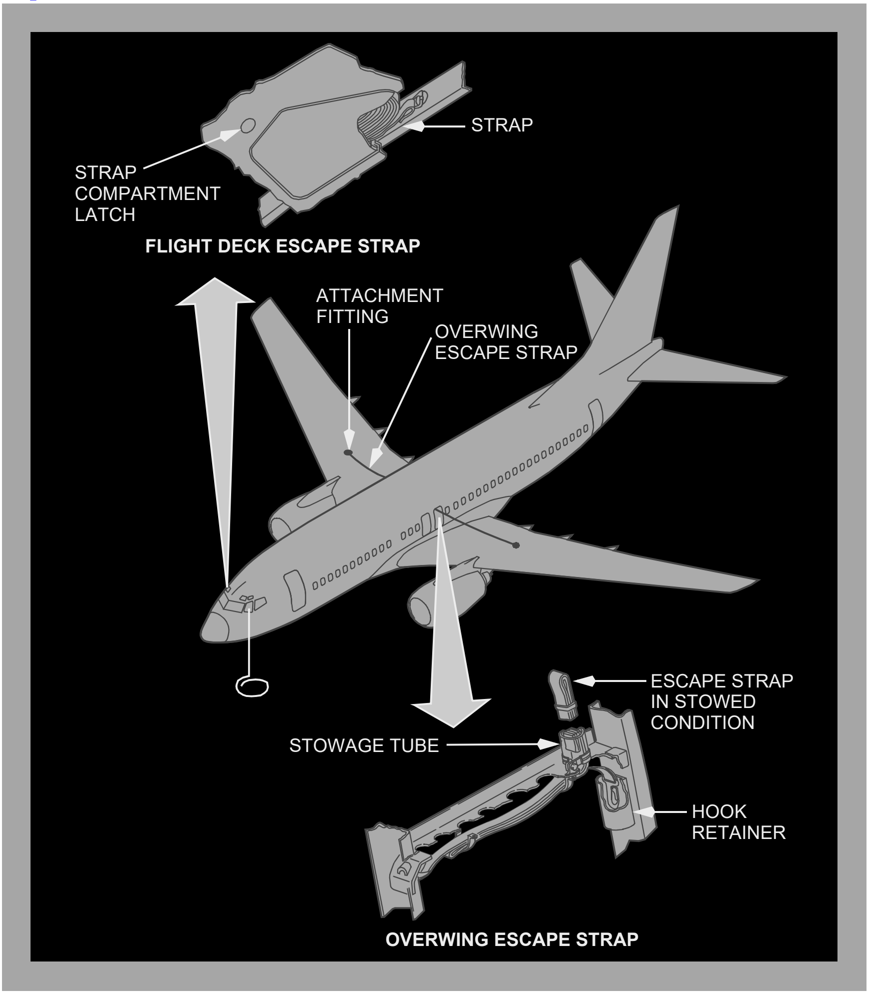
[Option - 737-800/900/900ER]
Escape straps are installed above each aft emergency exit door frame. The escape doors must be opened to expose the straps. One end of the strap is attached to the door frame. The remainder of the strap is stowed in a tube extending into the cabin ceiling. To use, the strap is pulled free from its stowage and attached to a ring on the top surface of the wing. The escape strap can be used as a hand hold in a ditching emergency for passengers to walk out on the wing and step into a life raft.

[Option - 737-600/700]

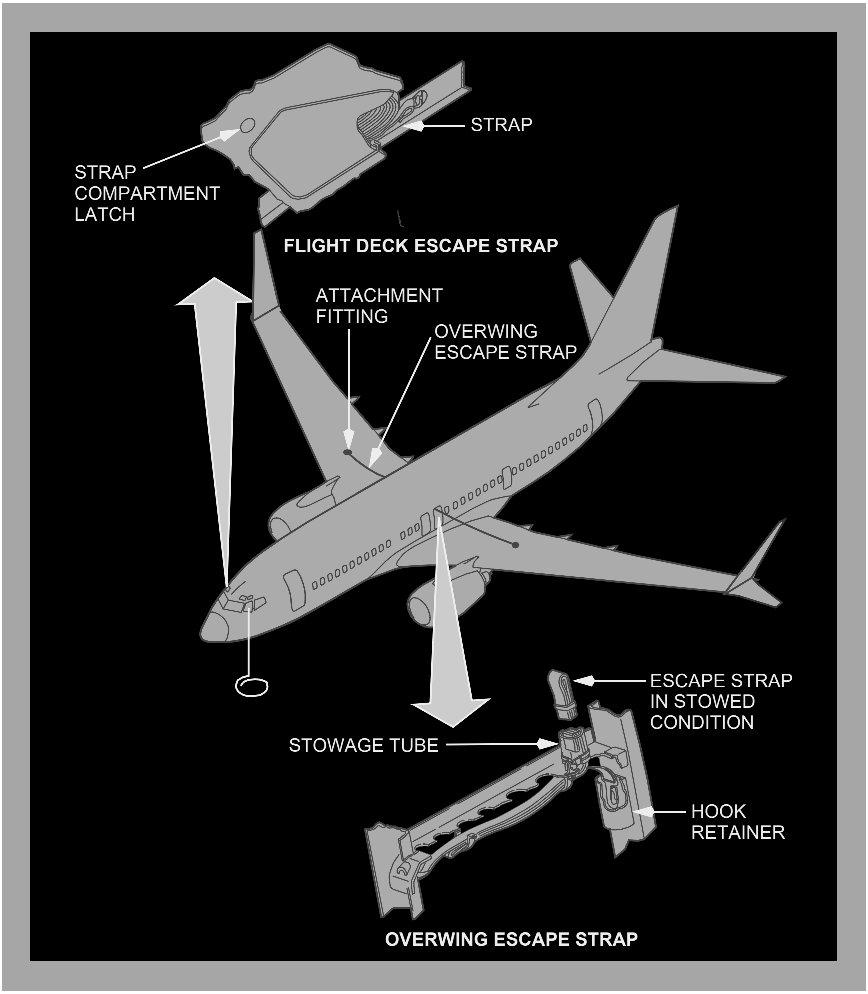



STRAP
STRAP
COMPARTMENT
LATCH
FLIGHT DECK ESCAPE STRAP

[Option - 737-800/900]



[Option - 737-900ER with Mid-Exit Doors activated]



Emergency Exit Doors

[Option - 737-600/700]
Two Type III emergency exits are located in the passenger cabin over the wings. These are canopy-type doors and are held in place by mechanical locks and airplane cabin pressure.

[Option - 737-800/900]
Four Type III emergency exits are located in the passenger cabin over the wings. These are canopy-type doors and are held in place by mechanical locks and airplane cabin pressure.

[Option - 737-900ER]
Four Type III emergency exits are located in the passenger cabin over the wings. These are canopy-type doors and are held in place by mechanical locks and airplane cabin pressure. In addition, two Type II mid-exit doors are located aft of the wings.

[Option - 737-600/700/800]
The overwing exit doors can be opened from inside or outside of the airplane by a spring–loaded handle at the top of the door. The 28 Volt DC flight lock system is designed to ensure that the flight lock will automatically lock during takeoff, in-flight, and landing and unlock on the ground to allow for opening of the door in emergency situations. Commands for the flight lock to lock and unlock are dependent upon engine speed, thrust lever position, air/ground mode status, and the open/closed status of the doors.

[Option - 737-900ER with Mid-Exit Doors activated]
The overwing exit doors can be opened from inside or outside of the airplane by a spring–loaded handle at the top of the door. The mid-exit doors are opened using the handles located on the side of the door. The 28 Volt DC flight lock system is designed to ensure that the flight lock will automatically lock during takeoff, in-flight, and landing and unlock on the ground to allow for opening of the door in emergency situations. Commands for the flight lock to lock and unlock are dependent upon engine speed, thrust lever position, air/ground mode status, and the open/closed status of the doors.

[Option - 737-600/700/800]
The overwing emergency exits lock when:

- three of the four Entry/Service doors are closed and
- either engine is running and
- the airplane air/ground logic indicates that the airplane is in the air or both thrust levers are advanced.

[Option - 737-900ER with Mid-Exit Doors activated]
The overwing and mid-exit emergency exits lock when:

- three of the four Entry/Service doors are closed and
- either engine is running and
- the airplane air/ground logic indicates that the airplane is in the air or both thrust levers are advanced.

[Option - 737-600/700/800]
The overwing emergency exits unlock when any one of the above conditions is not met or DC power is lost.

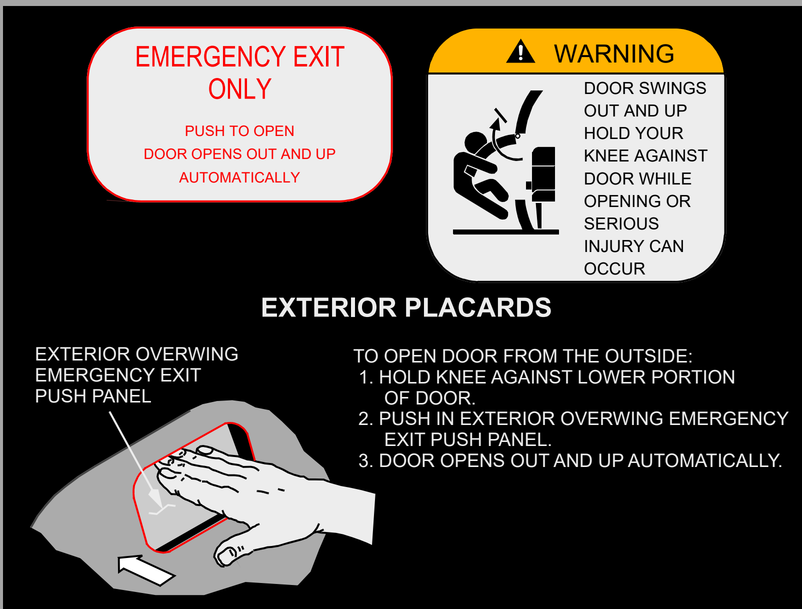
[Option - 737-900ER with Mid-Exit Doors activated]
The overwing and mid-exit emergency exits unlock when any one of the above conditions is not met or DC power is lost.

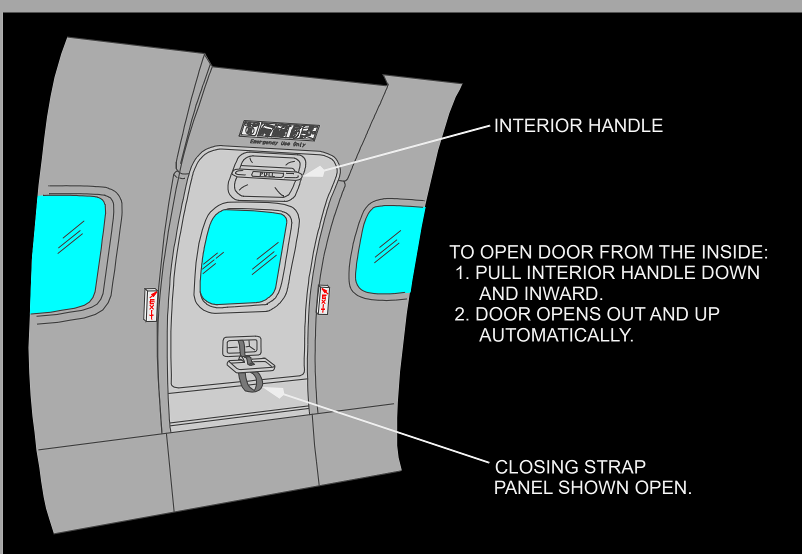
The LEFT OVERWING and/or RIGHT OVERWING warning lights, DOORS annunciator, and MASTER CAUTION light illuminate when an emergency exit door is not fully closed and locked or when the flight lock is not engaged, either during the takeoff roll or in-flight.

[Option - 737-600/700/800]
If a flight lock has failed locked or a fault is detected the PSEU light, the OVERHEAD annunciator, and the MASTER CAUTION lights illuminate. These indications are inhibited from takeoff until 30 seconds after the airplane is in the ground mode. When the doors are latched and locked and the flight lock is operating properly none of these lights will illuminate.

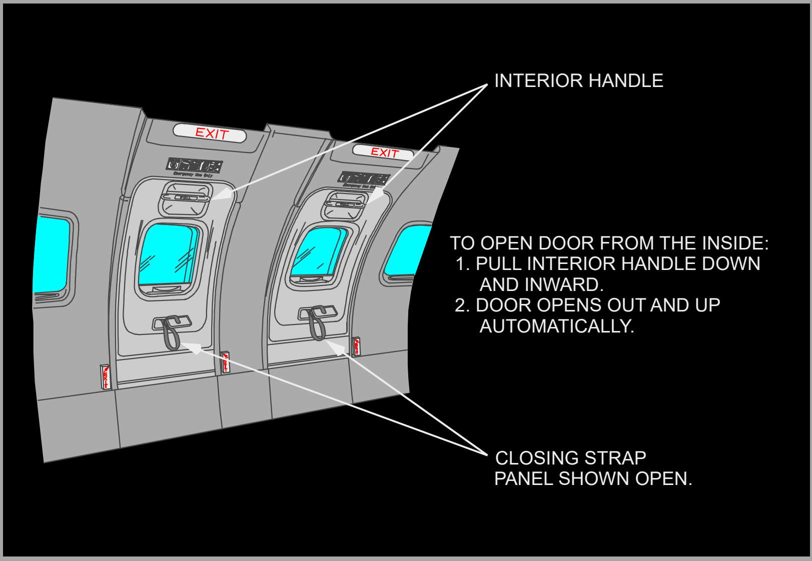
[Option - 737-900ER with Mid-Exit Doors activated]
If a flight lock has failed locked or a fault is detected the PSEU light illuminates. If the SPSEU light illuminates there is a disagreement between flight locks or there is an internal SPSEU failure. Illuminations of either of these lights will cause the OVERHEAD annunciator and the MASTER CAUTION lights to illuminate. These indications are inhibited from takeoff until 30 seconds after the airplane is in the ground mode. When the doors are latched and locked and the flight lock is operating properly none of these lights will illuminate.

[Option - 737-600/700]





[Option - 737-800/900]



Mid-Exit Doors

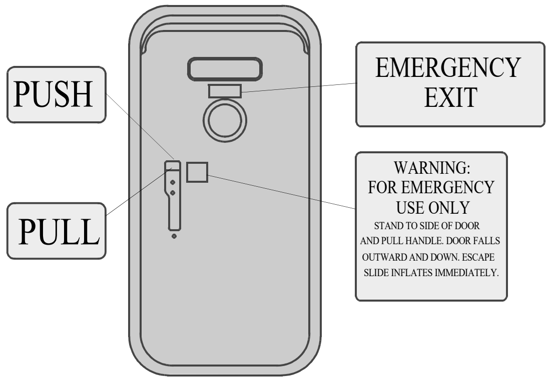
[Option - 737-900ER]

An emergency door is located aft of the wing on each side of the airplane. This door is only used as an emergency exit. A slide bustle in the lower face of the door contains an evacuation slide. A window in the door allows observation outside of the airplane.

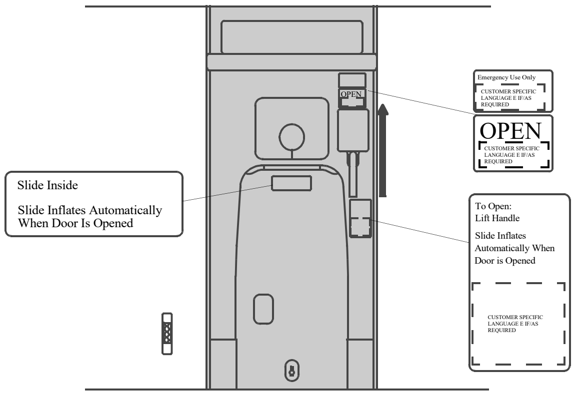
The emergency door is a plug-type door and is hinged on the bottom. Pulling the door operating handle up opens a pressure relief door and lifts the door inward and upward. The door can then be pushed out through the door frame and the slide automatically deploys and inflates.

A manual inflation handle can be pulled if the slide has not automatically inflated.

The emergency door evacuation slides are not configured as rafts, however they may be used as auxiliary flotation devices.



EXTERIOR PLACARDS



INTERIOR PLACARDS

Flight Deck Seats

The flight deck has two seat types:

- pilot seats (captain and first officer)
- first observer seat

[Option - Second Observer Seat]

The flight deck has three seat types:

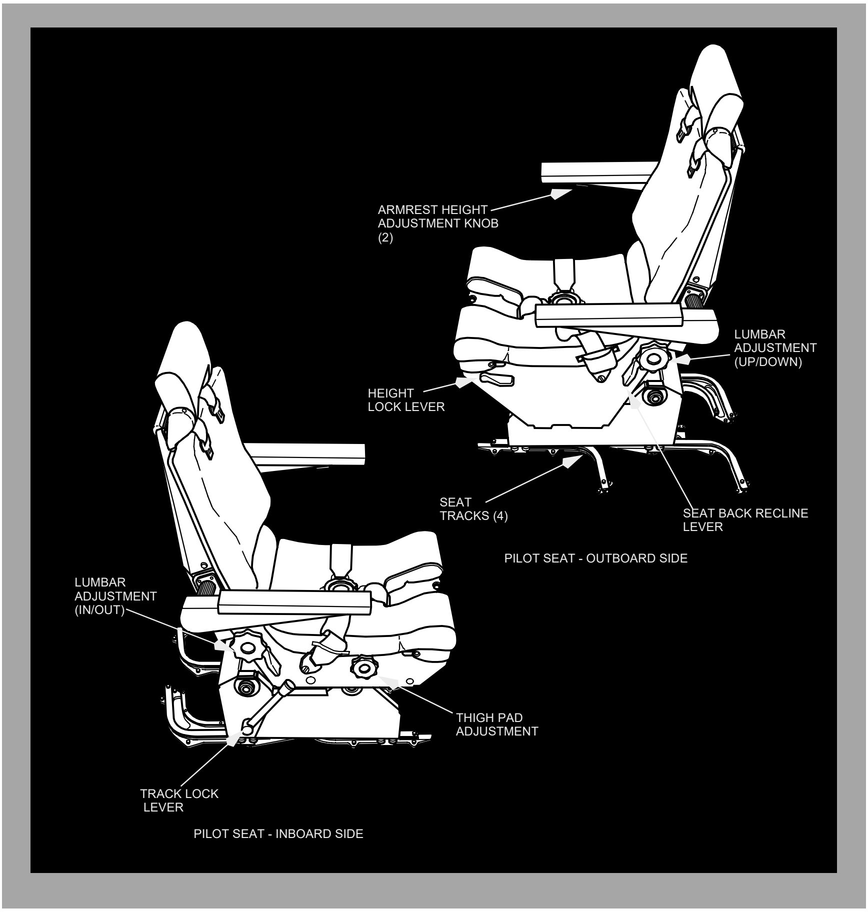
- pilot seats (captain and first officer)
- first observer seat
- second observer seat

Pilot Seat

The captain and first officer seats are adjustable. The following controls are provided:

- Seat height
- Thigh pad position
- Seat recline
- Armrest height and stowage
- Back cushion (lumbar support) position
- Headrest position

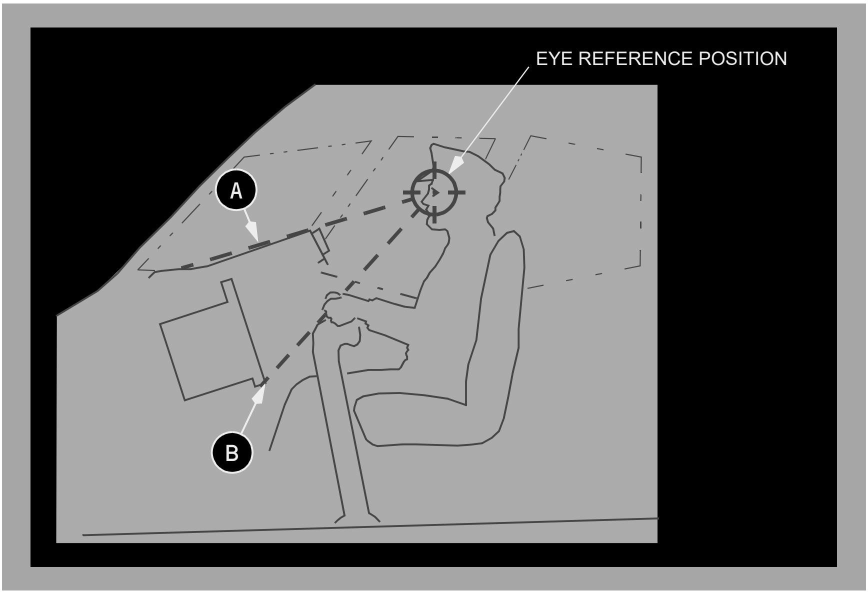
Four units hold the base of the seat to the aircraft seat tracks. A spring-loaded track lock lever mechanism sets fore and aft movement on the seat tracks.



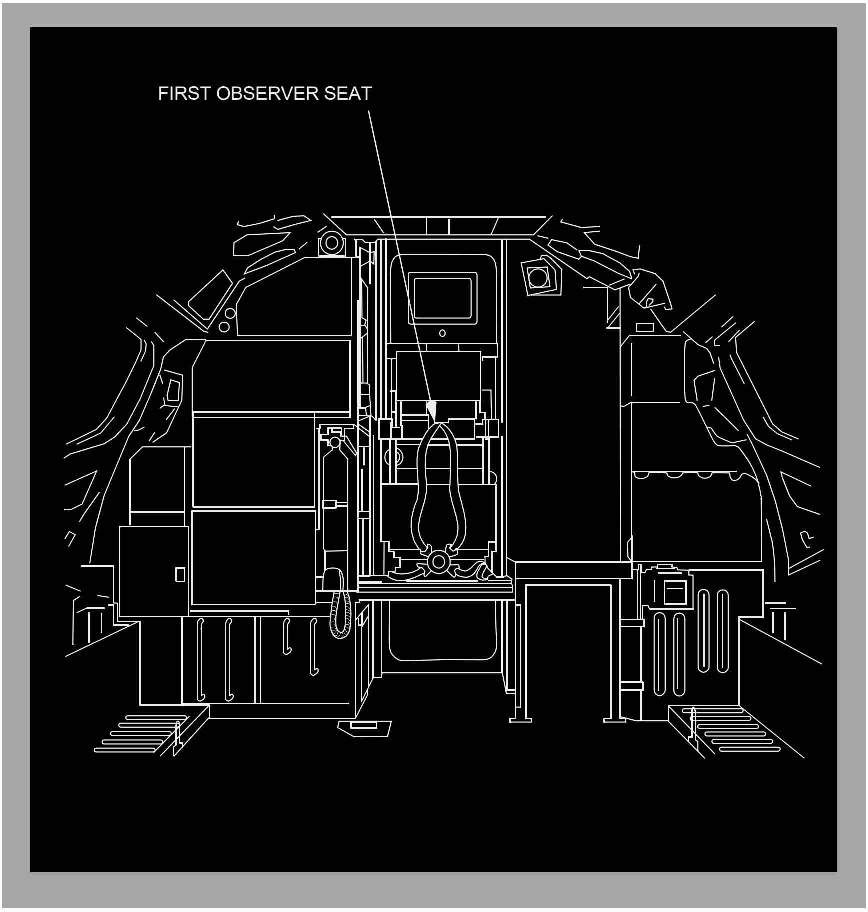
Pilot Seat Adjustment

Adjust the seat position with the appropriate controls to obtain the optimum eye reference position. Use the handhold above the forward window to assist. The following sight references are used:

- Sight along the upper surface of the glareshield with a small amount of the airplane nose structure visible (A)
- Sight over the control column (in the neutral position) until the bottom edge of the outboard display unit is visible (B).


EYE REFERENCE POSITION
A
B

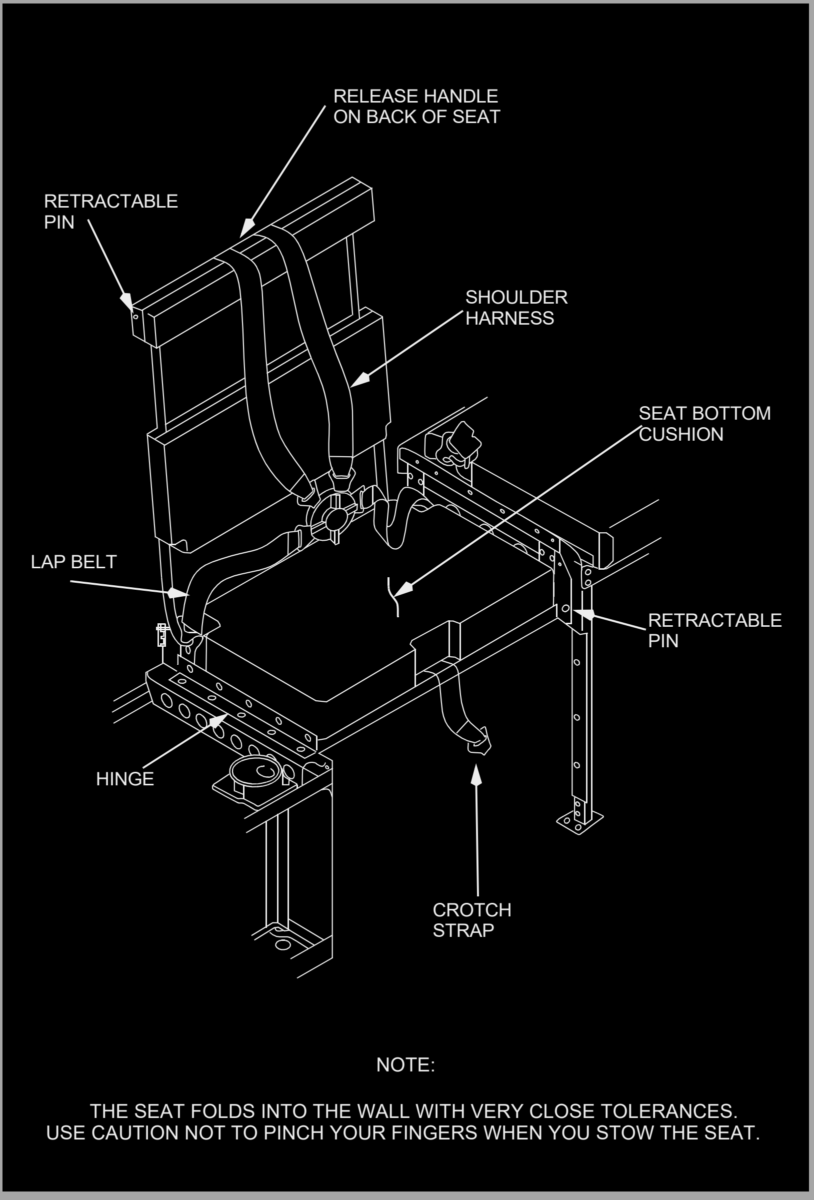
First Observer Seat



The first observer seat folds into the flight compartment wall when not in use. To use the seat, push the release latch. Then lower the seat into position. Raise the seat back to the detents in the doorway sidewall brackets. For seat storage, push the release on the seat back and reverse the procedure. The seat bottom cushion is an approved flotation device.

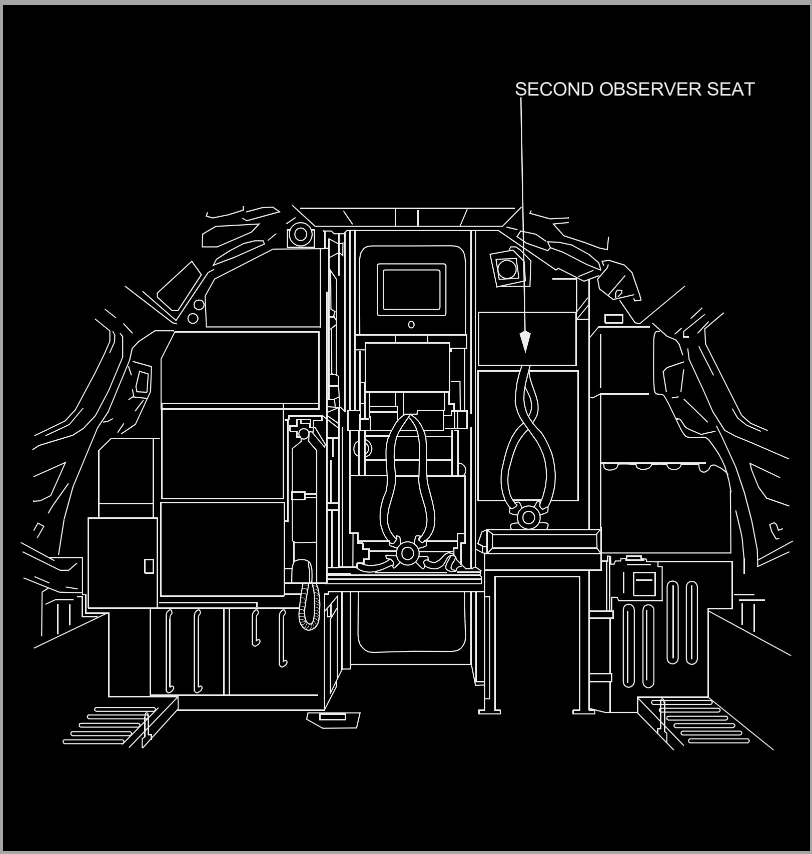
The seat has:

- shoulder harness
- crotch strap
- lap belt
- seat bottom cushion


RELEASE HANDLE
ON BACK OF SEAT
RETRACTABLE
PIN
SHOULDER
HARNESS
SEAT BOTTOM
CUSHION
LAP BELT
RETRACTABLE
PIN
HINGE
CROTCH
STRAP
NOTE:
THE SEAT FOLDS INTO THE WALL WITH VERY CLOSE TOLERANCES.
USE CAUTION NOT TO PINCH YOUR FINGERS WHEN YOU STOW THE SEAT.

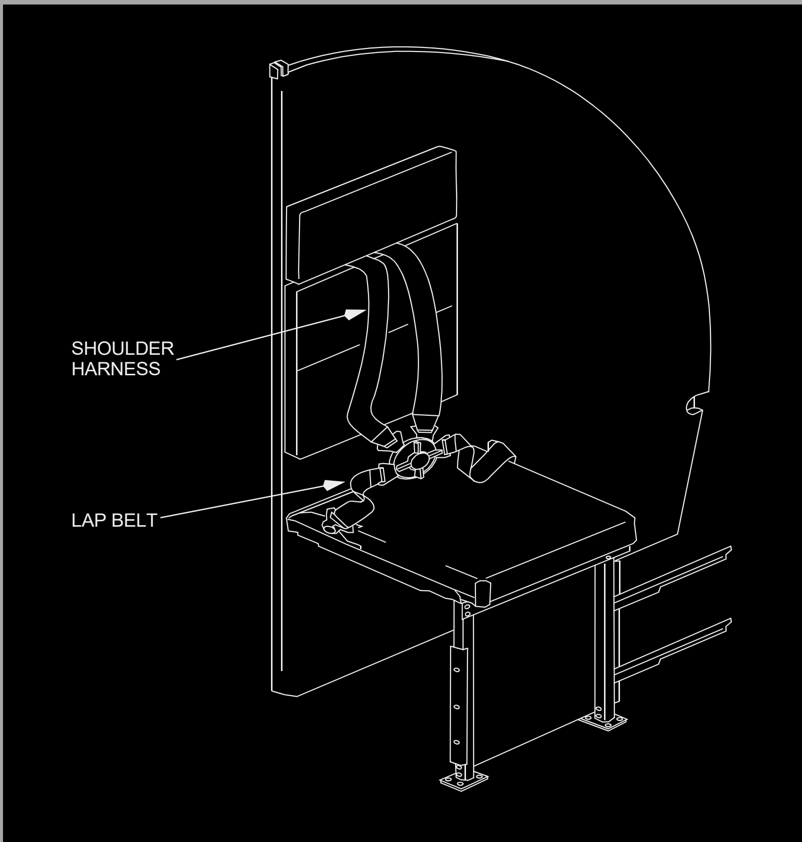
Second Observer Seat

[Option - Second Observer Seat]



The second observer seat is located behind the captain's seat and is not adjustable. The seat has:

- shoulder harness
- lap belt



Galleys

Galleys are located in the passenger cabin to provide convenient and rapid service to the passengers. Generally, they are installed in the cabin adjacent to the forward and aft galley service doors.

The galley is located in the supernumerary cabin to provide convenient and rapid service to the supernumeraries and crew. Generally, it is installed in the cabin adjacent to the forward galley service doors.

In general the equipment of the galley unit consists of the following main items:

- high speed ovens
- hot beverage containers

- hot cup receptacles
- refrigeration and main storage compartments.

Electrical control panel switches and circuit breakers to operate the above equipment are conveniently located within the galley work area. Storage space, miscellaneous drawers and waste containers are also integrated in the galley units.

Electrical Power

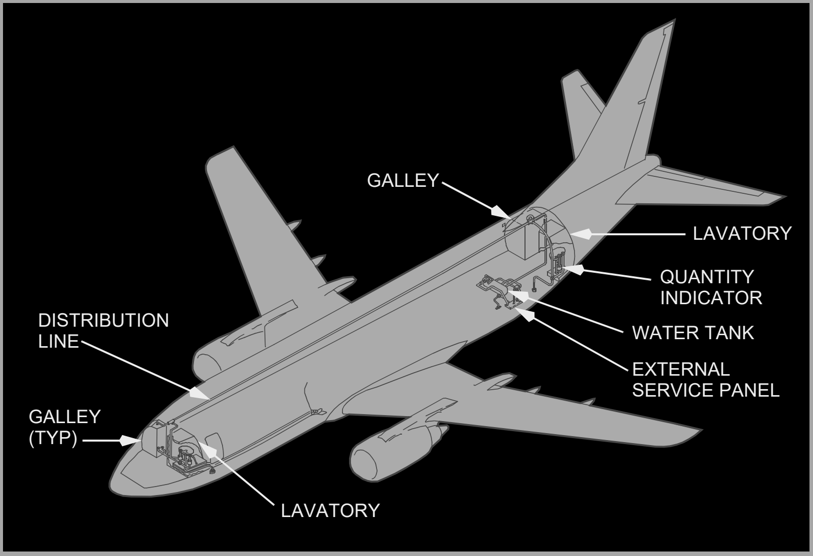
Electricity for the galleys is 115V AC supplied from the airplane transfer buses and controlled by a switch on the overhead panel. Circuit breakers are located in the lower E/E bay as part of the power distribution panels.

Water Service

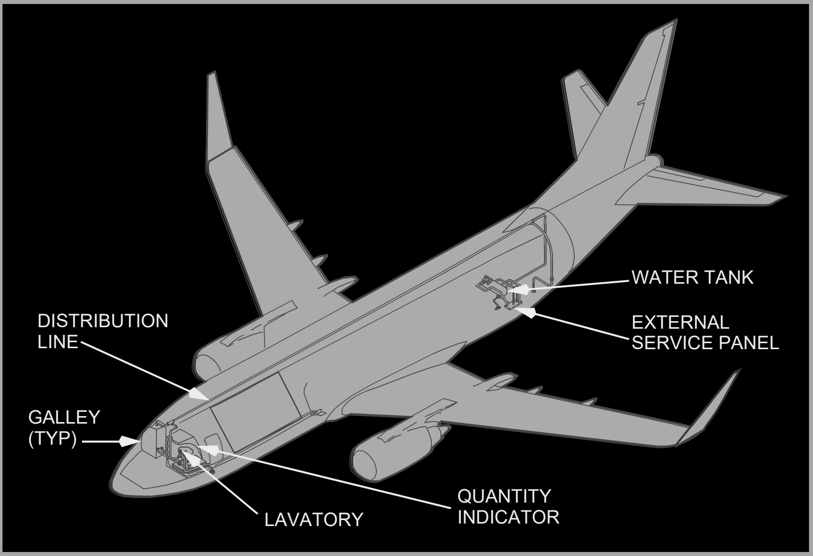
Water is supplied to the galleys from the airplane pressurized water system and, in an emergency, may be shut off at the galley.

Water System

The potable airplane water system is supplied from a single tank located behind the aft cargo compartment. Fresh water is supplied to the galleys and lavatory sinks.



WATER SYSTEM



WATER SYSTEM

Quantity Indication and System Operation

A quantity indicator is located on the attendant panel. The system is pressurized by engine bleed air or by the water system air compressor. Shutoff valves are located on each galley and below the sink in each lavatory. The drain position of this valve is used to drain all water overboard. Normally, the drain shutoff valves are ON.

Hot Water

Hot and cold water is available in all lavatories. The water heater is located below the lavatory sink. When emptied, it heats a new water charge in four minutes. An amber light is ON when the heater is operating normally. The heater has an overheat switch which turns off the heating element if an excess temperature is reached. The heater may be turned off at any time by using a manual switch on the heater. Cold water is supplied at the galleys.

Hot and cold water is available in the lavatory. The water heater is located below the lavatory sink. When emptied, it heats a new water charge in four minutes. An amber light is ON when the heater is operating normally. The heater has an overheat switch which turns off the heating element if an excess temperature is reached. The heater may be turned off at any time by using a manual switch on the heater. Cold water is supplied at the galley.

Servicing

The system is serviced from an exterior panel located on the bottom right side of the aft fuselage. Pressure filling is required. Waste water from the galleys and lavatory wash basins is drained overboard through two heated drain masts. The drain mast are on the bottom of the fuselage; one forward and one aft.

Forward Airstair

[Option - Airstairs]
The forward airstair provides the capability of boarding passengers without relying on the availability of airport ground equipment. The airstair is electrically operated and may be controlled from either inside or outside the airplane. The airstair is stowed inside a compartment just below the forward entry door. The compartment has a pressure door that automatically opens before the airstair can operate. For passenger safety, upper handrails are attached to support brackets inside the entry door after the airstair is fully extended.

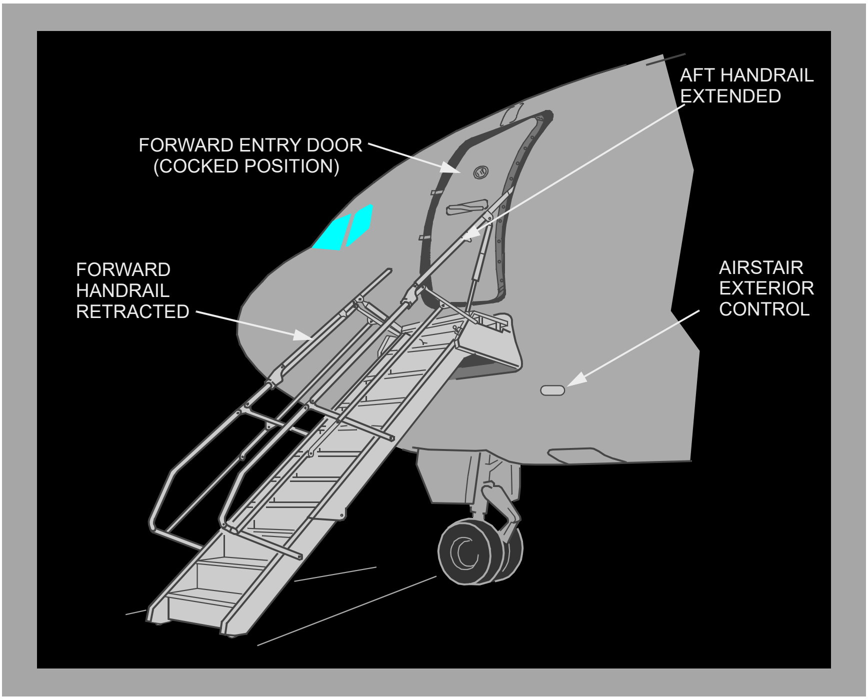
Interior Control

The interior control panel is located on the forward attendant panel. A white STAIR OPER light on the panel illuminates when the airstair is in transit. The airstair tread lights on the airstair steps are controlled by a single three–position airstair Tread LIGHTS switch. With the switch in the AUTO position, the tread lights illuminate when the airstair is fully extended and extinguish when the airstair retracts. The interior control panel has two modes of operation, normal and standby. The standby system provides an alternate means of electrical control in the event the normal mode of operation is not available. Normal operation requires 115V AC while standby operation requires the battery switch to be ON. Both operating modes require the forward entry door to be partially open. During normal operation the momentary extend or retract switches are depressed to operate the stairs. To operate in the standby mode, the momentary standby switch must be depressed while the retract or extend switches are also depressed.

Exterior Control

The exterior control is located to the right and below the airstair compartment. Operating instructions are located near the switches. When operating the airstair with the exterior control, the forward entry door need not be open. The exterior control switch by–passes the door–open requirement. A two–position switch, labeled NORMAL and STANDBY, is located in the exterior control recess. The switch is spring–loaded to NORMAL. Holding the NORMAL/STANDBY Switch to STANDBY provides DC power from the battery bus for airstair operation. The BAT switch on the flight deck does not need to be ON when operating the airstair on standby from the exterior control panel. The airstair control switch can be moved to extend or retract the airstair. The NORMAL and STANDBY systems are interlocked by the handrail switches to prevent the stair from being retracted with the handrail extended. Caution must be exercised when using the maintenance switch located under the airstair. If the upper handrail extensions are not properly stowed before retraction, damage to the airplane structure or damage to the airstair's handrail may result. An amber AIRSTAIR light, located on the overhead door caution annunciator panel, illuminates when the airstair pressure door is unlocked. Illumination of the AIRSTAIR light also activates the DOORS annunciator light and the MASTER CAUTION lights. The Airstair light is inoperative when DC bus 1 is not powered. The MASTER CAUTION and DOORS lights illuminate in normal or standby operation of the airstair.

Airstairs



WARNING: Use care not to fall from the airstair platform when operating the forward entry door. The small platform area and bad weather can make the door difficult to operate.

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Air Systems — Chapter 2
Table of Contents — Section TOC

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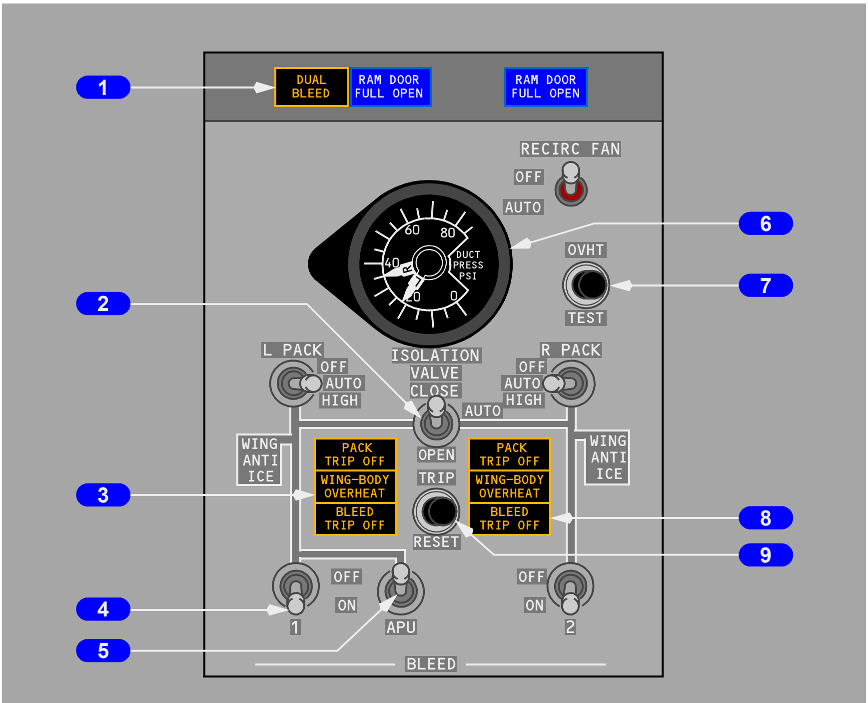
Air Systems — Chapter 2
Controls and Indicators — Section 10

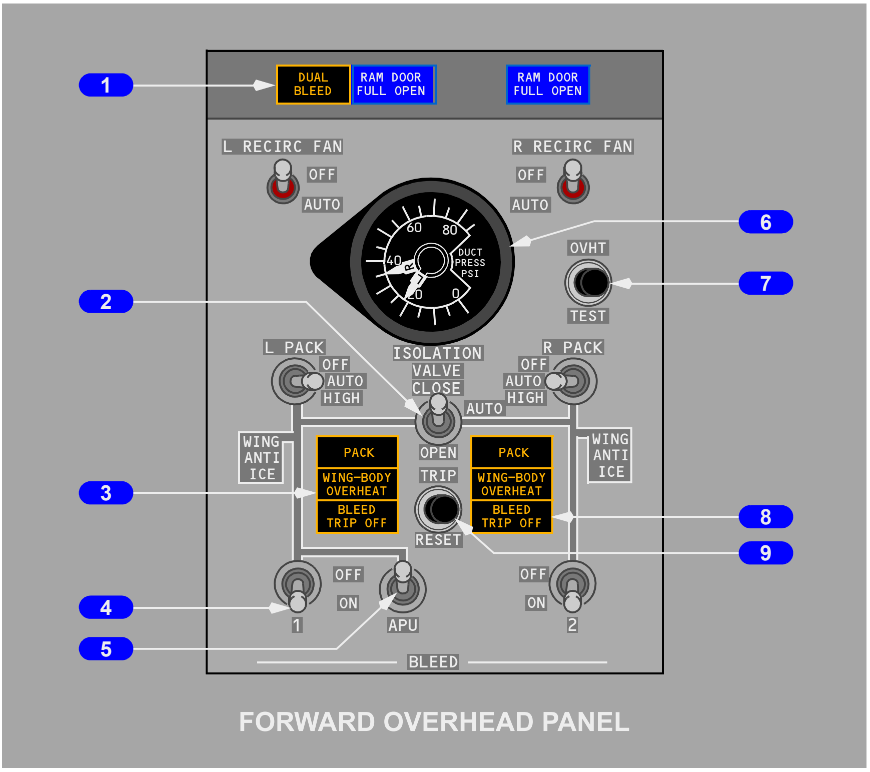
Bleed Air Controls and Indicators

[737 - 600/700]

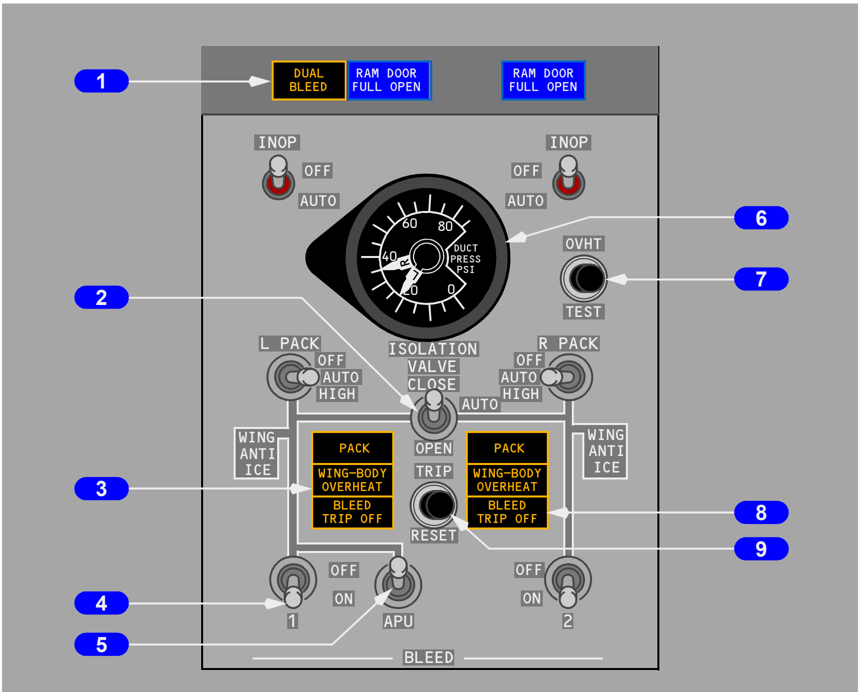


FORWARD OVERHEAD PANEL

[737 - 800/900]



FORWARD OVERHEAD PANEL



FORWARD OVERHEAD PANEL

1 DUAL BLEED Light

Illuminated (amber) – APU bleed air valve open and engine No. 1 BLEED air switch ON, or engine No. 2 BLEED air switch ON, APU bleed air valve and isolation valve open.

2 ISOLATION VALVE Switch

CLOSE – closes isolation valve.

AUTO –

- closes isolation valve if both engine BLEED air switches are ON and both air conditioning PACK switches are AUTO or HIGH
- opens isolation valve automatically if either engine BLEED air or air conditioning PACK switch positioned OFF

OPEN – opens isolation valve.

3 WING–BODY OVERHEAT Light

Illuminated (amber) –

- left light indicates overheat from bleed air duct leak in left engine strut, left inboard wing leading edge, left air conditioning bay, keel beam or APU bleed air duct
- right light indicates overheat from bleed air duct leak in right engine strut, right inboard wing leading edge or right air conditioning bay

4 Engine BLEED Air Switches

OFF – closes engine bleed air valve.

ON – opens engine bleed air valve when engines are operating.

5 APU BLEED Air Switch

OFF – closes APU bleed air valve.

ON – opens APU bleed air valve when APU is operating.

6 Bleed Air DUCT PRESSURE Indicator

Indicates pressure in L and R (left and right) bleed air ducts.

7 Wing–Body Overheat (OVHT) TEST Switch

Push –

- tests wing–body overheat detector circuits
- illuminates both WING–BODY OVERHEAT lights
- illuminates both MASTER CAUTION lights
- illuminates AIR COND light

8 BLEED TRIP OFF Light

Illuminated (amber) – excessive engine bleed air temperature or pressure

- related engine bleed air valve closes automatically
- requires reset

9 TRIP RESET Switch

[737 - 600/700]
Push (if fault condition is corrected) –

- resets BLEED TRIP OFF, PACK TRIP OFF or DUCT OVERHEAT lights
- related engine bleed air valve opens, or related pack valve opens, or related air mix valve opens

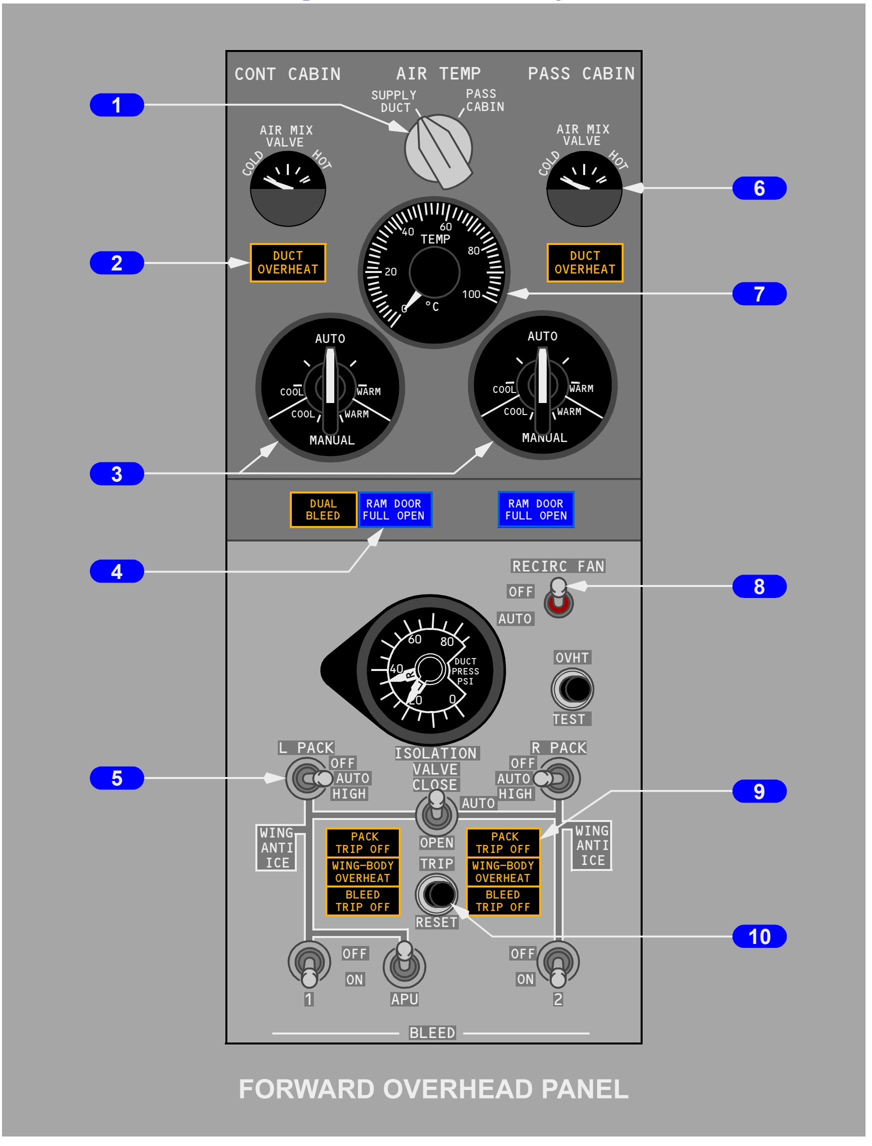
[737 - 800/900]

- resets BLEED TRIP OFF, PACK or ZONE TEMP lights
- related engine bleed air valve opens, or related pack valve opens, or related trim air modulating valve opens

Lights remain illuminated until reset.

Air Conditioning Controls and Indicators

[737 - 600/700 and Air Temperature Indicator in degrees C]



1 AIR Temperature (TEMP) Source Selector

SUPPLY DUCT – selects main distribution supply duct sensor for TEMP indicator.

PASS CABIN – selects passenger cabin sensor for TEMP indicator.

2 DUCT OVERHEAT Light

Illuminated (amber) –

- distribution air temperature in related duct exceeds limit
- air mix valves drive full cold
- requires reset

3 Control (CONT) CABIN and Passenger (PASS) CABIN Temperature Selector

AUTO – automatic temperature controller controls passenger cabin or flight deck temperature as selected.

MANUAL – air mix valves controlled manually. Automatic temperature controller bypassed.

4 RAM DOOR FULL OPEN Light

Illuminated (blue) – indicates ram door in full open position.

5 Air Conditioning PACK Switch

OFF – pack signaled OFF.

AUTO –

- with both packs operating, each pack regulates to low flow
- with one pack operating, operating pack regulates to high flow in flight with flaps up
- when operating one pack from APU (both engine BLEED air switches OFF), regulates to high flow

HIGH –

- pack regulates to high flow
- provides maximum flow rate on ground with APU BLEED air switch ON

6 AIR MIX VALVE Indicator

Indicates position of air mix valves:

- controlled automatically with related temperature selector in AUTO
- controlled manually with related temperature selector in MANUAL

7 Air Temperature (TEMP) Indicator

Indicates temperature at location selected with AIR TEMP source selector.

8 Recirculation (RECIRC) FAN Switch

OFF - fan signaled off.

AUTO – fan signaled on except when both packs operating with either PACK switch in HIGH.

9 PACK TRIP OFF Light

Illuminated (amber) –

- indicates pack temperature has exceeded limits
- related pack valve automatically closes and mix valves drive full cold
- requires reset

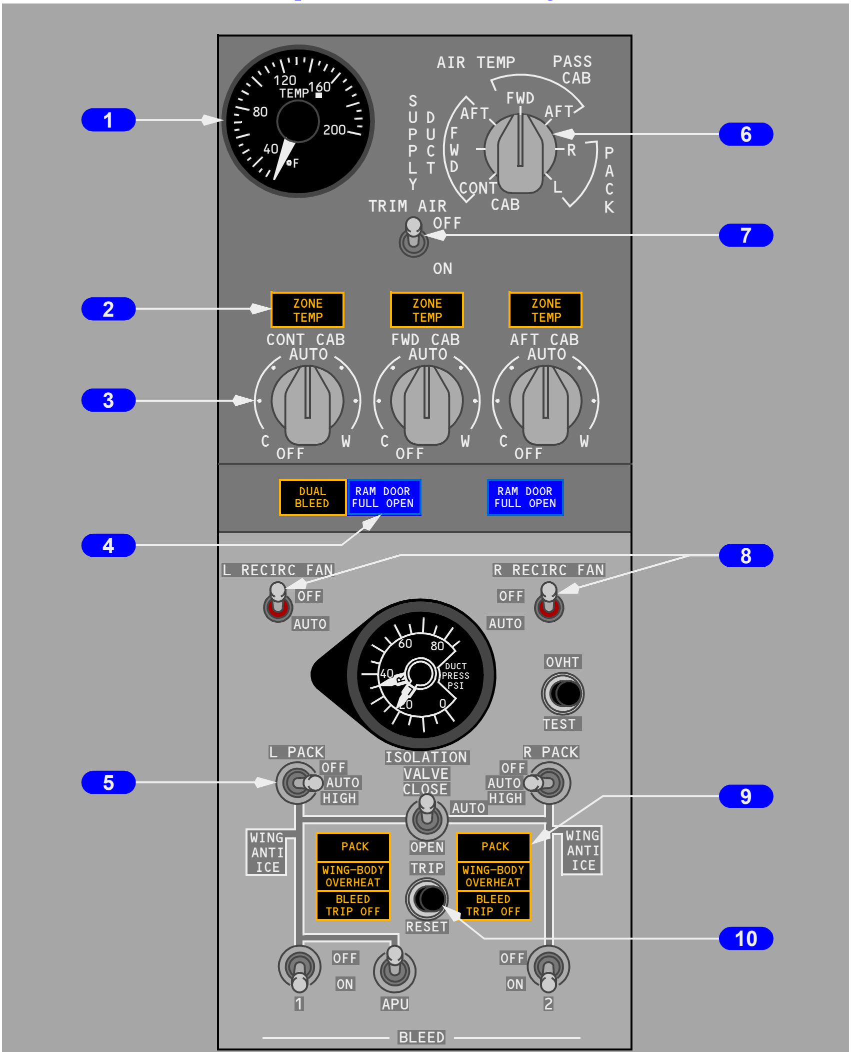
10 TRIP RESET Switch

Push (if fault condition is corrected) –

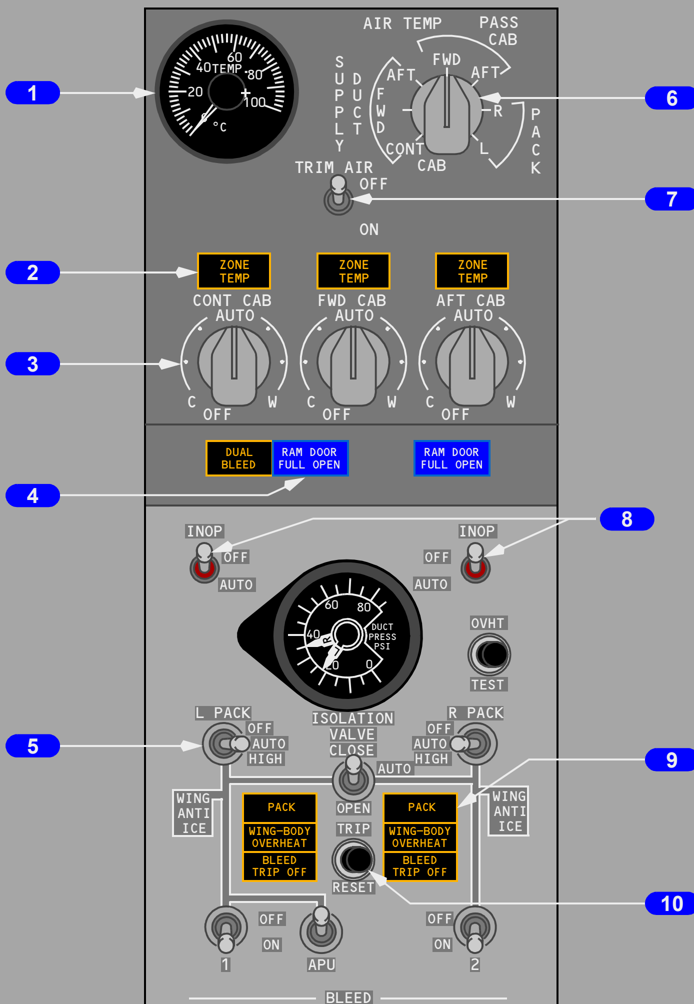
- resets BLEED TRIP OFF, PACK TRIP OFF or DUCT OVERHEAT lights
- related engine bleed air valve opens, or related pack valve opens, or related air mix valve opens

Lights remain illuminated until reset.

[737 - 800/900 and Air Temperature Indicator in degrees F]



FORWARD OVERHEAD PANEL



FORWARD OVERHEAD PANEL

1 Air Temperature (TEMP) Indicator

Indicates temperature at location selected with AIR TEMP source selector.

2 ZONE TEMP Lights

Illuminated (amber) –

- CONT CAB indicates a duct temperature overheat or failure of the flight deck primary and standby temperature control
- FWD CAB or AFT CAB indicates duct temperature overheat

During Master Caution light recall:

- CONT CAB indicates failure of the flight deck primary or standby temperature control
- either FWD CAB or AFT CAB indicates failure of the associated zone temperature control
- lights will extinguish when Master Caution is reset

3 Temperature Selector

AUTO – provides automatic temperature control for the associated zones. Rotating the control toward C (cool) or W (warm) manually sets the desired temperature.

CONT CAB – controls the flight deck compartment temperature in the 737-800 Boeing Converted Freighter.

FWD CAB – controls the supernumerary compartment temperature in the 737-800 Boeing Converted Freighter.

AFT CAB – controls the cargo compartment temperature in the 737-800 Boeing Converted Freighter.

OFF – closes the associated trim air modulating valve.

3 Temperature Selector

AUTO – provides automatic temperature control for the associated zones. Rotating the control toward C (cool) or W (warm) manually sets the desired temperature.

OFF – closes the associated trim air modulating valve.

4 RAM DOOR FULL OPEN Light

Illuminated (blue) – indicates ram door in full open position.

5 Air Conditioning PACK Switch

OFF – pack signaled OFF.

AUTO –

- with both packs operating, each pack regulates to low flow
- with one pack operating, operating pack regulates to high flow in flight with flaps up
- when operating one pack from APU (both engine BLEED air switches OFF), regulates to high flow

HIGH –

- pack regulates to high flow
- provides maximum flow rate on ground with APU BLEED air switch ON

6 AIR Temperature (TEMP) Source Selector

SUPPLY DUCT – selects appropriate zone supply duct temperature: CONT CAB for the flight deck supply duct; FWD for the supernumerary supply duct; AFT for the cargo compartment forward supply duct.

PASS CAB – selects supernumerary cabin temperature in the FWD position or cargo compartment temperature in the AFT position.

PACK – selects left or right pack temperatures.

6 AIR Temperature (TEMP) Source Selector

SUPPLY DUCT – selects appropriate zone supply duct temperature.

PASS CAB – selects forward or aft passenger cabin temperature.

PACK – selects left or right pack temperatures.

7 TRIM AIR Switch

ON - trim air pressure regulating and shutoff valve signaled open.

OFF - trim air pressure regulating and shutoff valve signaled closed.

8 Recirculation (RECIRC) FAN Switches

OFF - fan signaled off.

AUTO –

- in-flight –
  - the left recirculation fan operates if both packs are operating unless either PACK switch is in HIGH
  - the right recirculation fan operates if both packs are operating unless both PACK switches are in HIGH

- on the ground –
  - the left recirculation fan operates unless both PACK switches are in HIGH
  - the right recirculation fan operates even if both PACK switches are in HIGH

8 Recirculation (RECIRC) FAN Switches

Note: 737-800BCF. placarded INOP. The recirculation fans have been removed.

9 PACK Light

Illuminated (amber) –

- indicates pack trip off or failure of both primary and standby pack controls
- during Master Caution recall, indicates failure of either primary or standby pack control. Extinguishes when Master Caution is reset

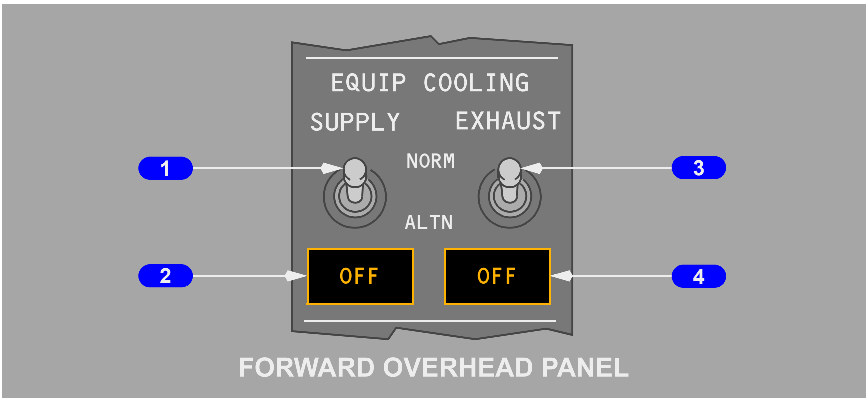
10 TRIP RESET Switch

Push (if fault condition is corrected) –

- resets BLEED TRIP OFF, PACK or ZONE TEMP lights
- related engine bleed air valve opens, or related pack valve opens, or related trim air modulating valve opens

Lights remain illuminated until reset.

Equipment Cooling Panel



1 Equipment (EQUIP) COOLING SUPPLY Switch

NORM – normal cooling supply fan activated.

ALTN – alternate cooling supply fan activated.

2 **Equipment Cooling Supply OFF Light**

Illuminated (amber) – no airflow from selected cooling supply fan.

3 **Equipment (EQUIP) COOLING EXHAUST Switch**

NORM – normal cooling exhaust fan activated.

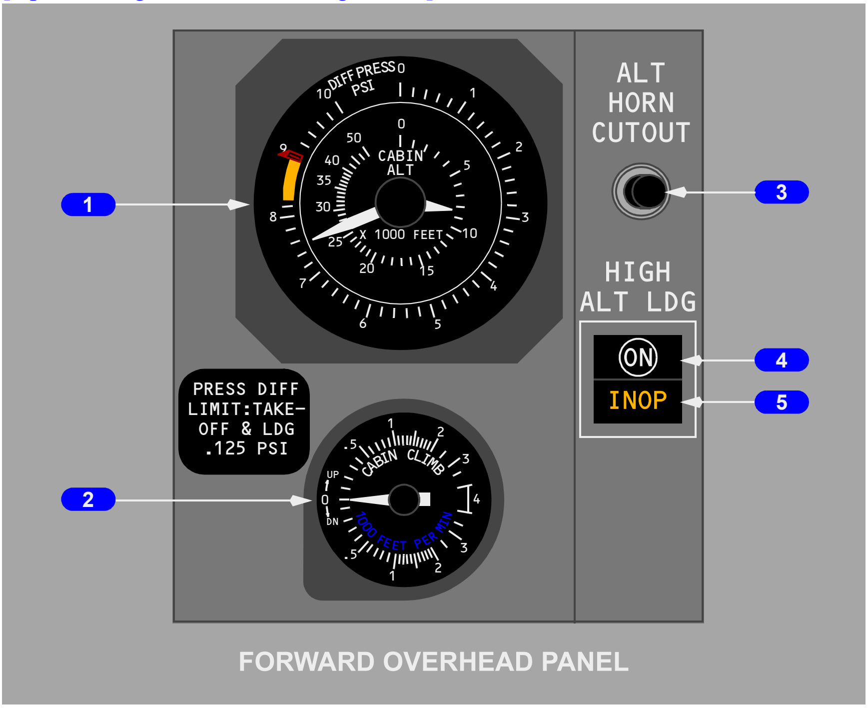
ALTN – alternate cooling exhaust fan activated.

4 **Equipment Cooling Exhaust OFF Light**

Illuminated (amber) – no airflow from selected cooling exhaust fan.

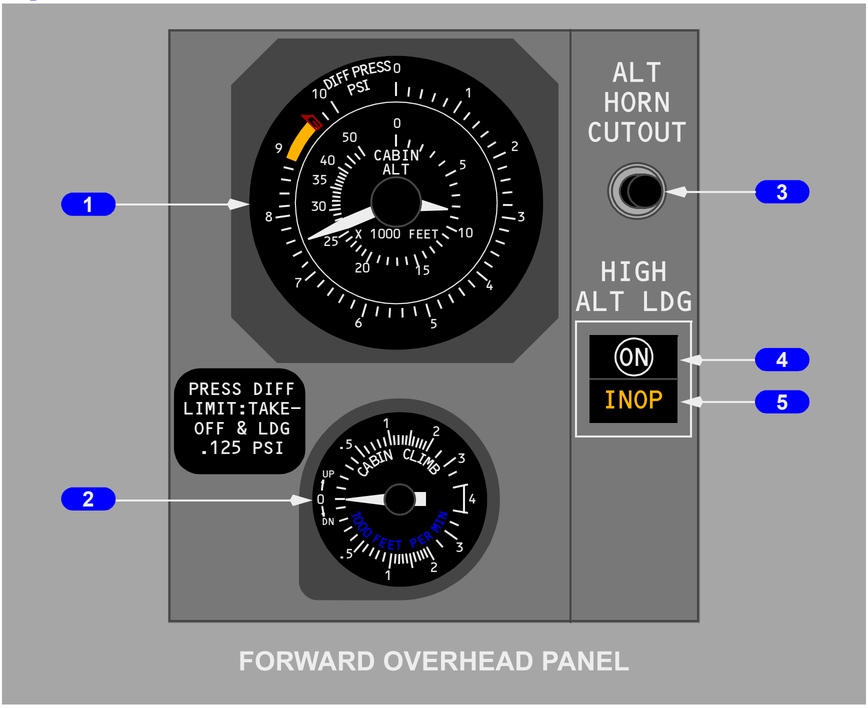
Cabin Altitude Panel

[Option - High Altitude Landing switch]



[Option - High Altitude Landing switch]

[Option - 6500 Foot Cabin Altitude]



1 CABIN Altimeter (ALT)/Differential Pressure (DIFF PRESS) Indicator

Inner Scale – indicates cabin altitude in feet.

Note: The CABIN ALT indicator can show a cabin altitude of less than 0 feet and reach the upper end of the cabin altitude scale. This can occur under the following conditions:

- on the ground at airports close to or below sea level
- in flight when the cabin is pressurized below sea level

Outer Scale – indicates differential pressure between cabin and ambient in psi.

2 CABIN Rate of CLIMB Indicator

Indicates cabin rate of climb or descent in feet per minute.

3 **Altitude (ALT) HORN CUTOUT Switch**

Push –

- cuts out intermittent cabin altitude warning horn
- altitude warning horn sounds when cabin exceeds 10,000 feet altitude

[Option - High Altitude Landing switch]

4 **High Altitude Landing Switch**

ON (white) – reprograms initiation of cabin altitude warning annunciation from 10,000 to 14,000 feet.

Off – (ON not visible)

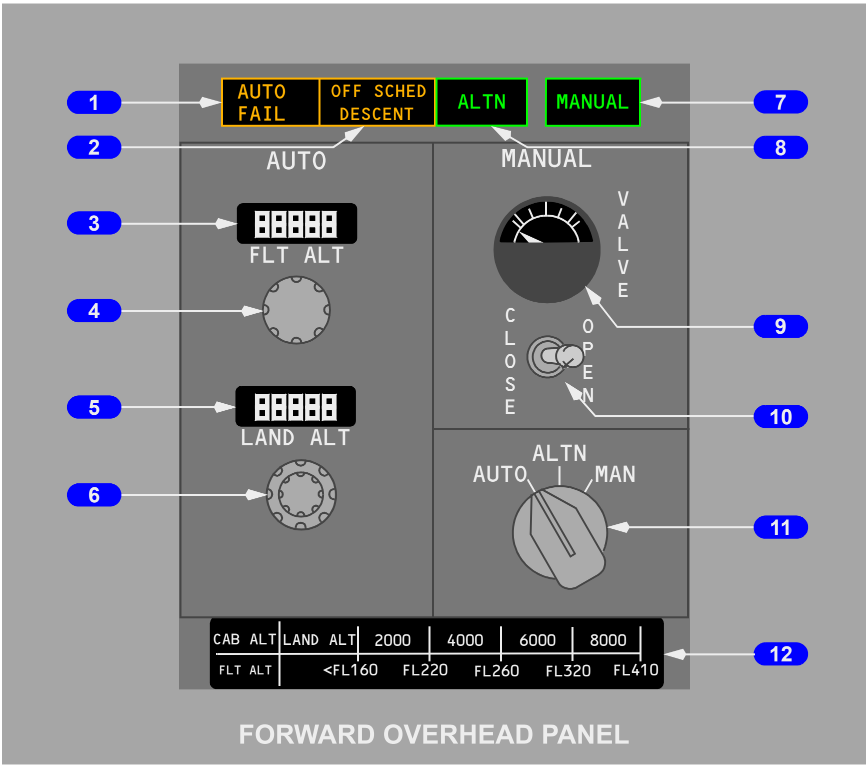
- reprograms cabin pressurization from high altitude to normal operation
- extinguishes INOP light

[Option - High Altitude Landing switch]

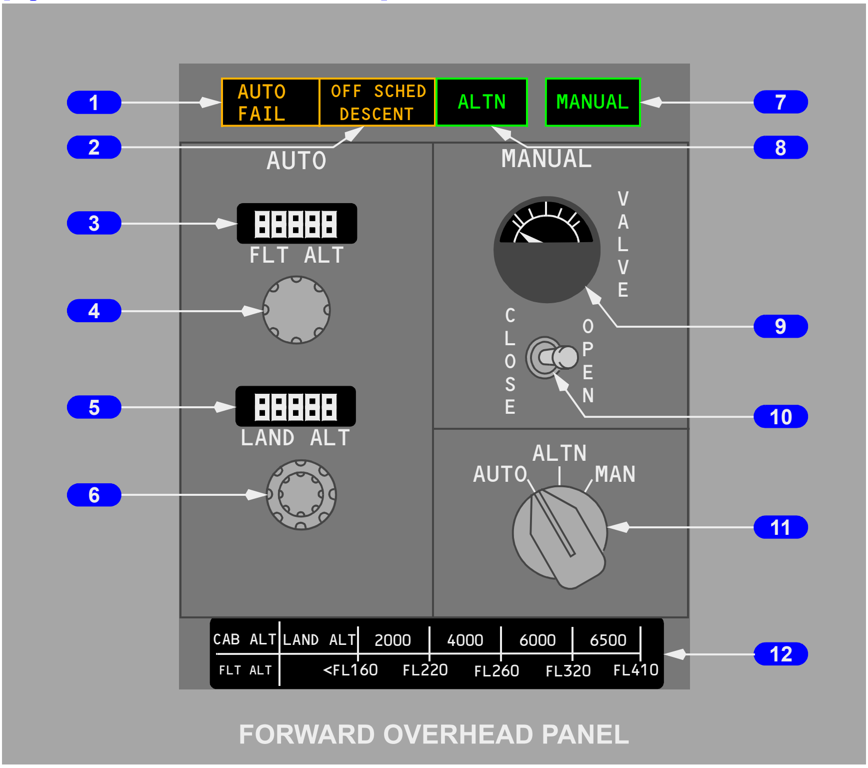
5 **High Altitude Landing INOP Light**

Illuminated (amber) – indicates high altitude landing system fault.

Cabin Pressurization Panel



[Option - 6500 Foot Cabin Altitude]



1 AUTO FAIL Light

Illuminated (amber) – automatic pressurization system failure detected:

- indicates a single controller failure when ALTN light is also illuminated
- indicates a dual controller failure when illuminated alone

2 OFF Schedule (SCHED) DESCENT Light

Illuminated (amber) – airplane descended before reaching the planned cruise altitude set in the FLT ALT indicator.

3 Flight Altitude (FLT ALT) Indicator

- indicates selected cruise altitude
- set before takeoff

Note: A panel failure detected after a DC power interruption will result in the display of "88888" or all dashes. If cabin altitude and cabin rate are normal, automatic control of cabin pressure is not affected by the failure.

Note: FLT ALT indicator failure may result in the display of non-numbers or a blank display. If the indicator cannot be changed by rotating the flight altitude selector, it may be necessary to monitor the pressurization system to ensure normal operation, especially during climb and descent.

4 Flight Altitude Selector

Rotate – set planned cruise altitude (-1,000 ft. to 42,000 ft. in 500 ft. increments).

5 Landing Altitude (LAND ALT) Indicator

- indicates altitude of intended landing field
- set before takeoff

Note: A panel failure detected after a DC power interruption will result in the display of "88888" or all dashes. If cabin altitude and cabin rate are normal, automatic control of cabin pressure is not affected by the failure.

Note: LAND ALT indicator failure may result in the display of non-numbers or a blank display. If the indicator cannot be changed by rotating the landing altitude selector, it may be necessary to monitor the pressurization system to ensure normal operation, especially during climb and descent.

6 Landing Altitude Selector

Rotate – select planned landing field altitude (-1,000 ft. to 14,000 ft. in 50 ft. increments).

7 MANUAL Light

Illuminated (green) – pressurization system operating in the manual mode.

8 Alternate (ALTN) Light

Illuminated (green) – pressurization system operating in the alternate automatic mode:

- Illumination of both ALTN and AUTO FAIL lights indicates a single controller failure and automatic transfer to ALTN mode
- pressurization mode selector in ALTN position

9 **Outflow VALVE Position Indicator**

- indicates position of outflow valve
- operates in all modes

10 **Outflow Valve Switch (spring–loaded to center)**

CLOSE – closes outflow valve electrically with pressurization mode selector in MAN position.

OPEN – opens outflow valve electrically with pressurization mode selector in MAN position.

11 **Pressurization Mode Selector**

AUTO – pressurization system controlled automatically.

ALTN – pressurization system controlled automatically using ALTN controller.

MAN –

- pressurization system controlled manually by outflow valve switch
- both auto controllers bypassed

12 **Cabin /Flight Altitude (CAB ALT)(FLT ALT) Placard**

Used to determine setting for cabin altitude when operating in manual mode.

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Introduction

Air for the bleed air system can be supplied by the engines, APU, or an external air cart/source. The APU or external cart supplies air to the bleed air duct prior to engine start. After engine start, air for the bleed air system is normally supplied by the engines.

The following systems rely on the bleed air system for operation:

- Air conditioning/pressurization
- Wing and engine thermal anti-icing
- Engine starting
- Hydraulic reservoirs pressurization
- Water tank pressurization

[Option]
- Aspirated TAT probe

[Option]
- Nitrogen Generation System

Switches on the air conditioning panel operate the APU and engine bleed air supply system.

Engine Bleed System Supply

Engine bleed air is obtained from the 5th and 9th stages of the compressor section. When 5th stage low pressure bleed air is insufficient for the bleed air system requirements, the high stage valve modulates open to maintain adequate bleed air pressure. During takeoff, climb, and most cruise conditions, low pressure bleed air from the 5th stage is adequate and the high stage valve remains closed.

Engine Bleed Air Valves

The engine bleed air valve acts as a pressure regulator and shutoff valve. With the engine bleed air switch ON, the valve is DC activated and pressure operated. The valve maintains proper system operating pressure and reduces bleed air outflow in response to high bleed air temperature.

Bleed Trip Sensors

Bleed trip sensors illuminate the respective BLEED TRIP OFF light when engine bleed air temperature or pressure exceeds a predetermined limit. The respective engine bleed air valve closes automatically.

Duct Pressure Transmitters

Duct pressure transmitters provide bleed air pressure indications to the respective (L and R) pointers on the bleed air duct pressure indicator. The indicator is AC operated. Differences between L and R duct pressure on the bleed air duct pressure indicator are considered normal as long as there is sufficient air for cabin pressurization.

Isolation Valve

The isolation valve isolates the left and right sides of the bleed air duct during normal operations. The isolation valve is AC operated.

With the isolation valve switch in AUTO, both engine bleed air switches ON, and both air conditioning pack switches AUTO or HIGH, the isolation valve is closed. The isolation valve opens if either engine bleed air switch or air conditioning pack switch is positioned OFF. Isolation valve position is not affected by the APU bleed air switch.

External Air Connection

An external air cart/source provides an alternate air source for engine start or air conditioning.

APU Bleed Air Valve

The APU bleed air valve permits APU bleed air to flow to the bleed air duct. The valve closes automatically when the APU is shut down. The APU bleed air valve is DC controlled and pressure operated.

With both the APU and engine bleed air valves open, and the engines operating at idle thrust, there is a possibility of APU bleed air back-pressuring the 9th stage modulating and shutoff valve. This would cause the 9th stage valve to close.

DUAL BLEED Light

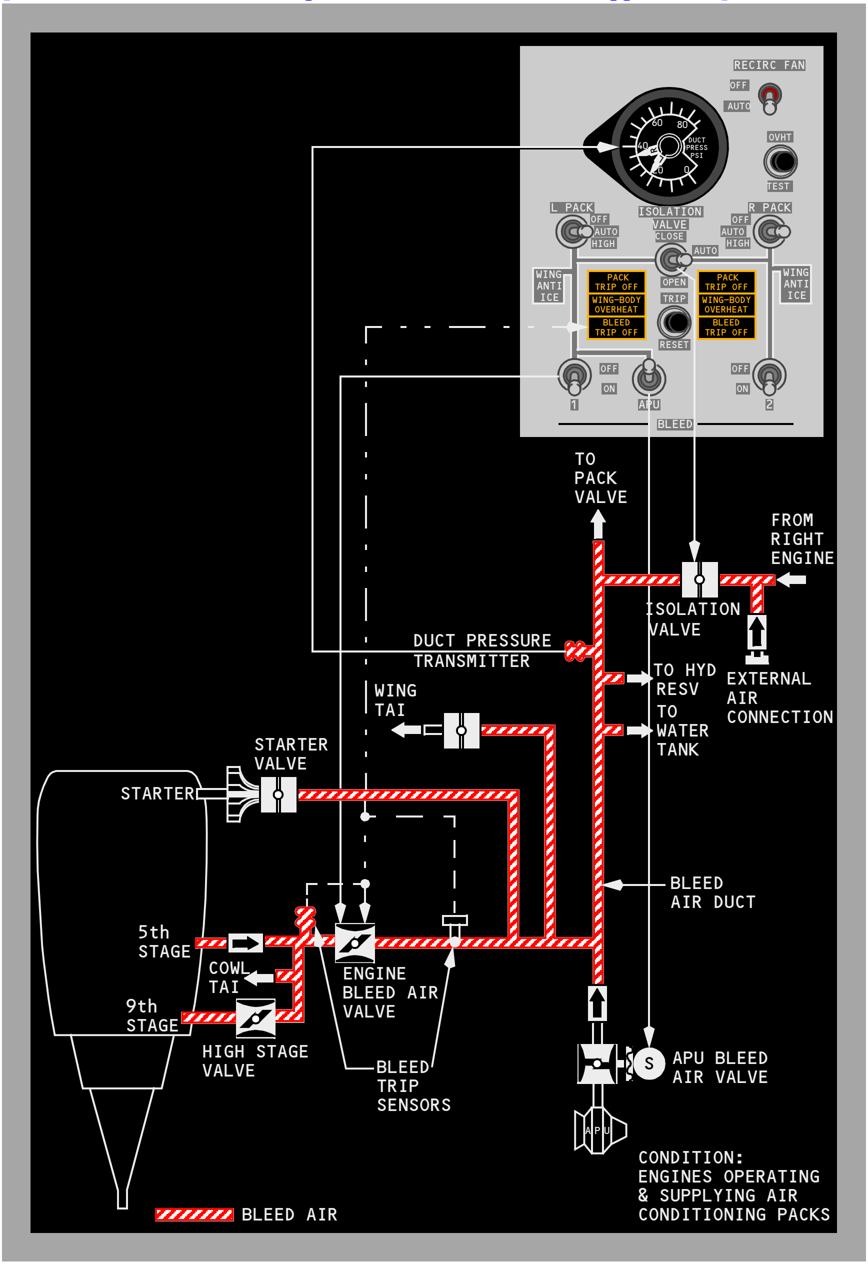
The DUAL BLEED light illuminates whenever the APU bleed air valve is open and the position of the engine bleed air switches and isolation valve would permit possible backpressure of the APU. Therefore, thrust must be limited to idle with the DUAL BLEED light illuminated.

Nitrogen Generation System

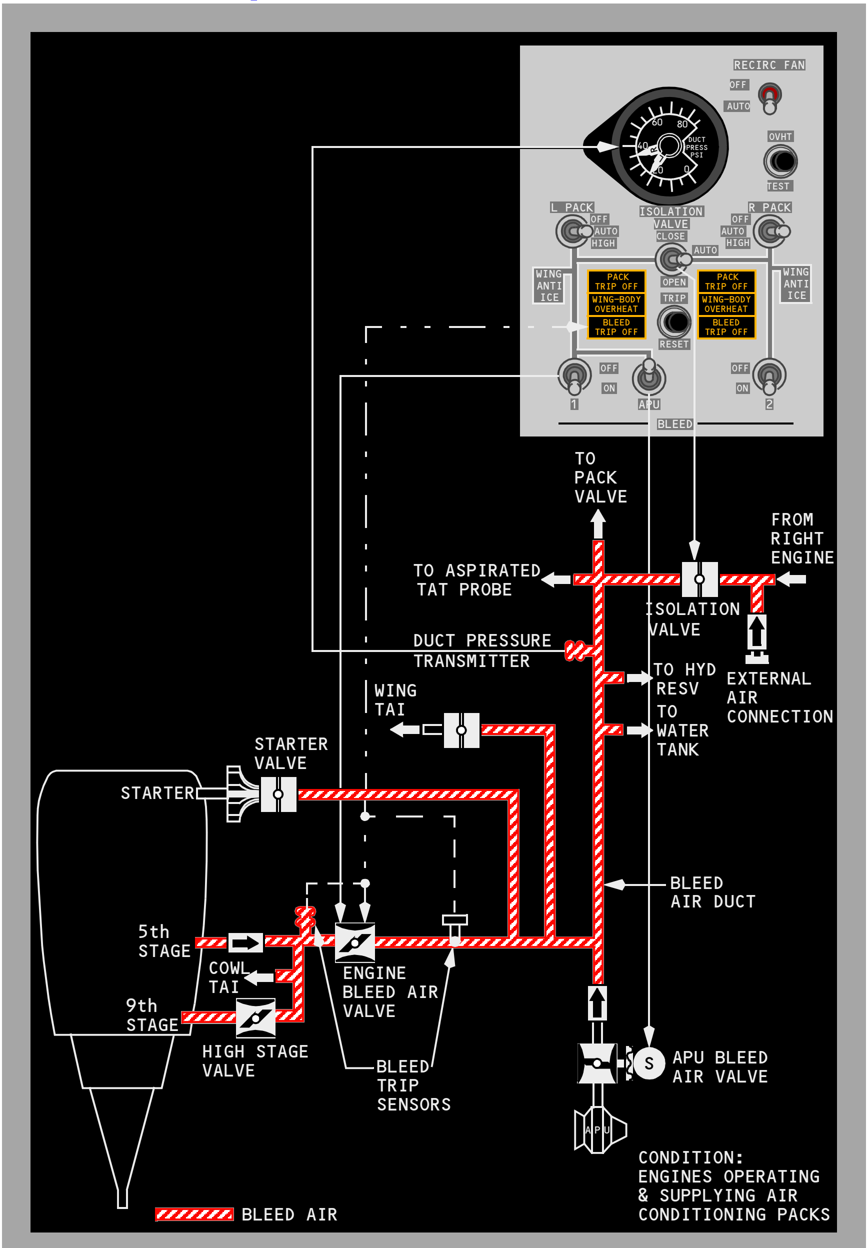
[Option]
The Nitrogen Generation System is described in Chapter 12.

Bleed Air System Schematic

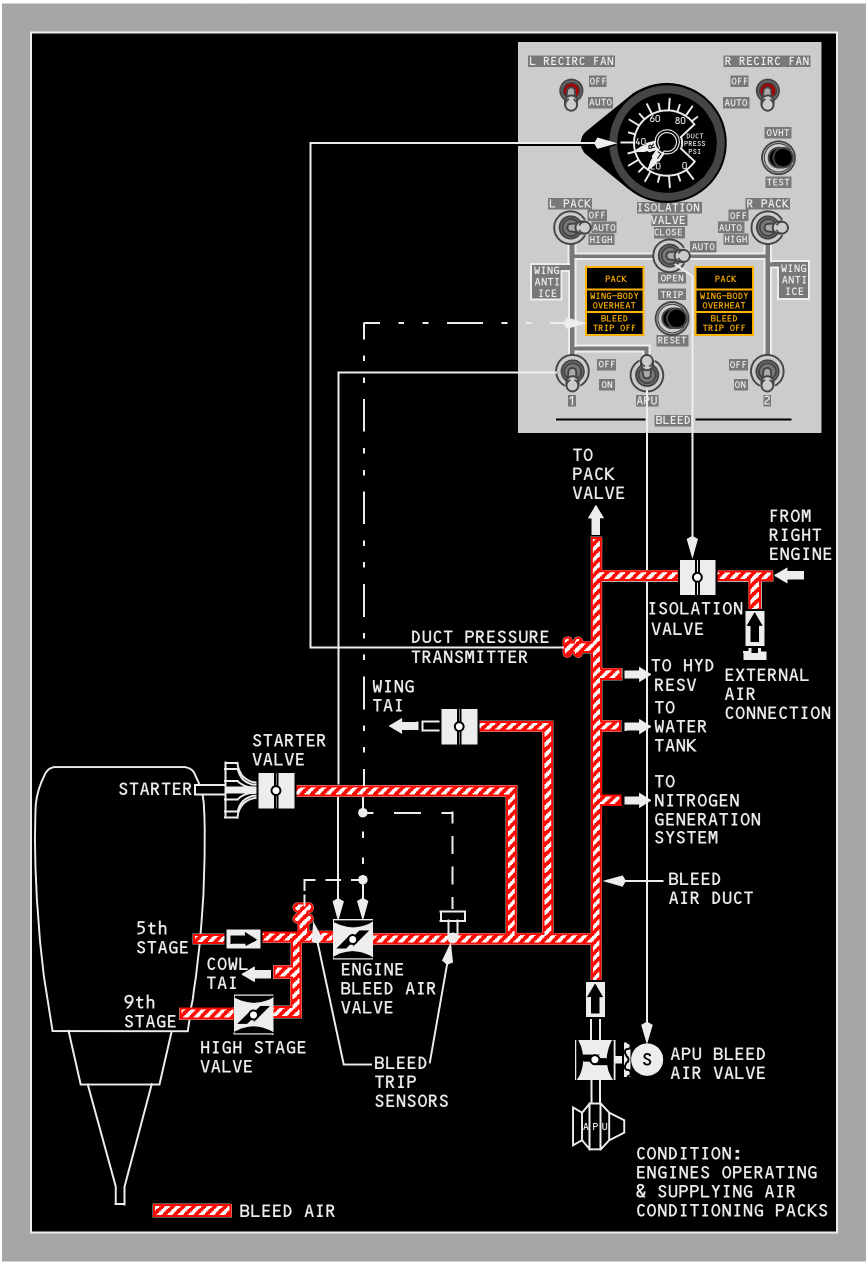
[737 - 600/700 with Non-Aspirated TAT or with Port-Capped TAT]



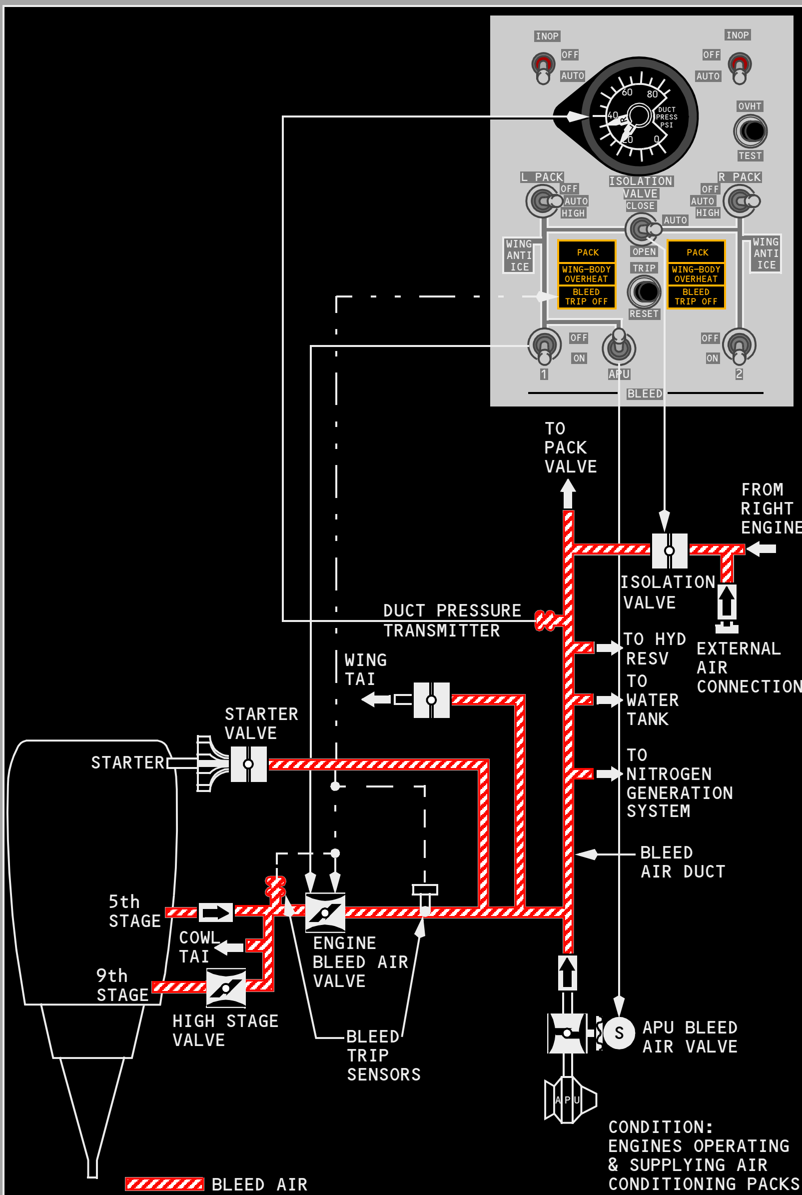
[737 - 600/700 with Aspirated TAT]



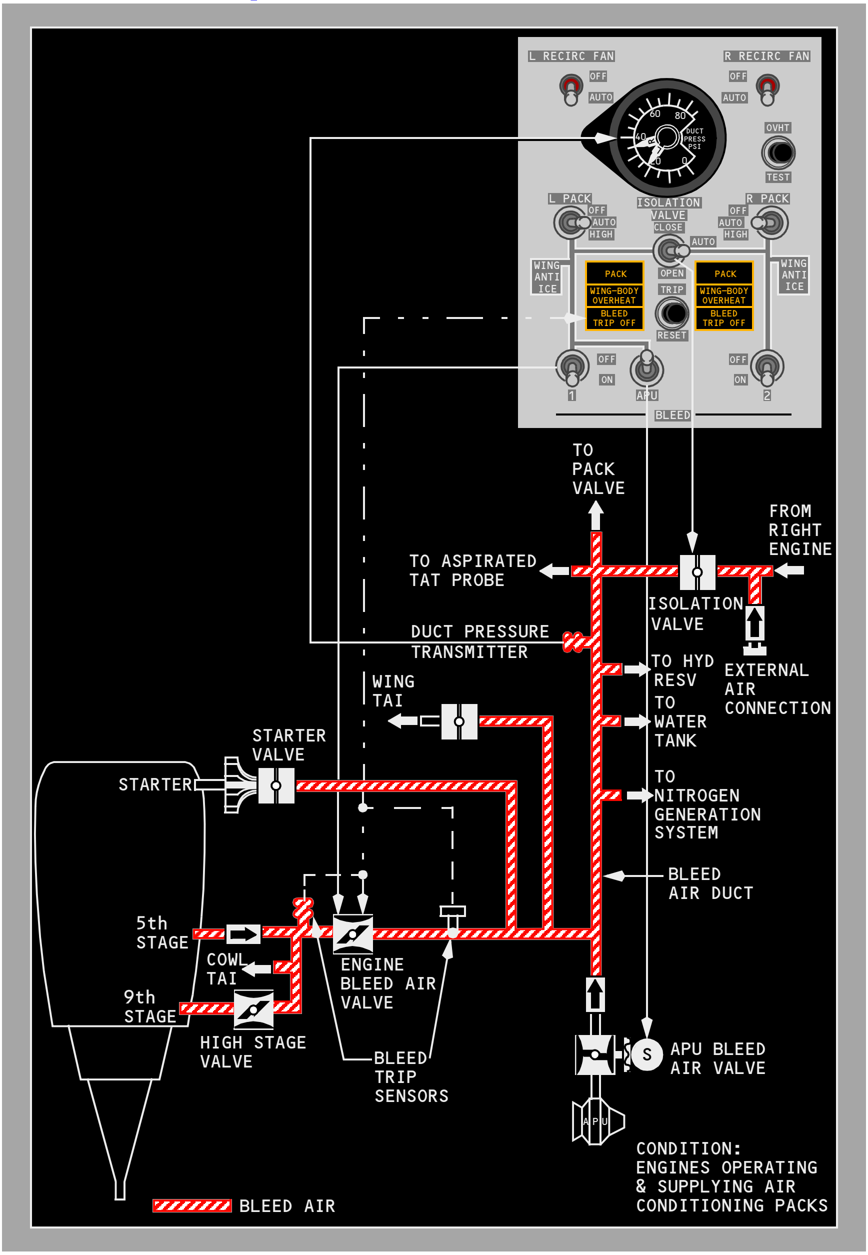
[737 - 800/900 with Non-Aspirated TAT or with Port-Capped TAT, without Aux Fuel Tanks, with NGS]



[737 - 800/900 with Non-Aspirated TAT or with Port-Capped TAT, without Aux Fuel Tanks, with NGS]



[737 - 800/900 with Aspirated TAT and without Aux Fuel Tanks, with NGS]

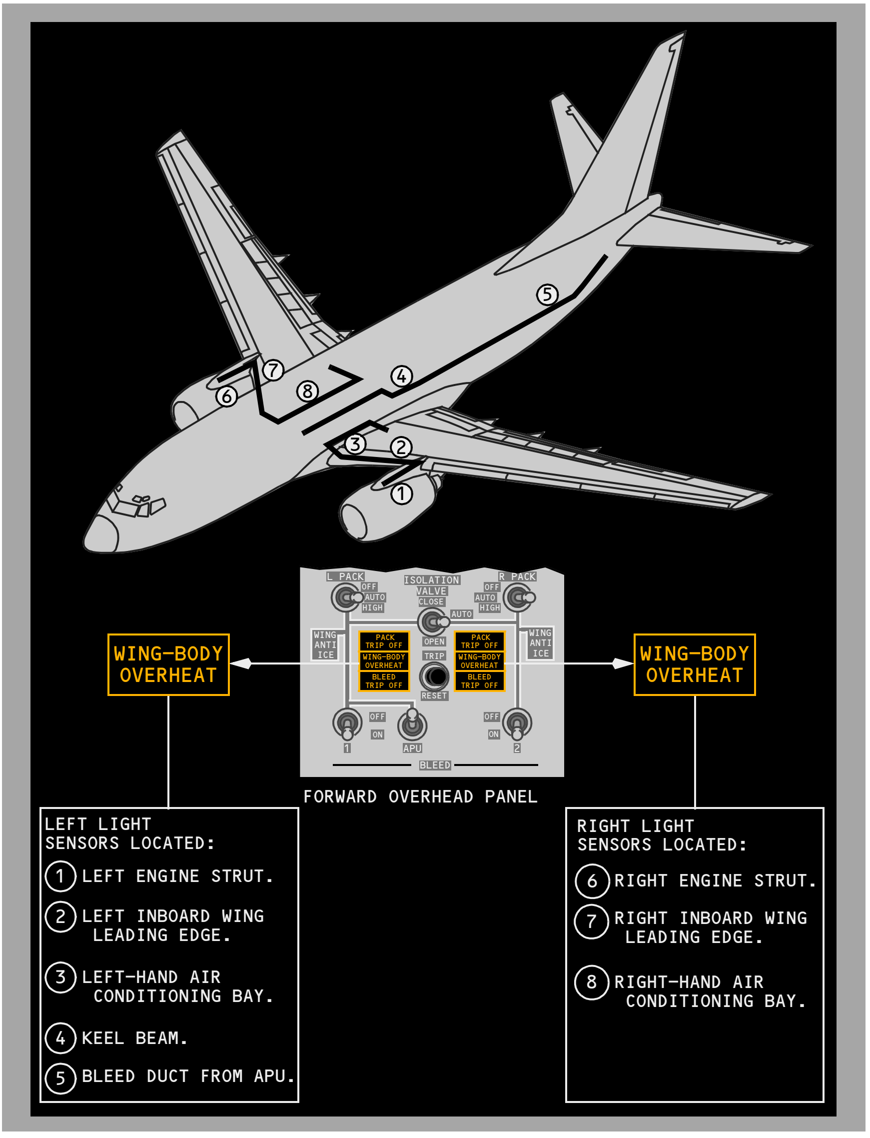


Wing-Body Overheat

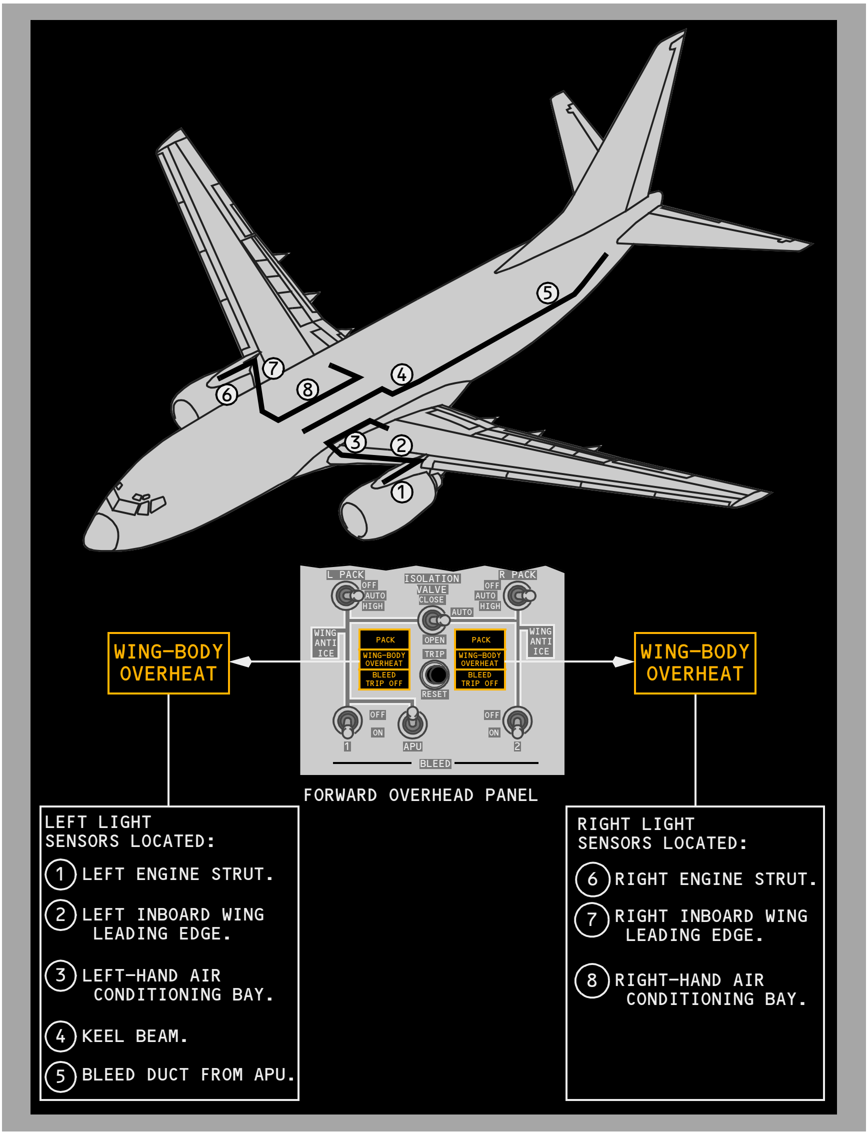
A wing-body overheat condition is caused by a bleed air duct leak. It is sensed by the overheat sensors located as shown.

Wing-Body Overheat Ducts and Lights

[737 - 600/700]



[737 - 800/900]



5
4
7
8
6
3
2
1
L PACK
OFF
AUTO
HIGH
ISOLATION
VALVE
CLOSE
AUTO
OPEN
R PACK
OFF
AUTO
HIGH
WING ANTI ICE
PACK
WING-BODY OVERHEAT
BLEED TRIP OFF
TRIP
RESET
PACK
WING-BODY OVERHEAT
BLEED TRIP OFF
WING ANTI ICE
OFF
ON
1
APU
OFF
ON
2
BLEED
WING-BODY OVERHEAT
WING-BODY OVERHEAT
FORWARD OVERHEAD PANEL
LEFT LIGHT SENSORS LOCATED:
1 LEFT ENGINE STRUT.
2 LEFT INBOARD WING LEADING EDGE.
3 LEFT-HAND AIR CONDITIONING BAY.
4 KEEL BEAM.
5 BLEED DUCT FROM APU.
RIGHT LIGHT SENSORS LOCATED:
6 RIGHT ENGINE STRUT.
7 RIGHT INBOARD WING LEADING EDGE.
8 RIGHT-HAND AIR CONDITIONING BAY.

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[737-600/700]

Introduction

The air conditioning system provides temperature controlled air by processing bleed air from the engines, APU, or a ground air source in air conditioning packs. Conditioned air from the left pack, upstream of the mix manifold, flows directly to the flight deck. Excess air from the left pack, air from the right pack, and air from the recirculation system is combined in the mix manifold. The mixed air is then distributed through the left and right sidewall risers to the passenger cabin.

Conditioned air for the cabin comes from either the airplane air conditioning system or a preconditioned ground source. Air from the preconditioned ground source enters the air conditioning system through the mix manifold.

Air Conditioning Pack

The flow of bleed air from the main bleed air duct through each air conditioning pack is controlled by the respective pack valve. Normally the left pack uses bleed air from engine No. 1 and the right pack uses bleed air from engine No. 2. A single pack in high flow is capable of maintaining pressurization and acceptable temperatures throughout the airplane up to the maximum certified ceiling.

The APU is capable of supplying bleed air for two packs on the ground, or one pack in flight. Most external air carts are capable of supplying adequate bleed air for two pack operation. Do not operate more than one pack from one engine.

Airflow Control

During normal flight, with both air conditioning pack switches set to AUTO, both engines operating and both engine bleed switches set to ON, the packs provide normal air flow to maintain necessary ventilation. If the air conditioning pack switches are set to HIGH, the packs provide high air flow to increase ventilation.

When the aircraft is not on the ground and the flaps are up, and both air conditioning pack switches are set to AUTO, and the engine bleed switches are both set to ON, if one pack fails or one engine fails or a pack switch is selected to OFF, the remaining pack automatically switches to high air flow to increase ventilation.

When the aircraft is on the ground or the flaps are down, and both air conditioning pack switches are set to AUTO, and engine bleed switches are both set to ON, if one pack fails or one engine fails or a pack switch is selected to OFF, the remaining pack will not automatically switch to high air flow. Automatic switching to high air flow is inhibited in this situation to ensure adequate engine power is available for single engine operations. However, when the APU is operating and the APU bleed switch is set to ON, both engine bleed switches are set to OFF and both pack switches are set to AUTO, automatic switching to high air flow occurs with a single pack failure, regardless of flap position or air/ground status. Also, in this configuration, the flight crew can force an "APU high air flow" rate when either or both pack switches are positioned to HIGH, providing maximum airflow for ventilation when the APU is the only source of ventilation.

Ram Air System

The ram air system provides cooling air for the heat exchangers. Operation of the system is automatically controlled by the packs through operation of ram air inlet doors.

On the ground, or during slow flight with the flaps not fully retracted, the ram air inlet doors move to the full open position for maximum cooling. In normal cruise, the doors modulate between open and closed. A RAM DOOR FULL OPEN light illuminates whenever a ram door is fully open.

Deflector doors are installed forward of the ram air inlet doors to prevent slush ingestion prior to liftoff and after touchdown. Deflector doors extend when activated electrically by the air–ground safety sensor.

Cooling Cycle

The flow through the cooling cycle starts with bleed air passing through a heat exchanger for cooling. The air then flows to an air cycle machine for refrigeration and to a water separator which removes moisture. The processed cold air is then combined with hot air. The conditioned air flows into the mix manifold and distribution system.

Overheat protection is provided by temperature sensors located in the cooling cycle. An overheat condition causes the pack valve to close and the PACK TRIP OFF light to illuminate.

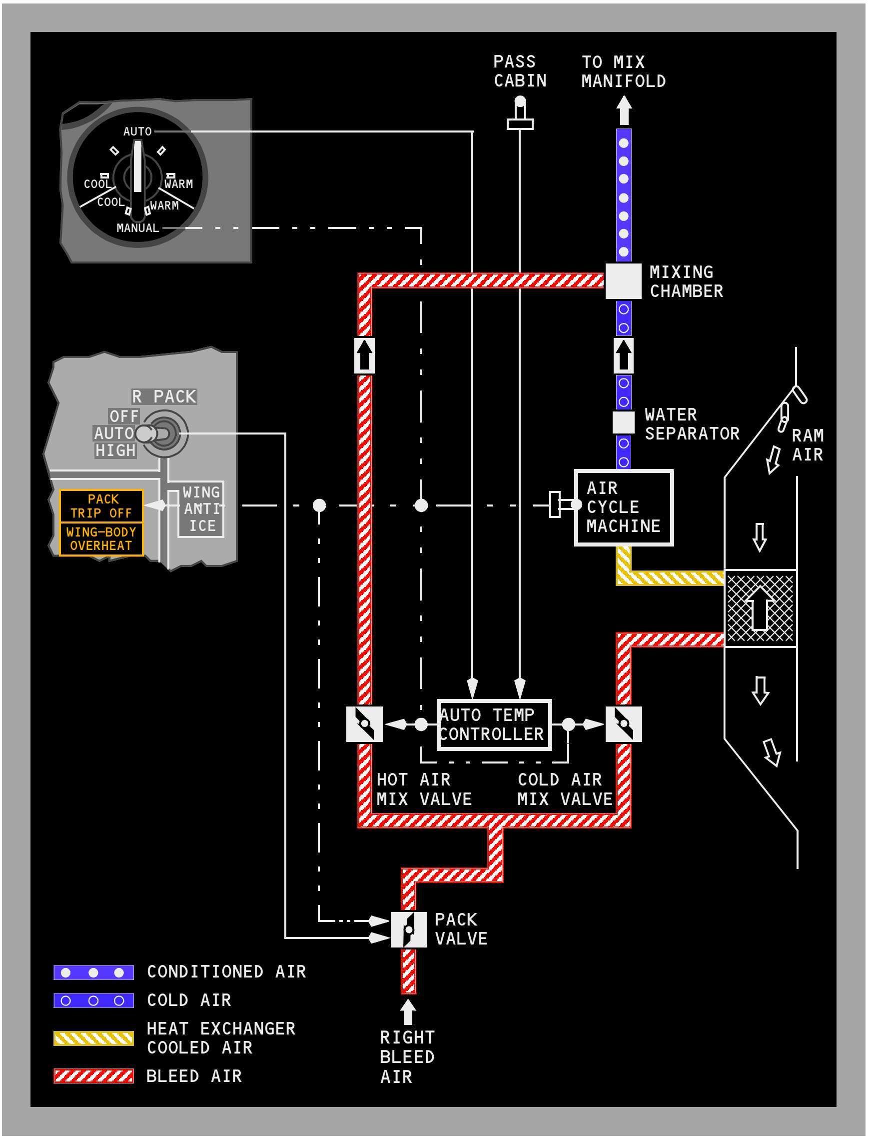
Air Mix Valves

The two air mix valves for each pack control hot and cold air according to the setting of the CONT CABIN or PASS CABIN temperature selector. Air that flows through the cold air mix valve is processed through a cooling cycle and then combined with hot air flowing from the hot air mix valve.

In the automatic temperature mode, the air mix valves are operated by the automatic temperature controller. The automatic temperature controller uses inputs from the respective temperature selector and cabin temperature sensor. The automatic temperature controller is bypassed when the temperature selector is positioned to MANUAL.

Anytime the pack valve closes, the air mix valves are driven to the full cold position automatically. This aids startup of the cooling cycle and prevents nuisance hot air trips when the pack is turned on.

Air Conditioning Pack Schematic



Air Conditioning Distribution

Conditioned air is collected in the mix manifold. The temperature of the air is directly related to the setting of the CONT CABIN and PASS CABIN temperature selectors.

Overheat detection is provided by temperature sensors located downstream of the packs. An overheat condition causes the appropriate mix valves to drive full cold and the DUCT OVERHEAT light to illuminate. A temperature higher than the duct overheat causes the appropriate pack valve to close and the PACK TRIP OFF light to illuminate.

Flight Deck

Since the flight deck requires only a fraction of the air supply provided by the left pack, most of the left pack air output is mixed with the right pack supply and routed to the passenger cabin.

Conditioned air for the flight deck branches into several risers which end at the floor, ceiling, and foot level outlets. Air diffusers on the floor under each seat deliver continuous air flow as long as the manifold is pressurized.

Overhead diffusers are located on the flight deck ceiling, above and aft of the No. 3 windows. Each of these outlets can be opened or closed as desired by turning a slotted adjusting screw.

There is also a dual purpose valve behind the rudder pedals of each pilot. These valves provide air for warming the pilots' feet and for defogging the inside of the No. 1 windshields. Each valve is controlled by knobs located on the Captain's and First Officer's panel, respectively.

Passenger Cabin

The passenger cabin air supply distribution system consists of the mix manifold, sidewall risers, and an overhead distribution duct.

Sidewall risers go up the right and left wall of the passenger cabin to supply air to the overhead distribution duct. The overhead distribution duct routes conditioned air to the passenger cabin. It extends from the forward to the aft end of the ceiling along the airplane centerline and also supplies the sidewall diffusers.

Recirculation Fan

The recirculation fan system reduces the air conditioning system pack load and the engine bleed air demand. Air from the passenger cabin and electrical equipment compartment is drawn to the forward cargo compartment where it is filtered and recirculated to the mix manifold. The fan is driven by an AC motor. The fan operates with the recirculation fan switch in AUTO except with both packs on and one or both in HIGH.

Equipment Cooling

The equipment cooling system cools electronic equipment in the flight deck and the E & E compartment.

The equipment cooling system consists of a supply duct and an exhaust duct. Each duct has a normal fan and an alternate fan. The supply duct supplies cool air to the flight deck displays and electronic equipment in the E & E compartment. The exhaust duct collects and discards warm air from the flight deck displays, the overhead and aft electronic panels, circuit breaker panels in the flight deck, and electronic equipment in the E & E compartment.

Loss of airflow due to failure of an equipment cooling fan results in illumination of the related EQUIPMENT COOLING OFF light. Selecting the alternate fan should restore airflow and extinguish the OFF light within approximately 5 seconds.

If an overtemperature occurs on the ground, alerting is provided through the crew call horn in the nose wheel well.

Forward Cargo Compartment

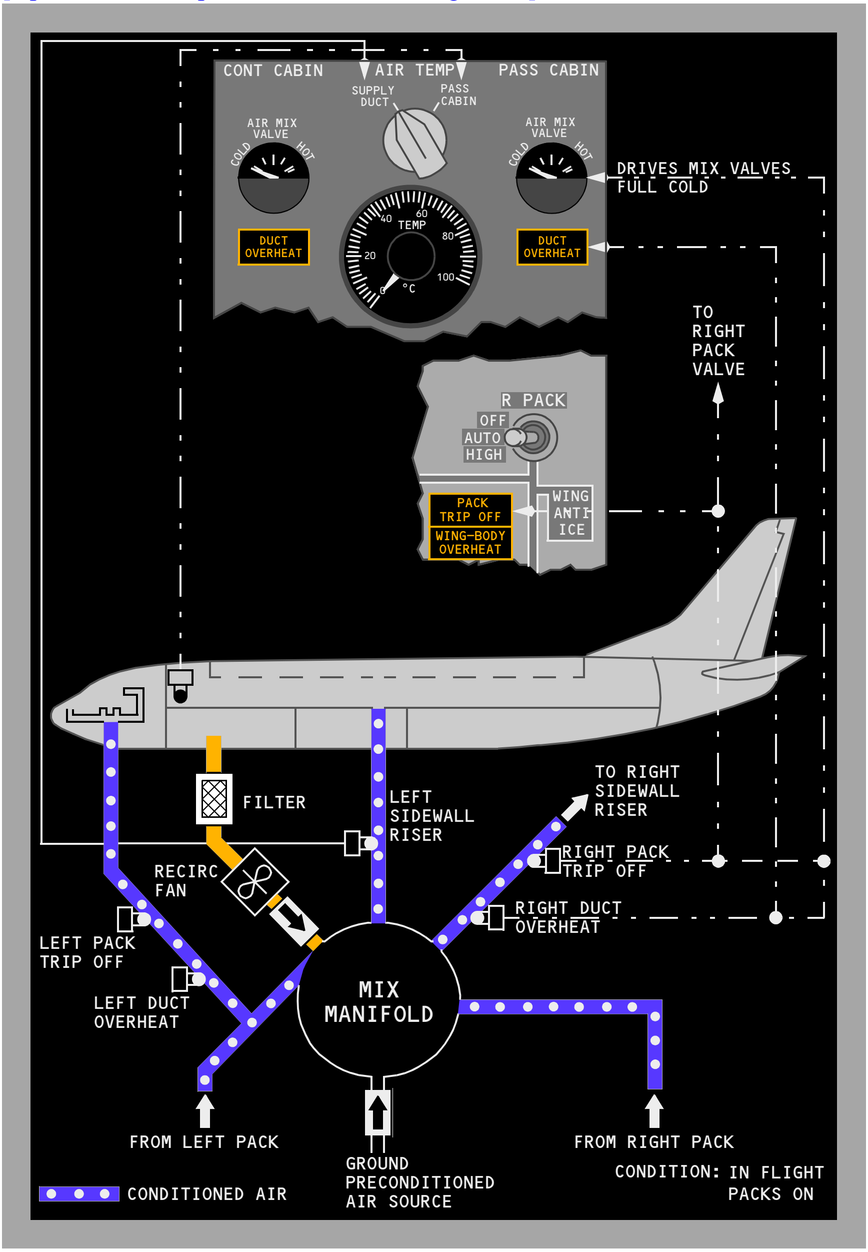
The recirculation fan system circulates air from the passenger cabin and E/E cooling system into the forward cargo compartment. As the overboard exhaust valve closes and differential pressure increases, exhaust from the E/E cooling system is also diffused to the lining of the forward cargo compartment for additional inflight heating.

Conditioned Air Source Connection

A ground air conditioning source may be connected to the mix manifold to distribute preconditioned air throughout the airplane.

Air Conditioning Distribution Schematic

[Option - Air Temperature Indicator in degrees C]



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[737-800/900]

Introduction

The air conditioning system provides temperature controlled air by processing bleed air from the engines, APU, or a ground air source in air conditioning packs. Conditioned air from the left pack, upstream of the mix manifold, flows directly to the flight deck. Excess air from the left pack, air from the right pack, and air from the recirculation system is combined in the mix manifold. The mixed air is then distributed through the left and right sidewall risers to the passenger cabin.

The air conditioning system provides temperature controlled air by processing bleed air from the engines, APU, or a ground air source in air conditioning packs. Conditioned air from the left pack, upstream of the mix manifold, flows directly to the flight deck. Excess air from the left pack and air from the right pack is combined in the mix manifold. The mixed air is then distributed to the supernumerary cabin through supernumerary risers and to the cargo compartment through dedicated cargo compartment risers.

Conditioned air comes from either the airplane air conditioning system or a preconditioned ground source. Air from the preconditioned ground source enters the air conditioning system through the mix manifold.

Air Conditioning Pack

The flow of bleed air from the main bleed air duct through each air conditioning pack is controlled by the respective pack valve. Normally, the left pack uses bleed air from engine No. 1 and the right pack uses bleed air from engine No. 2. A single pack in high flow is capable of maintaining pressurization and acceptable temperatures throughout the airplane up to the maximum certified ceiling.

The APU is capable of supplying bleed air for two packs on the ground, or one pack in flight. Most external air carts are capable of supplying adequate bleed air for two pack operation. Do not operate more than one pack from one engine.

Airflow Control

During normal flight, with both air conditioning pack switches set to AUTO, both engines operating and both engine bleed switches set to ON, the packs provide normal air flow to maintain necessary ventilation. If the air conditioning pack switches are set to HIGH, the packs provide high air flow to increase ventilation.

When the aircraft is not on the ground and the flaps are up, and both air conditioning pack switches are set to AUTO, and the engine bleed switches are both set to ON, if one pack fails or one engine fails or a pack switch is selected to OFF, the remaining pack automatically switches to high air flow to increase ventilation.

When the aircraft is on the ground or the flaps are down, and both air conditioning pack switches are set to AUTO, and engine bleed switches are both set to ON, if one pack fails or one engine fails or a pack switch is selected to OFF, the remaining pack will not automatically switch to high air flow. Automatic switching to high air flow is inhibited in this situation to ensure adequate engine power is available for single engine operations. However, when the APU is operating and the APU bleed switch is set to ON, both engine bleed switches are set to OFF and both pack switches are set to AUTO, automatic switching to high air flow occurs with a single pack failure, regardless of flap position or air/ground status. Also, in this configuration, the flight crew can force an “APU high air flow” rate when either or both pack switches are positioned to HIGH, providing maximum airflow for ventilation when the APU is the only source of ventilation.

Ram Air System

The ram air system provides cooling air for the heat exchangers. Operation of the system is automatically controlled by the packs through operation of ram air inlet doors.

On the ground, or during slow flight with the flaps not fully retracted, the ram air inlet doors move to the full open position for maximum cooling. In normal cruise, the doors modulate between open and closed. A RAM DOOR FULL OPEN light illuminates whenever a ram door is fully open.

Deflector doors are installed forward of the ram air inlet doors to prevent slush ingestion prior to liftoff and after touchdown. Deflector doors extend when activated electrically by the air–ground safety sensor.

Cooling Cycle

Flow through the cooling cycle starts with bleed air passing through a heat exchanger for cooling. The air then flows to an air cycle machine for refrigeration. The processed cold air is then combined with hot air which has bypassed the air cycle machine, then through a high pressure water separator which removes moisture. This conditioned air then flows into the mix manifold and distribution system.

Overheat protection is provided by temperature sensors located in the cooling cycle. An overheat condition causes the pack valve to close and the PACK light to illuminate.

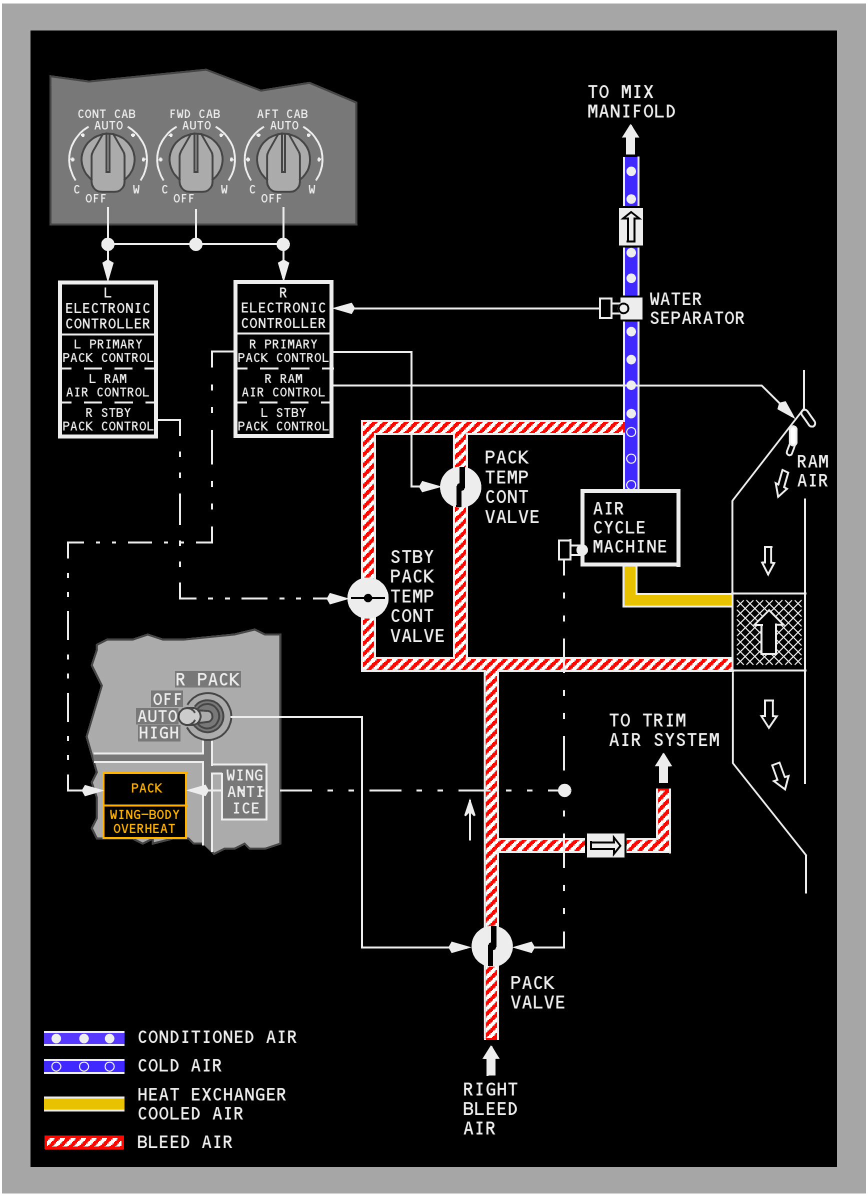
Pack Temperature Control

Electronic controllers command the pack temperature control valve toward open or closed to satisfy pack discharge requirements.

If a primary pack control fails, the affected pack is controlled by the standby pack control in the opposite controller. A primary or standby pack control failure causes the PACK, MASTER CAUTION and AIR COND System Annunciator lights to illuminate during recall.

If both the primary and the standby pack controls fail for the same pack, the PACK, MASTER CAUTION, and AIR COND System Annunciator lights illuminate. The pack will continue to operate without control unless excessive temperatures cause the pack to trip off.

Air Conditioning Pack Schematic



Zone Temperature Control

There are three zones: flight deck (CONT CAB), forward passenger cabin (FWD CAB) and aft passenger cabin (AFT CAB). Desired zone temperature is set by adjusting the individual Temperature Selectors. The selector range is approximately 65°F (18°C) to 85°F (30°C).

There are three zones: flight deck (CONT CAB), supernumerary compartment (FWD CAB) and cargo compartment (AFT CAB). Desired zone temperature is set by adjusting the individual Temperature Selectors. The selector range is approximately 65°F (18°C) to 85°F (30°C).

The packs produce an air temperature that satisfies the zone which requires the most cooling. Zone temperature is controlled by introducing the proper amount of trim air to the zone supply ducts. The quantity of trim air is regulated by individual trim air modulating valves.

During single pack operation with the TRIM AIR selected ON, zone temperature is controlled the same as during two pack operation. During single pack operation with the TRIM AIR selected OFF, the pack attempts to produce an air temperature to satisfy the average temperature demands of all three zones.

If air in a zone supply duct overheats, the associated amber ZONE TEMP light illuminates, and the associated trim air modulating valve closes. The trim air modulating valve may be reopened after the duct has cooled by pushing the TRIP RESET Switch.

Zone Temperature Control Modes

The left electronic controller controls the aft cabin zone and provides backup control for the flight deck. The right controller controls the forward cabin zone and provides primary control for the flight deck.

The left electronic controller controls the cargo compartment zone and provides backup control for the flight deck. The right controller controls the supernumerary cabin zone and provides primary control for the flight deck.

Failure of the primary flight deck temperature control will cause an automatic switch to the back up control and will illuminate the CONT CAB amber ZONE TEMP light upon Master Caution Recall. Failure of both the primary and standby controls will illuminate the lights automatically.

Failure of the forward or aft cabin temperature control will cause the associated trim air modulating valve to close. The Temperature Selectors operate normally, but the Temperature Selector settings of the two passenger cabin zones will be averaged. The amber ZONE TEMP light will illuminate upon Master Caution Recall to indicate failure of the associated zone control.

Failure of the Supernumerary cabin temperature control will cause the associated trim air modulating valve to close. Failure of the cargo compartment temperature control will cause the associated trim air modulating valve to close. The Temperature Selectors operate normally. The amber ZONE TEMP light will illuminate upon Master Caution Recall to indicate failure of the associated zone control.

Unbalanced Pack Temperature Control Mode

Any failure affecting the supply of trim air will cause the temperature control system to control both packs independently. If flight deck trim air is lost, the left pack will provide conditioned air to the flight deck at the selected temperature and the right pack will satisfy the demand of the passenger zone which requires the most cooling. If a passenger cabin zone trim air, or all trim air is lost, the forward and aft zone temperature demands will be averaged for control of the right pack.

Any failure affecting the supply of trim air will cause the temperature control system to control both packs independently. If flight deck trim air is lost, the left pack will provide conditioned air to the flight deck at the selected temperature and the right pack will satisfy the demand of the cargo compartment and supernumerary cabin zone, whichever requires the most cooling. If supernumerary cabin trim air or cargo compartment trim air, or all trim air is lost, the supernumerary cabin and cargo compartment temperature demands will be averaged for control of the right pack.

If any individual zone is switched OFF, the Temperature Selector setting will be ignored by the temperature control system.

Standby Pack Average Temperature

If all zone controls and primary pack controls fail, the standby pack controls command the packs to produce air temperatures which will satisfy the average temperature demand of the two cabin zones. The trim air modulating valves will close. The flight deck zone Temperature Selector will have no effect on the standby pack controls.

Fixed Cabin Temperature

If all Temperature Selectors are positioned OFF, the pack controls will cause the left pack to maintain a fixed temperature of 75°F (24°C) and the right pack to maintain 65°F (18°C) as measured at the pack temperature sensor.

Air Conditioning Distribution

Conditioned air is collected in the mix manifold. The temperature of the air is directly related to the setting of the Temperature Selectors.

Overheat detection is provided by temperature sensors located downstream of the packs and the mix manifold. An overheat condition causes the appropriate trim air modulating valve to close and the ZONE TEMP light to illuminate.

Flight Deck

Since the flight deck requires only a fraction of the air supply provided by the left pack, most of the left pack output is routed to the mix manifold.

Conditioned air for the flight deck branches into several risers which end at the floor, ceiling and foot level outlets. Air diffusers on the floor under each seat deliver continuous air flow as long as the manifold is pressurized.

Overhead diffusers are located on the flight deck ceiling, above and aft of the No. 3 windows. Each of these outlets can be opened or closed as desired by turning a slotted adjusting screw.

There is also a dual purpose valve behind the rudder pedal of each pilot. These valves provide air for warming the pilots' feet and for defogging the inside of the No. 1 windshields. Each valve is controlled by knobs located on the Captain's and First Officer's panels.

Passenger Cabin

The passenger cabin air supply distribution system consists of the mix manifold, sidewall risers, and an overhead distribution duct.

Sidewall risers go up the right and left walls of the passenger cabin to supply air to the overhead distribution duct. The overhead distribution duct routes conditioned air to the passenger cabin. It extends from the forward to the aft end of the ceiling along the airplane centerline and also supplies the sidewall diffusers.

Supernumerary Cabin

The Supernumerary cabin air supply distribution system consists of the mix manifold, sidewall risers, and an overhead distribution duct.

737-800BCF Cargo Compartment

The Cargo Compartment is supplied air from the Mix Manifold. Forward and Aft Main Deck Shutoff Valves are normally in the open position, but when closed will stop the supply of air to the cargo compartment. These valves will close when the DEPR switch on the cargo fire panel is pressed, after a MAIN smoke ALARM has been received and the MAIN ARMED switch has been pressed by the crew. These valves require several seconds to completely close. Closing these valves does not interrupt air flow to the flight deck or supernumerary cabin, allowing these cabins to maintain a positive pressure compared to the MAIN CARGO compartment, reducing smoke contamination in these cabins. When the Flight Crew performs the non-normal checklist for CARGO FIRE (MAIN), the crew will manually open the outflow valve enough to gradually depressurize the aircraft. The time to completely depressurize the aircraft varies according to altitude and the position of the outflow valve.

Mix Manifold Exhaust Shutoff Valve

The Mix Manifold on the Boeing Conversion Freight has a Mix Manifold Exhaust Shutoff Valve, which is normally in the closed position. This valve will open when the DEPR switch on the Cargo Fire Panel is pressed. When opened, mix manifold air is discharged below the floor and above the front spar, reducing pressure in the Mix Manifold. Although the Mix Manifold Exhaust Shutoff will open when the flight crew presses the DEPR switch after receiving a smoke event ALARM, the flight crew must still perform the CARGO FIRE (MAIN) non-normal checklist and manually open the outflow valve as directed in that checklist.

Recirculation Fans

The recirculation fan system reduces the air conditioning system pack load and the engine bleed air demand. Air from the passenger cabin and electrical equipment compartment is drawn to the forward cargo compartment where it is filtered and recirculated to the mix manifold. (Additional information about the forward cargo compartment air circulation can be found in the Forward Cargo Compartment section of this chapter.) The fans are driven by AC motors. Each recirculation fan operates only if the respective RECIRC FAN Switch is selected to AUTO. In flight, the left recirculation fan operates if both packs are operating unless either PACK switch is in HIGH. The right recirculation fan operates in flight if both packs are operating unless both PACK switches are in HIGH. On the ground, the left recirculation fan operates unless both PACK switches are in HIGH and the right recirculation fan operates even if both PACK switches are in HIGH.

Recirculation fans have been removed from the 737-800BCF and the RECIRC FAN switches on the pressurization panel on the flight deck are non-functional and labeled “INOP”.

Equipment Cooling

The equipment cooling system cools electronic equipment in the flight deck and the E & E compartment.

The equipment cooling system consists of a supply duct and an exhaust duct. Each duct has a normal fan and an alternate fan. The supply duct supplies cool air to the flight deck displays and electronic equipment in the E & E compartment. The exhaust duct collects and discards warm air from the flight deck displays, the overhead and aft electronic panels, circuit breaker panels in the flight deck, and electronic equipment in the E & E compartment.

Loss of airflow due to failure of an equipment cooling fan results in illumination of the related EQUIPMENT COOLING OFF light. Selecting the alternate fan should restore airflow and extinguish the OFF light within approximately 5 seconds.

If an overtemperature occurs on the ground, alerting is provided through the crew call horn in the nose wheel well.

Forward Cargo Compartment Smoke Penetration Prevention

When the PACK switches are in the HIGH position, these actions occur automatically:

- The smoke control relay will shut off the equipment cooling supply fan for 5 minutes. After 5 minutes, the equipment cooling fans will return to normal operation
- The smoke control relay will inhibit the EQUIPMENT COOLING OFF light illumination for 5 minutes. After 5 minutes, the EQUIPMENT COOLING OFF light will return to normal operation
- The equipment cooling exhaust fan will be shut off for the remainder of the flight

Note: If any PACK switches are moved out of these positions, the electronic equipment cooling fans will begin to operate again.

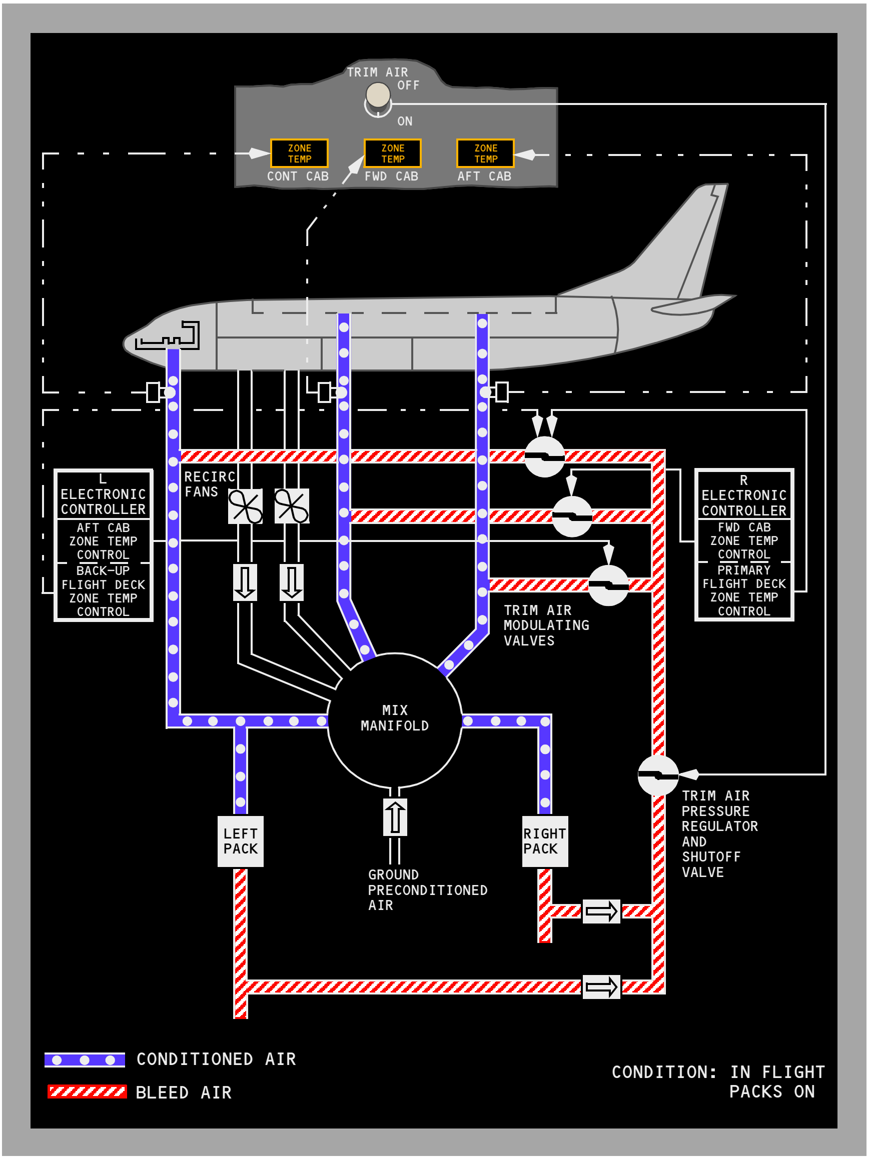
Forward Cargo Compartment

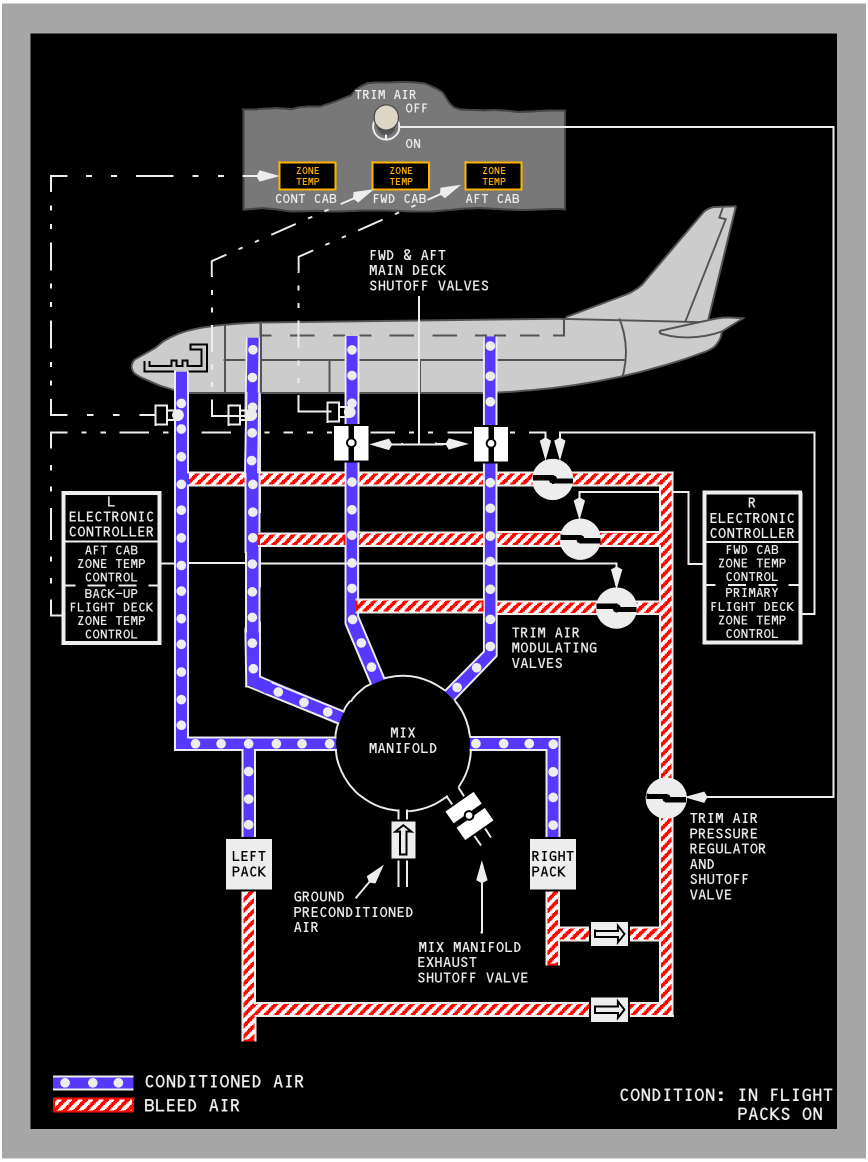
The recirculation fan system circulates air from the passenger cabin and E/E Cooling system into the Forward Cargo Compartment. As the overboard exhaust valve closes to increase differential pressure, exhaust from the E/E Cooling system is also diffused to the lining of the Forward Cargo Compartment for additional inflight heating.

Conditioned Air Source Connection

A ground air conditioning source may be connected to the mix manifold to distribute preconditioned air throughout the airplane.

Air Conditioning Distribution Schematic




TRIM AIR
OFF
ON
ZONE TEMP
ZONE TEMP
ZONE TEMP
CONT CAB
FWD CAB
AFT CAB
FWD & AFT
MAIN DECK
SHUTOFF VALVES
L
ELECTRONIC
CONTROLLER
AFT CAB
ZONE TEMP
CONTROL
BACK-UP
FLIGHT DECK
ZONE TEMP
CONTROL
R
ELECTRONIC
CONTROLLER
FWD CAB
ZONE TEMP
CONTROL
PRIMARY
FLIGHT DECK
ZONE TEMP
CONTROL
TRIM AIR
MODULATING
VALVES
MIX
MANIFOLD
TRIM AIR
PRESSURE
REGULATOR
AND
SHUTOFF
VALVE
LEFT
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GROUND
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AIR
MIX MANIFOLD
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SHUTOFF VALVE
CONDITIONED AIR
BLEED AIR
CONDITION: IN FLIGHT
PACKS ON

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Introduction

Cabin pressurization is controlled during all phases of airplane operation by the cabin pressure control system. The cabin pressure control system includes two identical automatic controllers available by selecting AUTO or ALTN and a manual (MAN) pilot–controlled mode.

The system uses bleed air supplied to and distributed by the air conditioning system. Pressurization and ventilation are controlled by modulating the outflow valve and the overboard exhaust valve.

Pressure Relief Valves

Two pressure relief valves provide safety pressure relief by limiting the differential pressure to a maximum of 9.1 psi. A negative relief valve prevents external atmospheric pressure from exceeding internal cabin pressure.

[Option - 6,500 Foot Cabin Altitude]
Two pressure relief valves provide safety pressure relief by limiting the differential pressure to a maximum of 9.74 psi. A negative relief valve prevents external atmospheric pressure from exceeding internal cabin pressure.

Cabin Pressure Controller

Cabin altitude is normally rate–controlled by the cabin pressure controller up to a cabin altitude of 8,000 feet at the airplane maximum certified ceiling of 41,000 feet.

[Option - 6,500 Foot Cabin Altitude]
Cabin altitude is normally rate–controlled by the cabin pressure controller up to a cabin altitude of 6,500 feet at the airplane maximum certified ceiling of 41,000 feet.

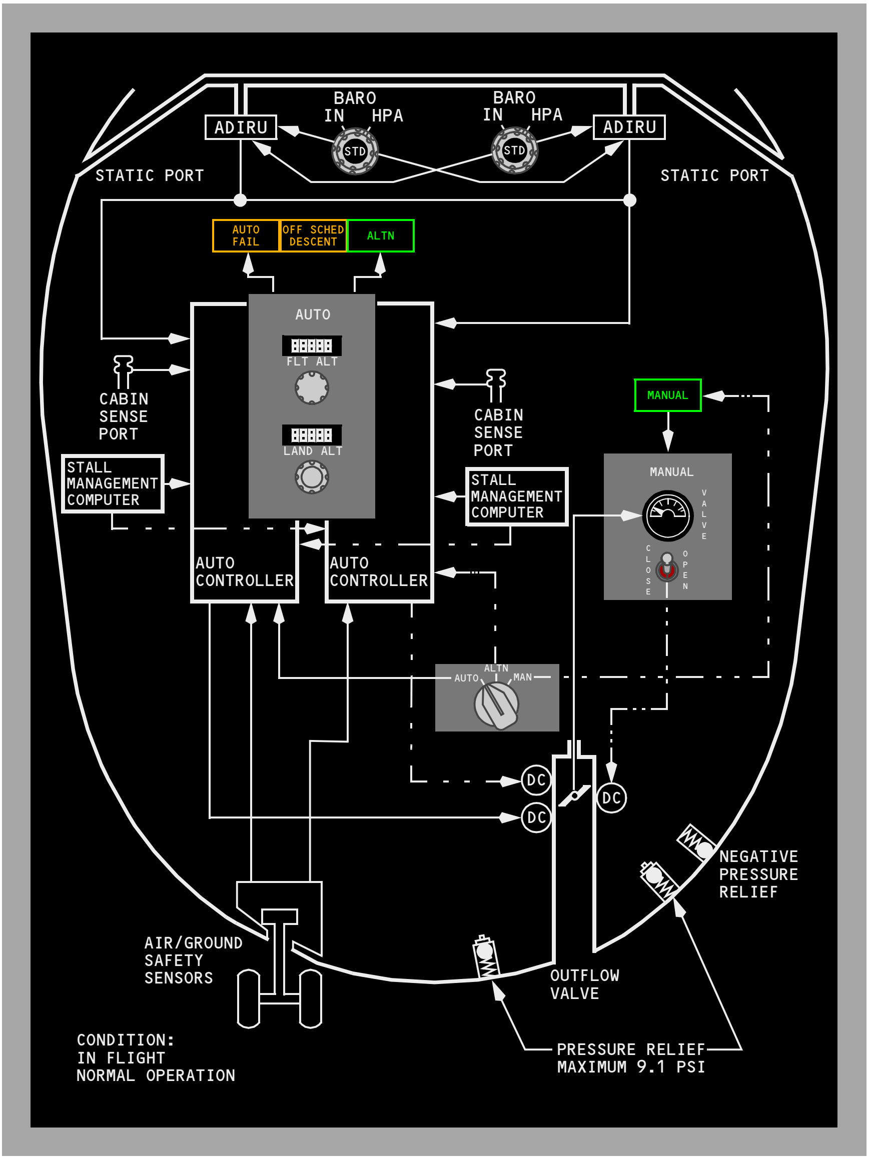
The cabin pressure controller controls cabin pressure in the following modes:

- AUTO – Automatic pressurization control; the normal mode of operation. Uses DC motor
- ALTN – Automatic pressurization control; the alternate mode of operation. Uses DC motor
- MAN – Manual control of the system using DC motor

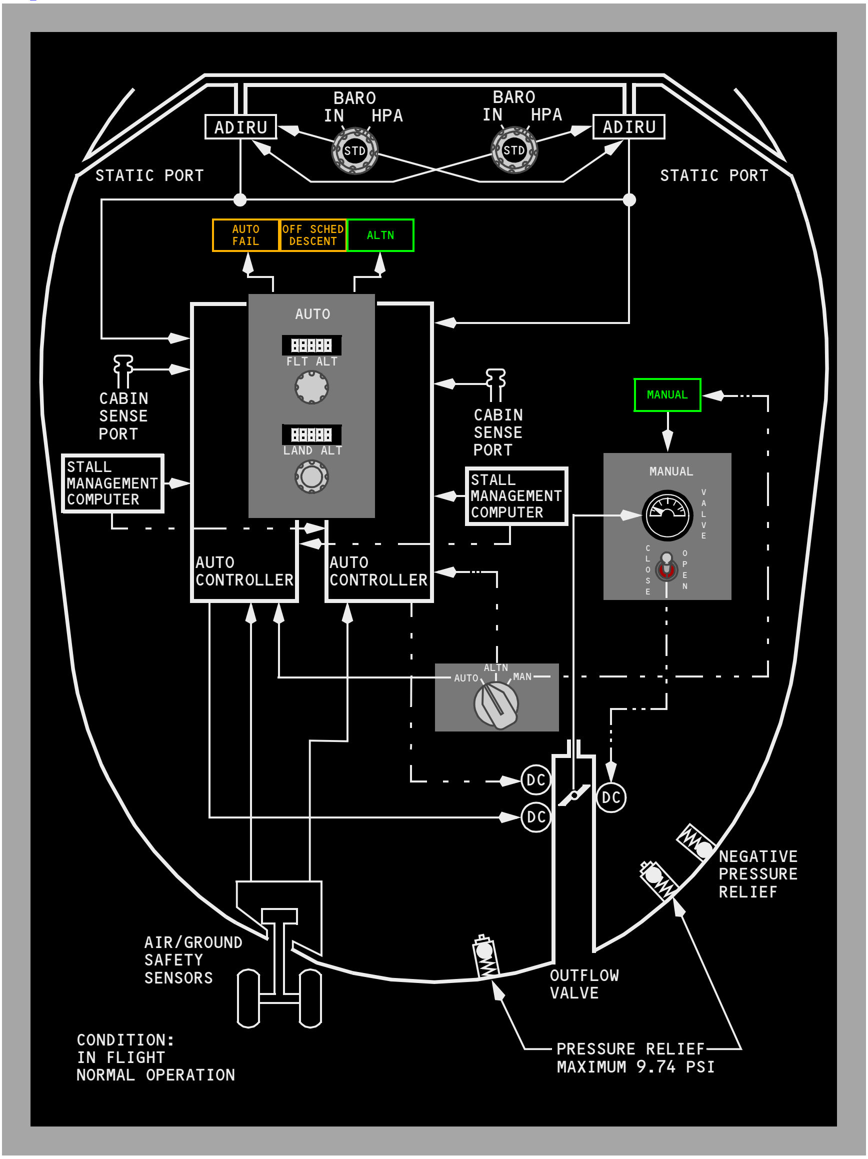
The air data inertial reference units (ADIRUs) provides ambient static pressure, baro corrected altitude, non-corrected altitude and calibrated airspeed to both automatic controllers. The ADIRUs receive barometric corrections from the Captain’s and First Officer’s BARO reference selectors.

The automatic controllers also receive throttle position from both stall management computers and signals from the air/ground sensors.

Cabin Pressure Control System Schematic



[Option - 6,500 Foot Cabin Altitude]



Pressurization Outflow

Cabin air outflow is controlled by the outflow valve and the overboard exhaust valve. A small amount is also exhausted through toilet and galley vents, miscellaneous fixed vents, and by seal leakage.

Outflow Valve

The outflow valve is the overboard exhaust exit for the majority of the air circulated through the passenger cabin. Passenger cabin air is drawn through foot level grills, down around the aft cargo compartment, where it provides heating, and is discharged overboard through the outflow valve.

The outflow valve is the overboard exhaust exit for the majority of the air circulated through the cargo compartments. Air is drawn through floor level grills, down around the aft cargo compartment, where it provides heating, and is discharged overboard through the outflow valve.

Overboard Exhaust Valve

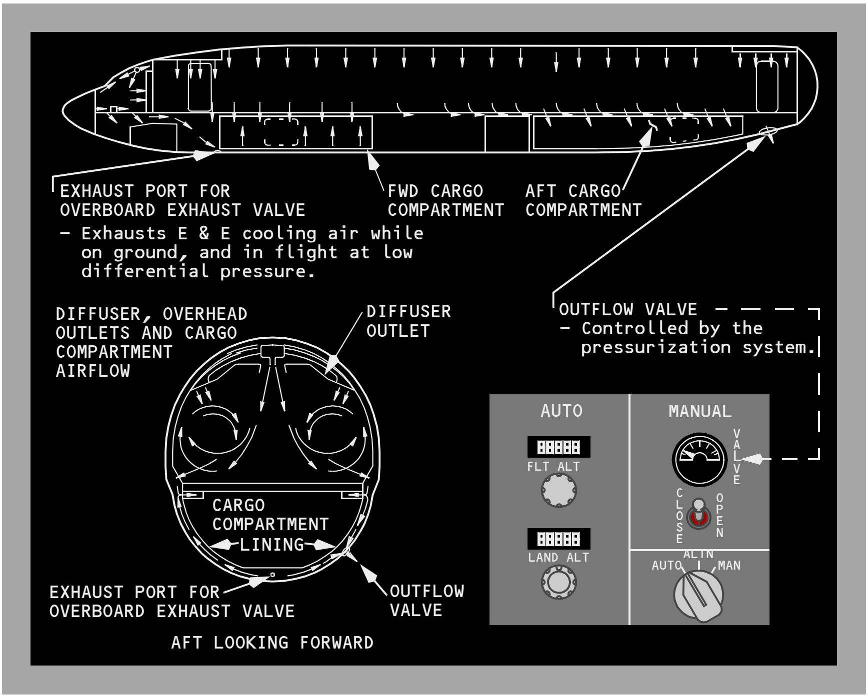
On the ground and in flight with low differential pressure, the overboard exhaust valve is open and warm air from the E & E compartment is discharged overboard. In flight, at higher cabin differential pressures, the overboard exhaust valve is normally closed and exhaust air is diffused to the lining of the forward cargo compartment.

[737-600 or 737-700]
However, the overboard exhaust valve is driven open if either pack switch is in high and the recirculation fan is off. This allows for increased ventilation in the smoke removal configuration.

[737-800 or 737-900]
However, the overboard exhaust valve is driven open if either pack switch is in high and the right recirculation fan is off. This allows for increased ventilation in the smoke removal configuration.

However, the overboard exhaust valve is driven open if either pack switch is in high. This allows increased ventilation in the smoke removal configuration.

Pressurization Outflow Schematic



Auto Mode Operation

The AUTO system consists of two identical controllers, with one controller alternately sequenced as the primary operational controller for each new flight. The other automatic controller is immediately available as a backup.

In the AUTO or ALTN mode, the pressurization control panel is used to preset two altitudes into the auto controllers:

- FLT ALT (flight or cruise altitude)
- LAND ALT (landing or destination airport altitude)

Takeoff airport altitude (actually cabin altitude) is fed into the auto controllers at all times when on the ground.

The air/ground safety sensor signals whether the airplane is on the ground or in the air. On the ground and at lower power settings, the cabin is depressurized by driving the outflow valve to the full open position.

The cabin begins to pressurize on the ground at higher power settings. The controller modulates the outflow valve toward close, slightly pressurizing the cabin. This ground pressurization of the cabin makes the transition to pressurized flight more gradual for the passengers and crew, and also gives the system better response to ground effect pressure changes during takeoff.

The cabin begins to pressurize on the ground at higher power settings. The controller modulates the outflow valve toward close, slightly pressurizing the cabin. This ground pressurization of the cabin makes the transition to pressurized flight more gradual, and also gives the system better response to ground effect pressure changes during takeoff.

In the air, the auto controller maintains a proportional pressure differential between airplane and cabin altitude. By increasing the altitude at a rate proportional to the airplane climb rate, cabin altitude change is held to the minimum rate required.

An amber OFF SCHED DESCENT light illuminates if the airplane begins to descend without having reached the preset cruise altitude; for example, a flight aborted in climb and returning to the takeoff airport. The controller programs the cabin to land at the takeoff field elevation without further pilot inputs. If the FLT ALT indicator is changed, the automatic abort capability to the original takeoff field elevation is lost.

The cruise mode is activated when the airplane climbs to within 0.25 psi of the selected FLT ALT. During cruise the controller maintains the lowest possible cabin altitude based on the differential pressure limits indicated in the table below. In certain circumstances the selected LAND ALT may exceed the target cabin altitude determined by the differential pressure limits. In these cases, the controller will maintain a cabin altitude slightly below the selected LAND ALT. Deviations from flight altitude can cause the pressure differential to vary as the controller modulates the outflow valve to maintain a constant cabin altitude.

Selected FLT ALT	Differential Pressure Limit
At or below 28,000 feet	7.45 psid
28,000 feet to 37,000 feet	7.80 psid
Above 37,000 feet	8.35 psid

[Option - 6,500 Foot Cabin Altitude]

Selected FLT ALT	Differential Pressure Limit
At or below 28,000 feet	7.45 psid
28,000 feet to 37,000 feet	8.44 psid
Above 37,000 feet	8.99 psid

The descent mode is activated when the airplane descends 0.25 psi below the selected FLT ALT. The cabin begins a proportional descent to slightly below the selected LAND ALT. The controller programs the cabin to land slightly pressurized so that rapid changes in altitude during approach result in minimum cabin pressure changes.

While taxiing in, the controller drives the outflow valve slowly to the full open position depressurizing the cabin.

An amber AUTO FAIL light illuminates if any of the following conditions occurs:

- Loss of DC power
- Controller fault
- Outflow valve control fault
- Excessive differential pressure (> 8.75 psi)*

[Option - 6,500 Foot Cabin Altitude]

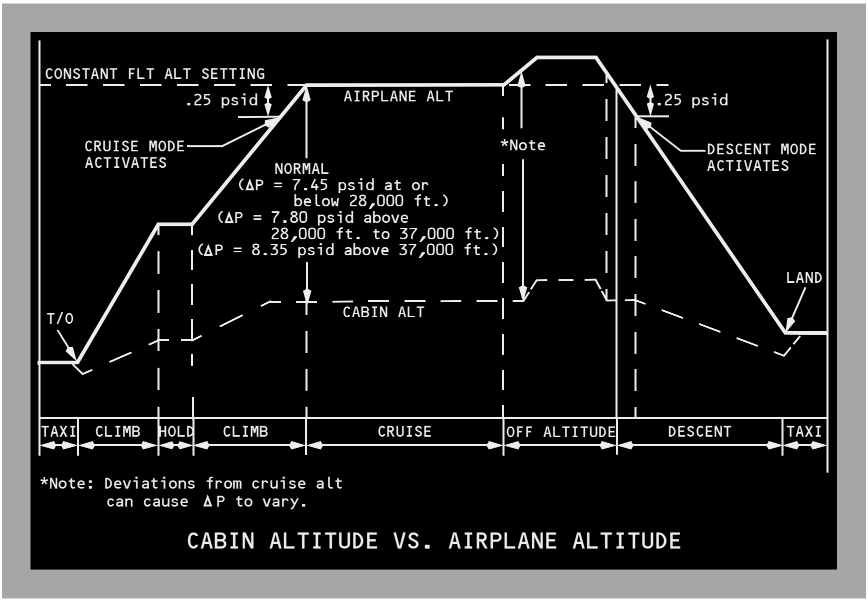
- Excessive differential pressure (> 9.39 psi)*
- Excessive rate of cabin pressure change (±2000 sea level feet/minute)*
- High cabin altitude (above 15,800 feet)*

*If controller is not responding properly

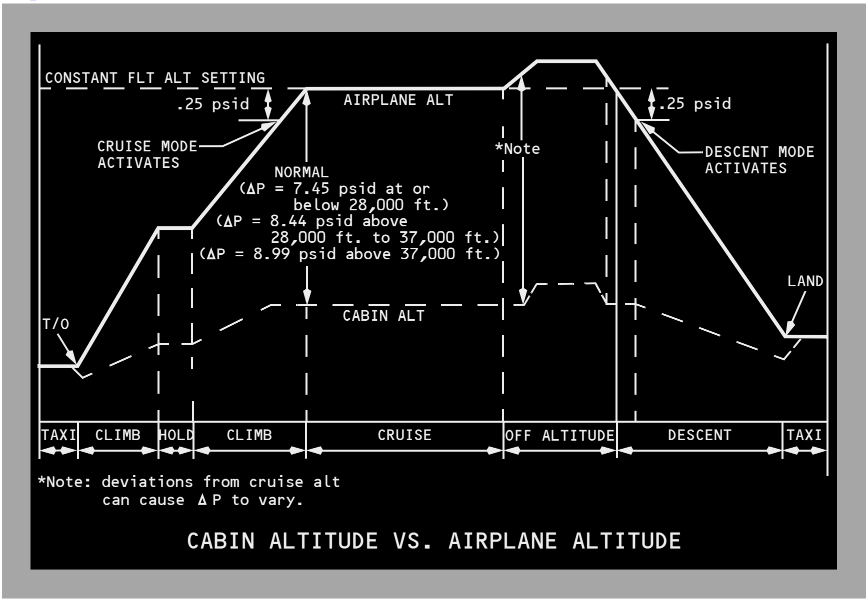
With illumination of the AUTO FAIL light, the pressure control automatically transfers to the other auto controller (ALTN mode).

Moving the pressurization mode selector to the ALTN position extinguishes the AUTO FAIL light, however the ALTN light remains illuminated to indicate single channel operation.

Flight Path Events – Auto Mode



[Option - 6,500 Foot Cabin Altitude]



High Altitude Landing

[Option - High Altitude Landing System]

The High Altitude Landing System is engaged by selecting the high altitude landing switch ON. This switch is located on the Cabin Altitude Panel. When the high altitude landing system is engaged and the actual landing altitude is set, the controller brings the cabin altitude to the landing airport elevation when the descent mode is activated. Upon departure from a high altitude airport, the system returns to normal operation as the cabin altitude descends through 8,500 feet.

Manual Mode Operation

A green MANUAL Light illuminates with the pressurization mode selector in the MAN position.

Manual control of the cabin altitude is used if both the AUTO and ALTN modes are inoperative or during a non-normal situation. In the MAN mode, the Flight Crew changes the position of the outflow valve using the Outflow Valve switch. In MAN mode, a separate DC motor, powered by the DC standby system, drives the outflow valve at a faster rate than during AUTO or ALTN modes. In MAN mode, the outflow valve full range of motion takes up to 20 seconds. This faster movement of the outflow valve allows the crew to quickly depressurize the airplane during non-normal situations. The Flight Crew verifies position of the outflow valve by monitoring the cabin altitude panel and valve position on the outflow valve position indicator.

CAUTION: A small movement of the outflow valve can cause a large change in cabin rate of climb or descent. Manual actuation of the outflow valve can produce large, rapid changes in cabin pressure which could result in passenger and crew discomfort and/or injury.

CAUTION: A small movement of the outflow valve can cause a large change in cabin rate of climb or descent. Manual actuation of the outflow valve can produce large, rapid changes in cabin pressure which could result in crew discomfort and/or injury.

Intentionally
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Anti-Ice, Rain — Chapter 3
Table of Contents — Section TOC

Intentionally
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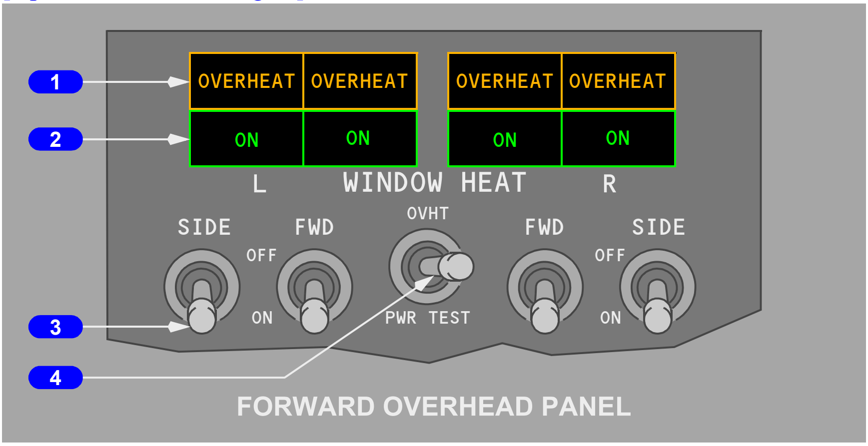
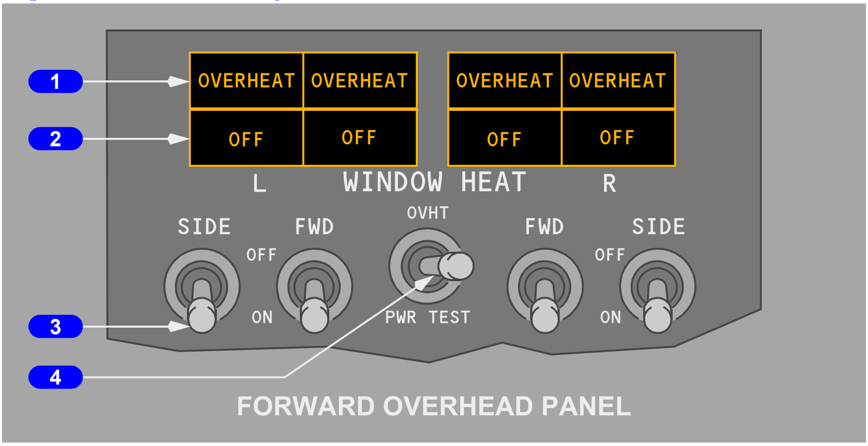
Window Heat Panel

[Option – Green ON Lights]



[Option – Amber OFF Lights]



1 Window OVERHEAT Lights

Illuminated (amber) – overheat condition is detected.

Note: OVERHEAT lights also illuminate if electrical power to window(s) is interrupted.

[Option – Green ON Lights]

2 Window Heat ON Lights

Illuminated (green) – window heat is being applied to selected window(s).

Extinguished –

- switch is OFF, or
- an overheat is detected, or
- a system failure has occurred
- system is at correct temperature

[Option – Amber OFF Lights]

2 Window Heat OFF Lights

Illuminated (amber) –

- switch is OFF, or
- an overheat is detected, or
- a system failure has occurred
- system is at correct temperature

Extinguished – window heat is being applied to selected window(s).

3 WINDOW HEAT Switches

ON – window heat is applied to selected window(s).

OFF – window heat not in use.

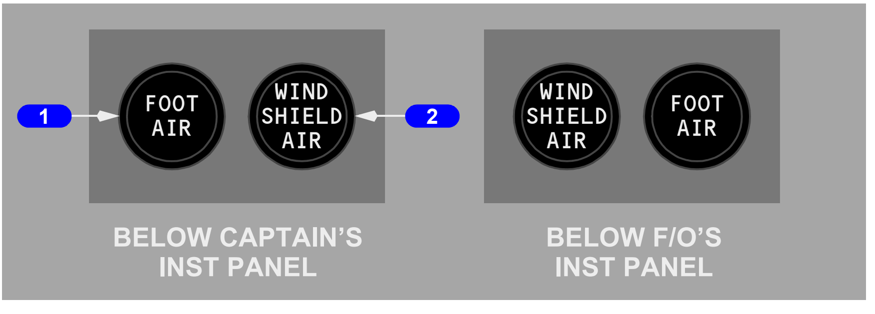
4 WINDOW HEAT Test Switch (spring–loaded to neutral)

OVHT – simulates an overheat condition.

PWR TEST – provides a confidence test.

Note: Refer to Supplementary Normal Procedures for Window Heat Test procedures.

Windshield/Foot Air Controls



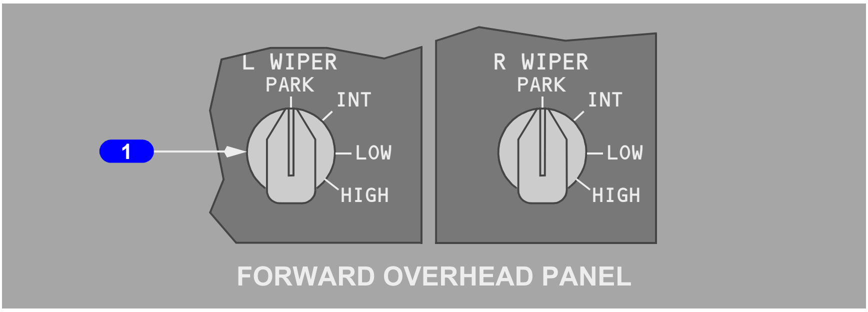
1 FOOT AIR Controls

PULL – supplies conditioned air to pilots' leg positions.

2 WINDSHIELD AIR Controls

PULL – supplies conditioned air to number 1 windows for defogging.

Windshield Wiper Selector Panel



1 Windshield WIPER Selectors

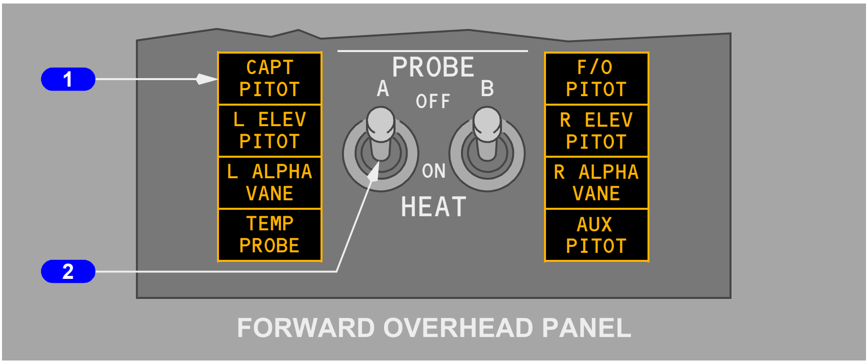
PARK – turns off wiper motors and stows wiper blades.

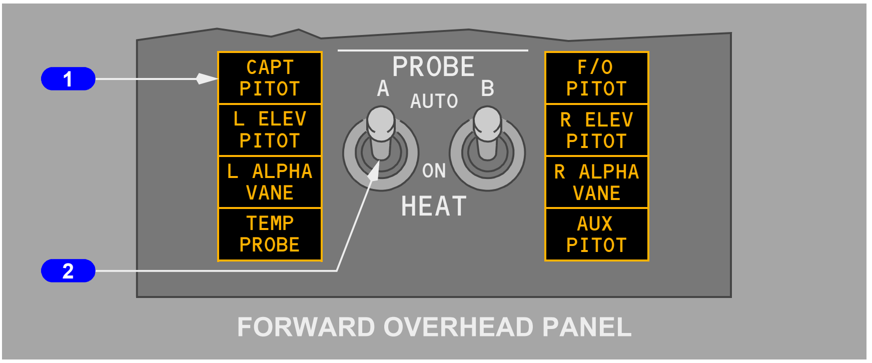
INT – seven second intermittent operation.

LOW – low speed operation.

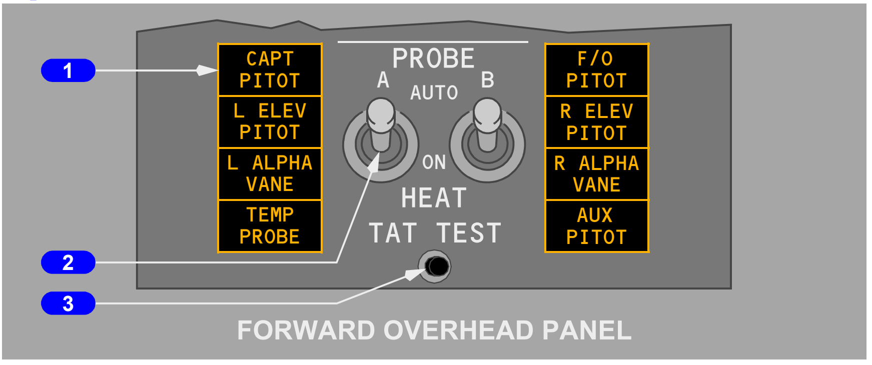
HIGH – high speed operation.

Probe Heat Panel





[Option - AUTO Probe Heat Switch]



1 Probe Heat Lights

Illuminated (amber) – related probe not heated.

Note: If operating on standby power, probe heat lights do not indicate system status.

2 PROBE HEAT Switches

ON – power is supplied to heat related system.

OFF – power off.

[Option - AUTO Probe Heat Switch]

2 PROBE HEAT Switches

ON – power is supplied to heat related system.

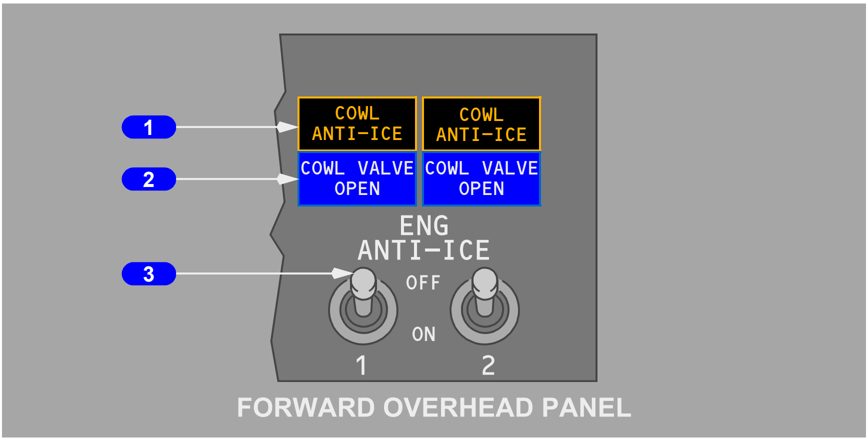
AUTO – power is automatically supplied to both A and B probe heat systems when either engine is running.

[Option - Aspirated TAT]

3 TAT TEST Switch

Push - Electrical power applied to TEMP PROBE on the ground.

Engine Anti–Ice Panel



1 COWL ANTI–ICE Lights

Illuminated (amber) – indicates an overpressure condition in duct downstream of engine cowl anti–ice valve.

2 COWL VALVE OPEN Lights

Illuminated (blue) –

- bright – related cowl anti–ice valve is in transit, or, cowl anti–ice valve position disagrees with related ENGINE ANTI–ICE switch position
- dim – related cowl anti–ice valve is open (switch ON)

Extinguished – related cowl anti–ice valve is closed (switch OFF).

3 ENGINE ANTI–ICE Switches

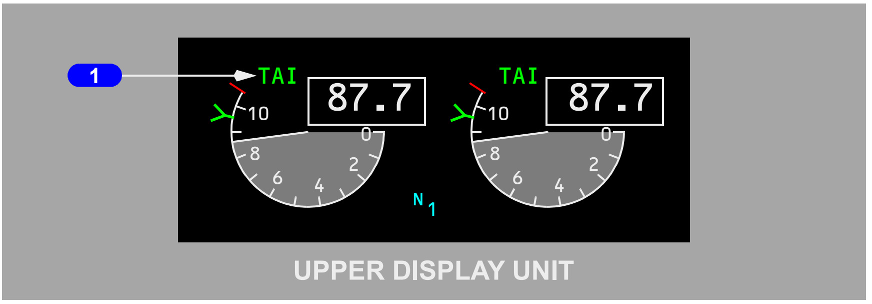
ON –

- related cowl anti–ice valve is open
- stick shaker logic is set for icing conditions
- Green TAI indication shows on the engine display

OFF –

- related cowl anti–ice valve is closed
- stick shaker logic returns to normal if wing anti–ice has not been used in flight
- Green TAI indication on the engine display extinguishes

Thermal Anti–Ice Indication

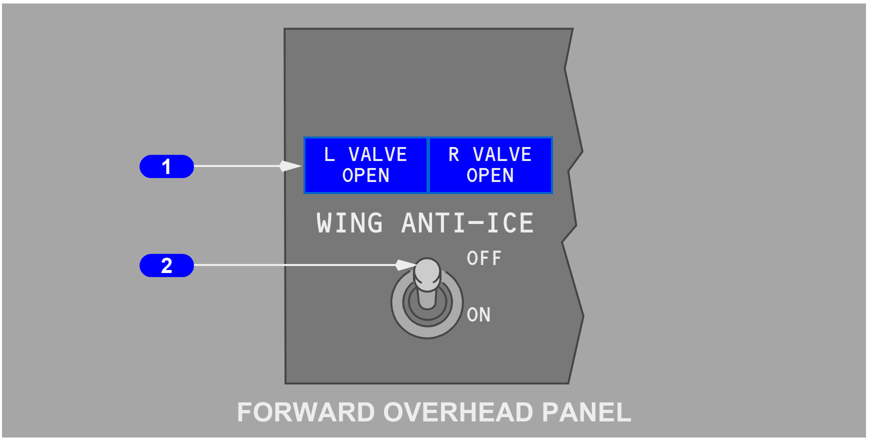


1 Thermal Anti–Ice Indications

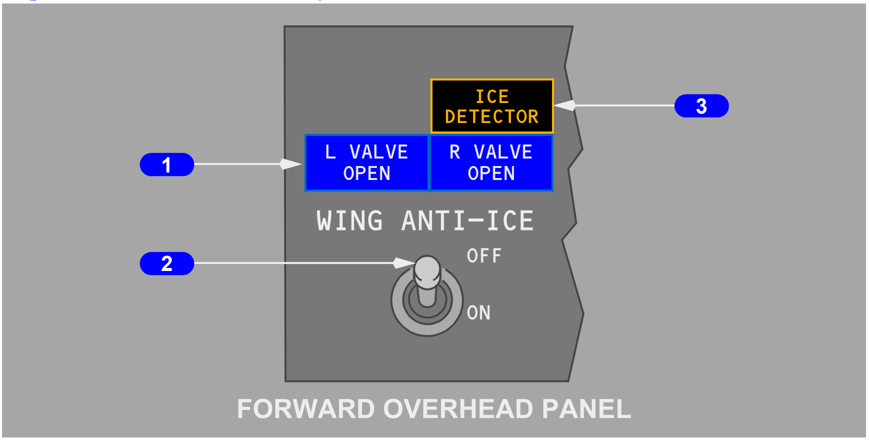
Illuminated –

- Green – cowl anti–ice valve(s) open
- Amber – cowl anti–ice valve is not in position indicated by related engine anti–ice switch

Wing Anti–Ice Panel



[Option - ICE DETECTOR System]



1 Wing Anti–Ice VALVE OPEN Lights

Illuminated (blue) –

- bright – related wing anti–ice control valve is in transit, or, related wing anti–ice control valve position disagrees with WING ANTI–ICE switch position
- dim – related wing anti–ice control valve is open (switch ON)

Extinguished – related wing anti–ice control valve is closed (switch OFF).

2 WING ANTI–ICE Switch

OFF – wing anti–ice control valves are closed.

ON (in the air) –

- wing anti–ice control valves are open
- stick shaker logic is set for icing conditions

Note: Stick shaker logic remains set for icing conditions for the remainder of the flight, regardless of subsequent WING ANTI–ICE switch position.

ON (on the ground) –

- wing anti–ice control valves open if thrust on both engines is below takeoff warning setting and temperature inside both distribution ducts is below thermal switch activation temperature
- control valves close if either engine thrust is above takeoff warning setting or thermal switch is activated in either distribution duct. Switch remains ON
- switch trips OFF at lift–off

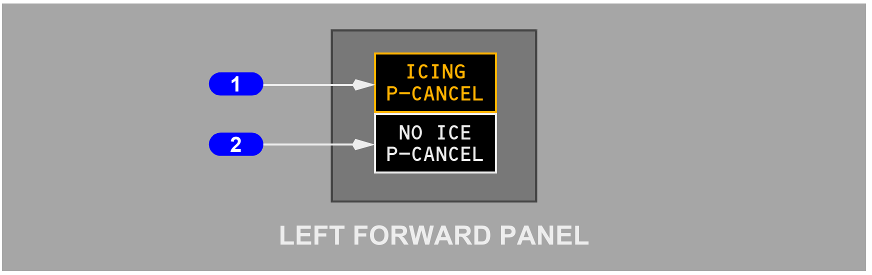
[Option - ICE DETECTOR System]

3 ICE DETECTOR Light

Illuminated (amber) – Ice detector system has failed.

Icing Advisory Lights

[Option - Icing Detector System]



1 ICING Light

Illuminated (amber) –

- ice detector is detecting ice
- light is inhibited on the ground

Press – extinguishes light, if illuminated.

2 NO ICE Light

Illuminated (white) –

- ice detector is not detecting ice, and the ice detector probe had previously detected ice
- light is inhibited on the ground

Press – extinguishes light, if illuminated.

Anti-Ice, Rain — Chapter 3
System Description — Section 20

Introduction

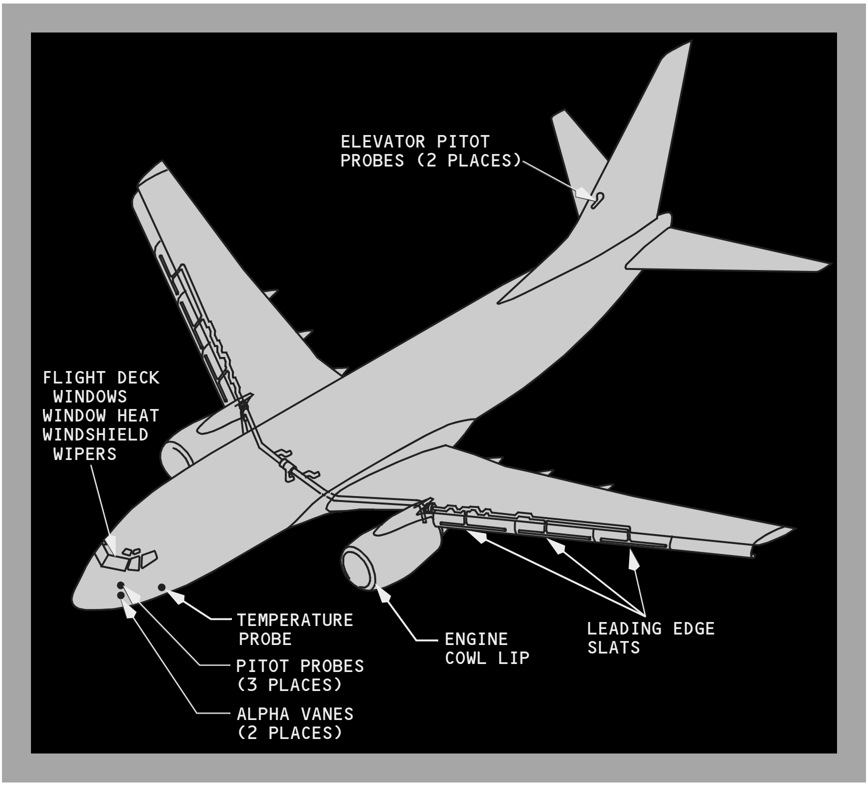
Thermal anti-icing (TAI), electrical anti-icing, and windshield wipers are the systems provided for ice and rain protection.

The anti-ice and rain systems include:

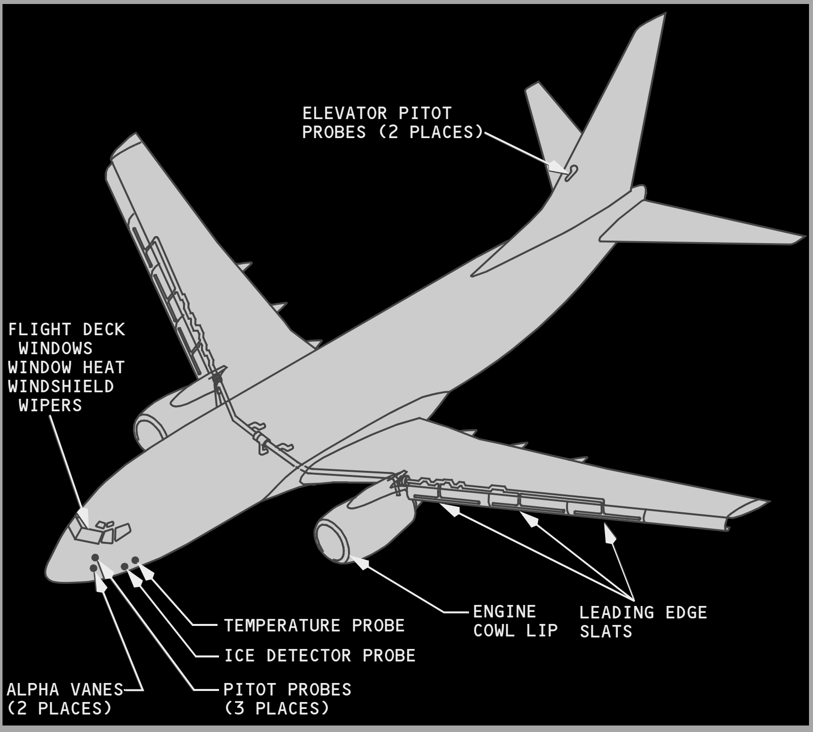
- Flight Deck Window Heat
- Windshield Wipers
- Probe and Sensor Heat
- Engine Anti-Ice System
- Wing Anti-Ice System

[Option]
- Ice Detection System

Anti-Ice Components Diagram



[Option - Ice detector probe]



Flight Deck Window Heat

[Option – Window # 3 not heated]
Flight deck window numbers 1, 2, 4 and 5 consist of glass panes laminated to each side of a vinyl core. Flight deck window number 4 has an additional vinyl layer and acrylic sheet laminated to the inside surface. Flight deck window number 3 consists of two acrylic panes separated by an air space.

[Option – Window # 3 not heated]
A conductive coating on the outer glass pane of window numbers 1 and 2 permits electrical heating to prevent ice build–up and fogging. A conductive coating on the inner glass pane of window numbers 4 and 5 permits electrical heating to prevent fogging. Window number 3 is not electrically heated.

[Option – Window # 3 not heated]
Flight deck window numbers 1 and 2 consist of glass panes laminated to each side of a vinyl core. Flight deck window number 3 consists of two acrylic panes separated by an air space.

[Option – Window # 3 not heated]
A conductive coating on the outer glass pane of window numbers 1 and 2 permits electrical heating to prevent ice build–up and fogging. Window number 3 is not electrically heated.

[Option – Window # 3 heated]
Flight deck windows consist of glass panes laminated to each side of a vinyl core. Flight deck window number 4 has an additional vinyl layer and acrylic sheet laminated to the inside surface.

[Option – Window # 3 heated]
A conductive coating on the outer glass pane of window numbers 1 and 2 permits electrical heating to prevent ice build–up and fogging. A conductive coating on the inner glass pane of window numbers 3, 4 and 5 permits electrical heating to prevent fogging.

Flight Deck Window Heat Operation

[Option – Window # 3 not heated]
The FWD WINDOW HEAT switches control heat to window No. 1. The SIDE WINDOW HEAT switches control heat to window number 2, 4, and 5.

[Option – Window # 3 not heated]
Temperature controllers maintain window numbers 1 and 2 at the correct temperature to ensure maximum strength of the windows in the event of bird impact. Power to window numbers 1 and 2 is automatically removed if an overheat condition is detected. A thermal switch located on window 5 opens and closes to maintain the correct temperature of window numbers 4 and 5.

[Option – Window # 3 not heated]
The FWD WINDOW HEAT switches control heat to window No. 1. The SIDE WINDOW HEAT switches control heat to window numbers 2.

[Option – Window # 3 not heated]
Temperature controllers maintain window numbers 1 and 2 at the correct temperature to ensure maximum strength of the windows in the event of bird impact. Power to window numbers 1 and 2 is automatically removed if an overheat condition is detected.

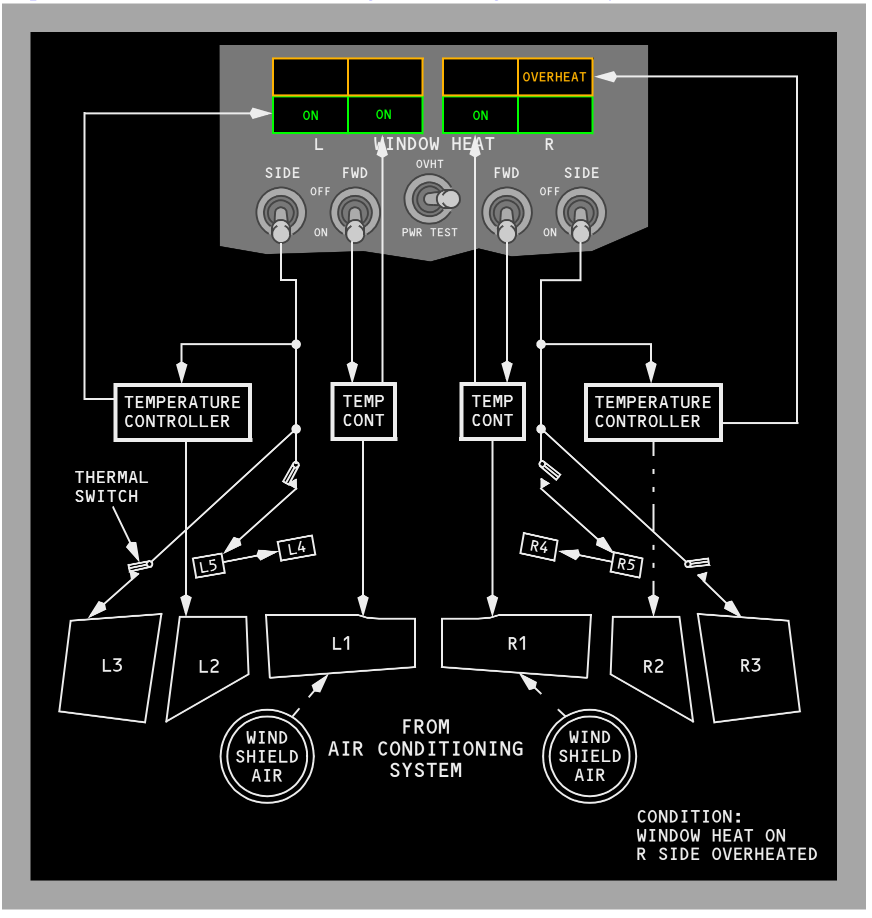
[Option – Window # 3 heated]
The FWD WINDOW HEAT switches control heat to window number 1. The SIDE WINDOW HEAT switches control heat to window numbers 2, 3, 4 and 5.

[Option – Window # 3 heated]

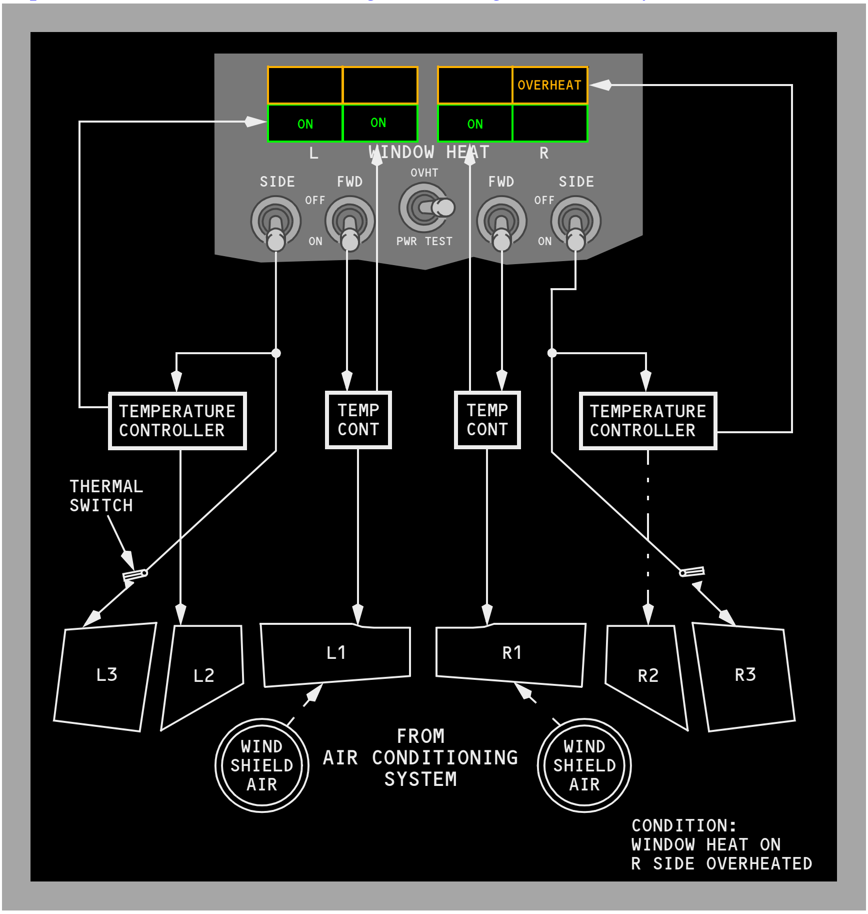
Temperature controllers maintain windows numbers 1 and 2 at the correct temperature to ensure maximum strength of the windows in the event of bird impact. Power to window numbers 1 and 2 is automatically removed if an overheat condition is detected. Thermal switches, located on window numbers 3 and 5, open and close to maintain the correct temperature of window numbers 3, 4, and 5.

Flight Deck Window Heat Schematic

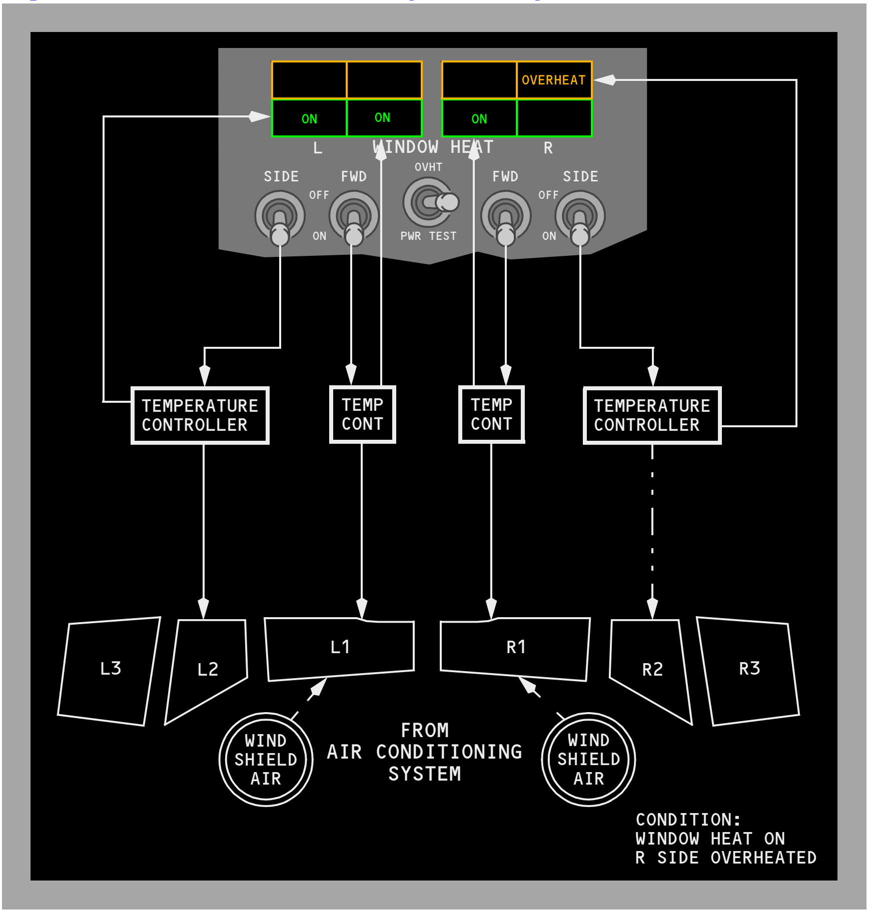
[Option –Window # 3 heated and green ON lights with eyebrow windows]



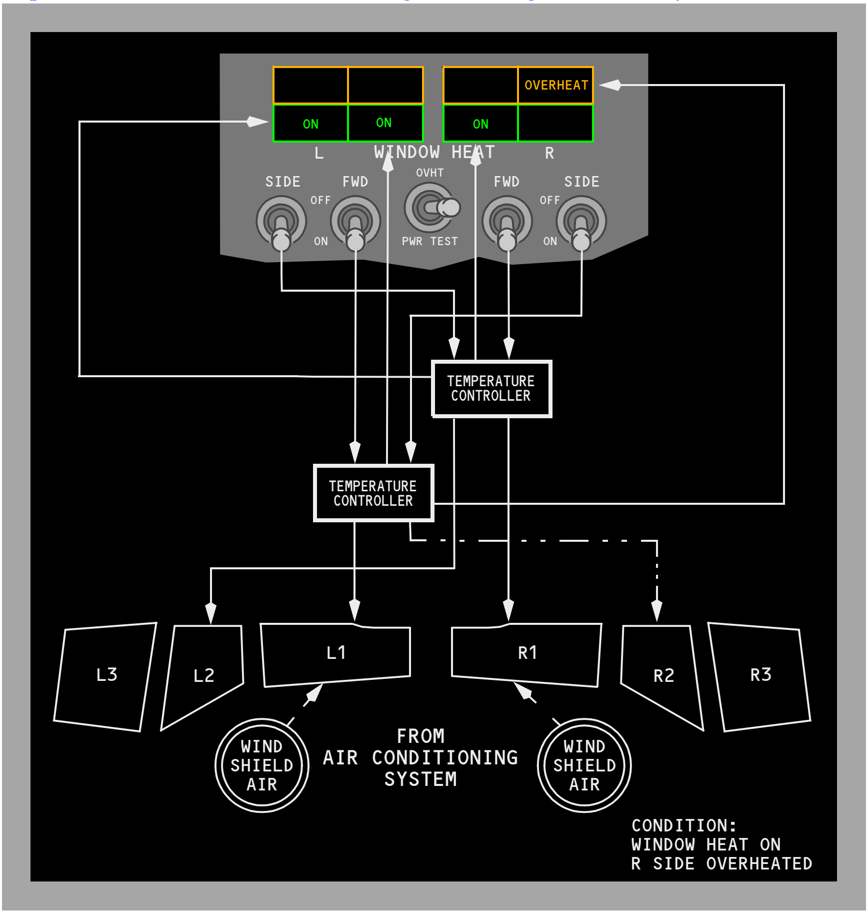
[Option –Window # 3 heated and green ON lights without eyebrow windows]



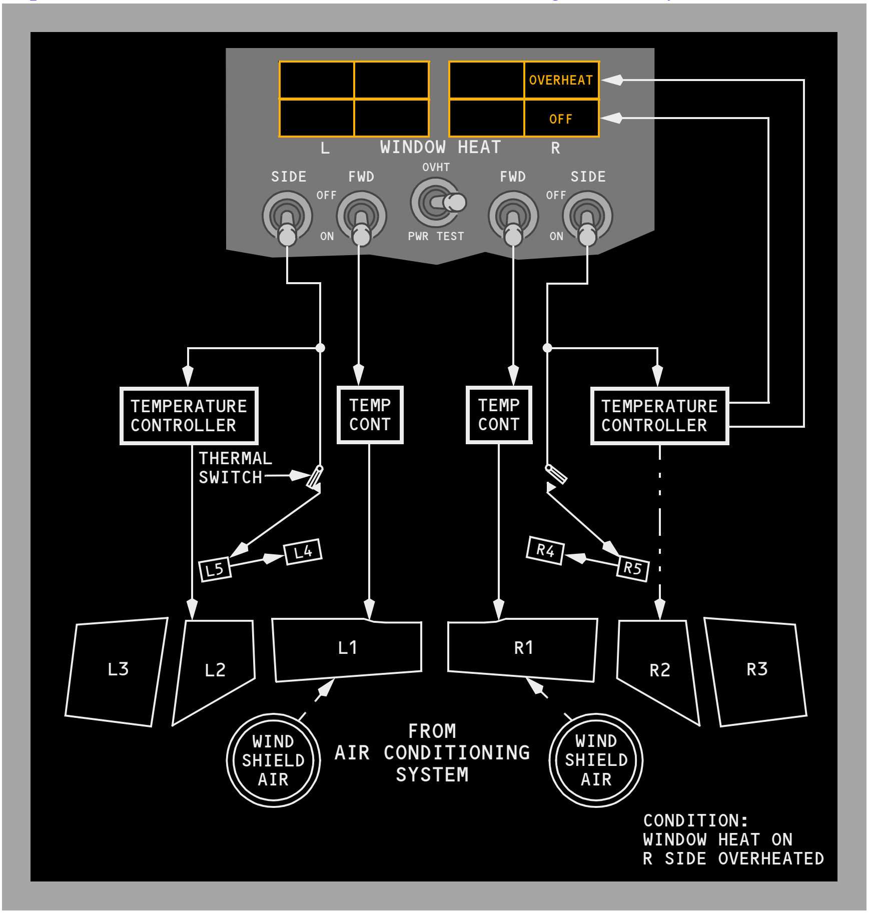
[Option –Window # 3 not heated and green ON lights]



[Option –Window # 3 not heated and green ON lights without eyebrow windows]



[Option –Window # 3 not heated and amber OFF lights with eyebrow windows]



Windshield Wipers

The rain removal system for the forward windows consists of windshield wipers and a permanent rain repellent coating on the windows.

CAUTION: Windshield scratching will occur if the windshield wipers are operated on a dry windshield.

Probe and Sensor Heat

Pitot probes, the total air temperature probe and the alpha vanes are electrically heated. Static ports are not heated.

[Option - Captain’s pitot probe on standby power]
Pitot probes, the total air temperature probe and the alpha vanes are electrically heated. Static ports are not heated. When operating on standby power, only the captain’s pitot probe is heated, however, the CAPT PITOT light does not illuminate for a failure.

Note: The pitot probe for standby airspeed is not heated when the airplane is on standby power.

Ice Detection System

[Option]
An advisory only ice detection system detects airplane icing in flight. The system consists of a probe located on the forward left fuselage and advisory lights located on the left forward panel.

When the probe senses ice build–up inflight, the ICING light illuminates. When ice has previously been detected and the probe is no longer detecting ice, the ICING light will extinguish and the NO ICE light will illuminate. The ICING light and the NO ICE light do not illuminate simultaneously.

Note: Residual ice may remain on the window areas with the NO ICE light illuminated.

The ICE DETECTOR light, located on the forward overhead panel, will illuminate if the ice detection system fails. Illumination of the ICE DETECTOR light also illuminates the MASTER CAUTION and ANTI–ICE system annunciator lights.

Engine Anti–Ice System

Engine bleed air thermal anti–icing prevents the formation of ice on the engine cowl lip. Engine anti–ice operation is controlled by individual ENG ANTI–ICE switches. The engine anti–ice system may be operated on the ground and in flight.

Engine Anti–Ice System Operation

Each cowl anti–ice valve is electrically controlled and pressure actuated. Positioning the ENG ANTI–ICE switches to ON:

- allows engine bleed air to flow through the cowl anti–ice valve for cowl lip anti–icing
- sets stall warning logic for icing conditions

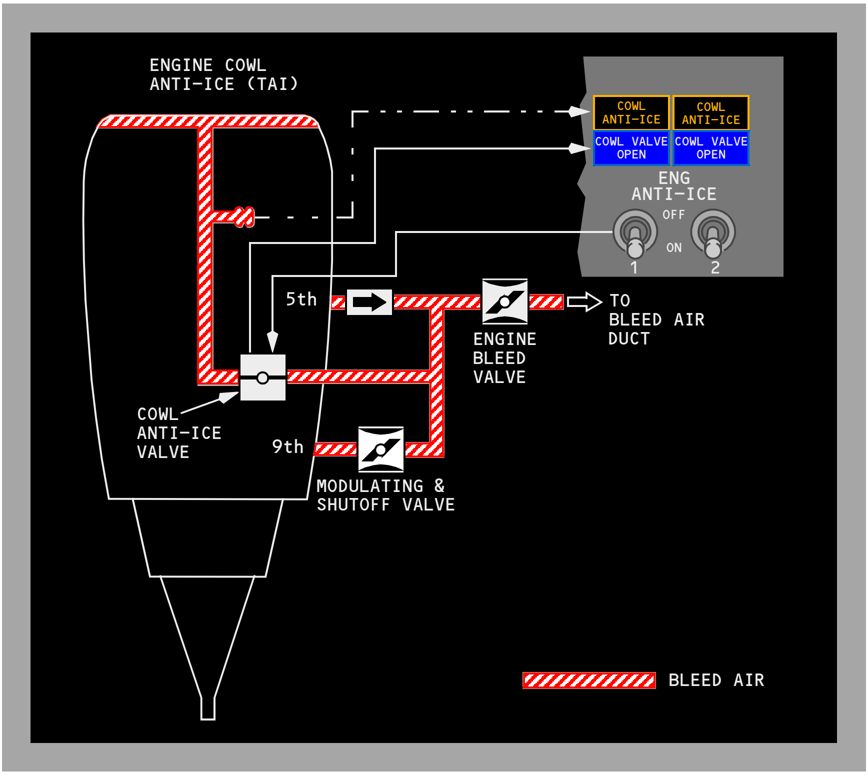
Note: Stall warning logic adjusts stick shaker and minimum maneuver speed bars on the airspeed indicator. FMC displayed VREF is not adjusted automatically.

Note: Stall warning logic, airspeed indications, and minimum maneuver speeds on the airspeed indicator return to normal when engine anti–ice is positioned OFF if wing anti–ice has not been used in flight.

If the cowl anti–ice valve fails to move to the position indicated by the ENG ANTI–ICE switch, the COWL VALVE OPEN light remains illuminated bright blue and an amber TAI indication illuminates on the CDS after a short delay.

The amber COWL ANTI–ICE light illuminates due to excessive pressure in the duct leading from the cowl anti–ice valve to the cowl lip.

Engine Anti–Ice System Schematic



Wing Anti–Ice System

The wing anti–ice system provides protection for the three inboard leading edge slats by using bleed air. The wing anti–ice system does not include the leading edge flaps or the outboard leading edge slats.

The wing anti–ice control valves are AC motor–operated. With a valve open, bleed air flows to the three leading edge inboard slats, and is then exhausted overboard. The wing anti–ice system is effective with the slats in any position.

Wing Anti–Ice System Operation

On the ground, positioning the WING ANTI–ICE switch ON opens both control valves if thrust on both engines is below the setting for takeoff warning activation and the temperature inside both wing distribution ducts is less than the thermal switch activation temperature.

Both valves close if either engine thrust is above the takeoff warning setting or either temperature sensor senses a duct overtemperature. The valves automatically reopen if thrust on both engines is reduced and both temperature sensors are cool.

With the air/ground sensor in the ground mode and the WING ANTI–ICE switch ON, the switch remains in the ON position regardless of control valve position. The WING ANTI–ICE switch automatically trips OFF at lift–off when the air/ground sensor goes to the air mode.

Positioning the WING ANTI–ICE switch to ON in flight:

- opens both control valves
- sets stall warning logic for icing conditions

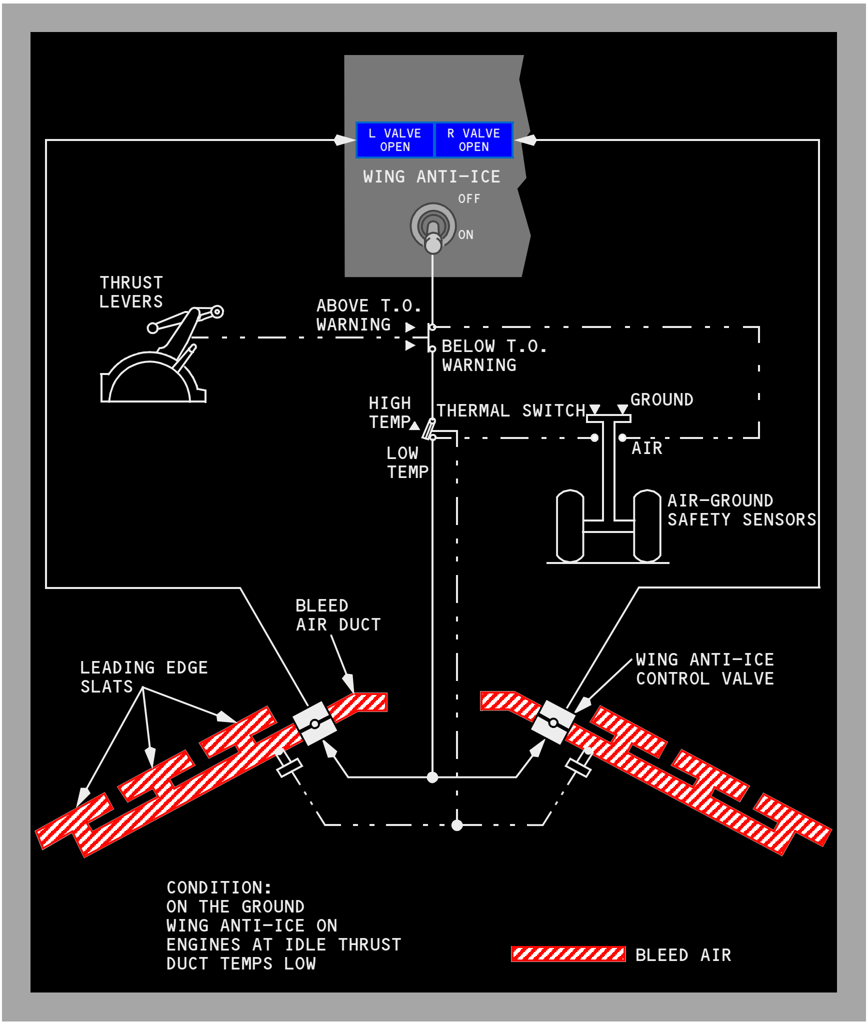
Note: Stall warning logic adjusts stick shaker and minimum maneuver speed bars on airspeed indications. FMC displayed VREF is not adjusted automatically.

Note: Stall warning logic remains set for icing conditions for the remainder of the flight, regardless of subsequent WING ANTI–ICE switch position.

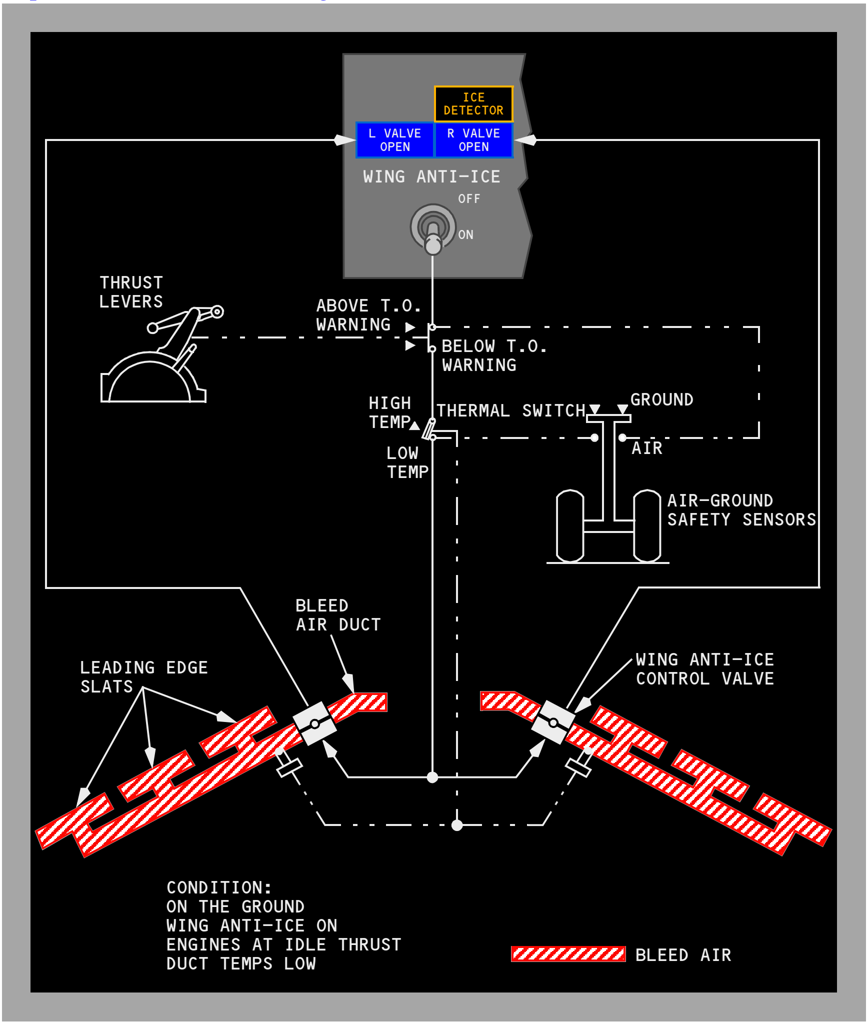
Duct temperature and thrust setting logic are disabled and have no effect on control valve operation in flight.

Valve position is monitored by the blue VALVE OPEN lights.

Wing Anti–Ice System Schematic



[Option - ICE DETECTOR light]



Automatic Flight — Chapter 4
Table of Contents — Section TOC

Automatic Flight — Chapter 4
Controls and Indicators — Section 10

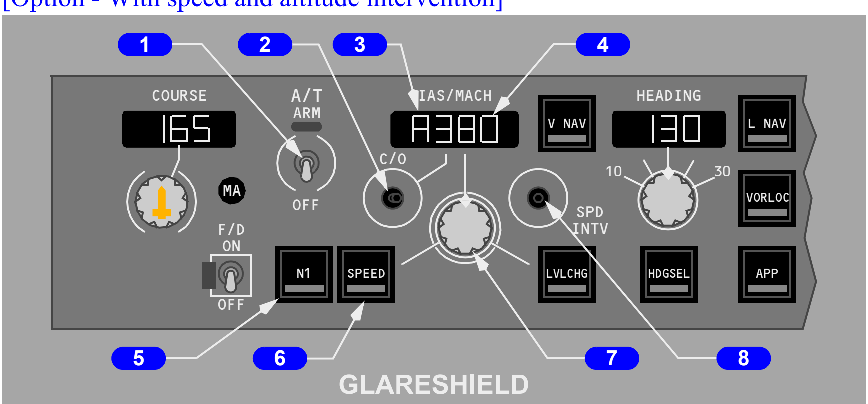
Mode Control Panel (MCP)

[Option - Collins MCP with speed and altitude intervention]
Below Vertical Speed window there is a white light sensor on all Collins MCP.

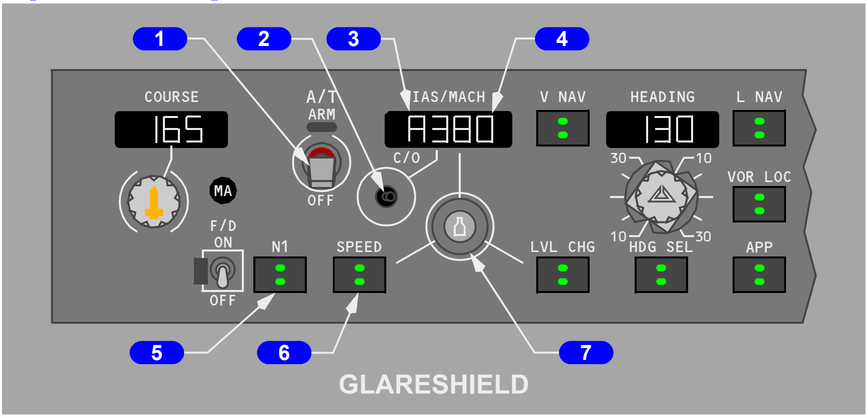
[Option - Honeywell MCP without speed and altitude intervention]

Speed Controls

[Option - With speed and altitude intervention]



[Option - Without speed and altitude intervention]



1 Autothrottle (A/T) ARM Switch

ARM – Arms A/T for engagement. Magnetically held at ARM. A/T engages automatically when following AFDS modes are engaged:

- LVL CHG
- ALT ACQ
- V/S
- VNAV
- ALT HOLD
- G/S capture
- TO/GA.

The indicator light illuminates green when A/T ARM switch is in the ARM position. The illumination of this light varies between manufactures and may appear off in a bright cockpit.

OFF – disengages A/T and prevents A/T engagement.

2 Changeover (C/O) Switch

Push –

- changes IAS/MACH display between IAS and MACH
- automatic changeover occurs at approximately FL260.

3 MCP Speed Condition Symbols

Overspeed or underspeed limiting symbol appears when commanded speed cannot be reached.

Underspeed limiting (flashing character “A”) – minimum speed

Overspeed limiting (flashing character “8”) –

- Vmo or Mmo limit
- landing gear limit
- flap limit.

4 IAS/MACH Display

Displays speed selected by IAS/MACH selector

- display is blank when:
  - VNAV mode engaged
  - A/T engaged in FMC SPD mode
  - during 2 engine AFDS go–around
- displays 100 knots when power is first applied
- display range is:
  - 100 KIAS – Vmo in 1 knot increments
  - .60M – Mmo in .01M increments.

5 N1 Switch

Push – (light not illuminated)

- engages A/T in N1 mode if compatible with AFDS modes already engaged
- illuminates N1 switch light
- annunciates N1 autothrottle mode.

Push – (light illuminated)

- deselects N1 mode and extinguishes switch light
- engages autothrottles in ARM mode.

N1 Mode

- A/T maintains thrust at N1 limit selected from FMC CDU. N1 mode engaged manually by pushing N1 switch if N1 mode is compatible with existing AFDS modes. N1 mode engages automatically when:
  - engaging LVL CHG in climb (except during inhibit period for 2 1/2 minutes after lift-off)
  - engaging VNAV in climb.

6 SPEED Switch

Push – (light not illuminated)

- engages A/T in SPEED mode if compatible with engaged AFDS modes
- illuminates SPEED switch light
- annunciates MCP SPD autothrottle mode
- maintains speed in MCP IAS/MACH display.

Push – (light illuminated)

- deselects speed mode and extinguishes switch light
- engages A/T in ARM mode.

Speed Mode

Autothrottle holds speed in IAS/MACH display or a performance or limit speed. Speed mode engaged manually by pushing SPEED switch if speed mode is compatible with existing AFDS modes. Speed mode engages automatically when:

- ALT ACQ engages
- ALT HOLD engages
- V/S engages
- G/S capture occurs.

When the "N1 SET" outer knob is in the AUTO position the A/T will not set thrust above the displayed N1 limit, however, A/T can exceed an N1 value manually set with the "N1 SET" outer knob in the manual BOTH, 1, or 2 position. Setting the thrust reference manually is intended to provide guidance when manually controlling thrust.

7 IAS/MACH Selector

Rotate –

- sets speed in IAS/MACH display and positions airspeed cursor
- selected speed is reference speed for AFDS and A/T
- not operative when IAS/MACH display is blank.

[Option - With speed and altitude intervention]

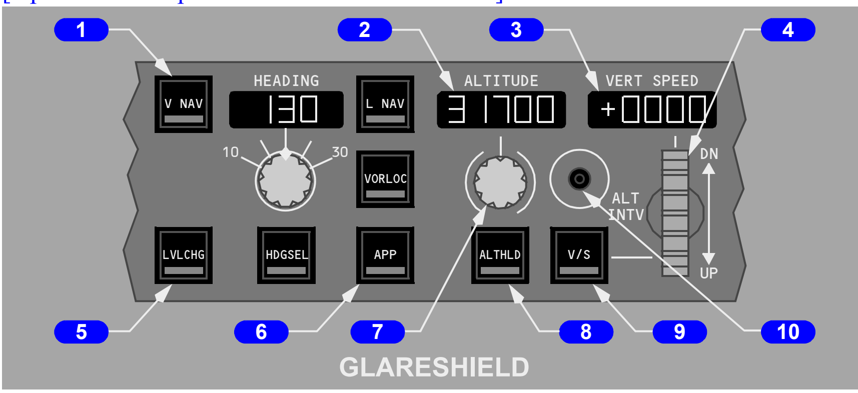
8 Speed Intervention (SPD INTV) Switch

Push (when VNAV engaged) –

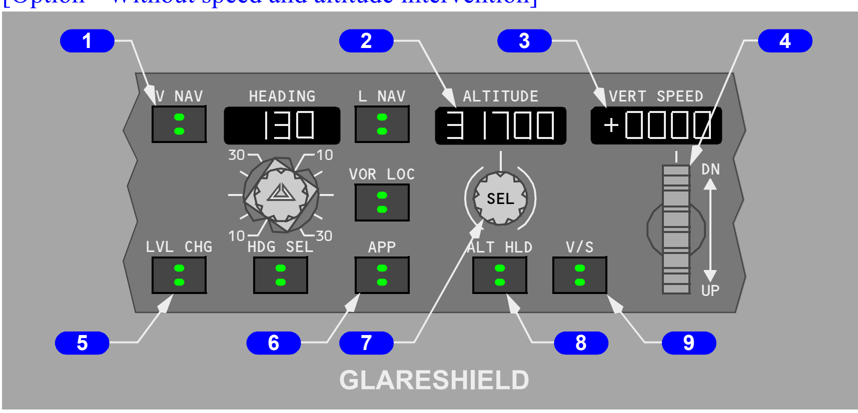
- IAS/MACH display alternately shows selected IAS/Mach and blanks
- when IAS/MACH display is unblanked, FMC speed intervention is active, FMC target speed is displayed, and IAS/MACH Selector may be used to set desired speed
- when IAS/MACH display is blank, FMC computed target speed is active and displayed on the airspeed indicator.

Vertical Navigation

[Option - With speed and altitude intervention]



[Option - Without speed and altitude intervention]



1 VNAV Switch

Push –

- VNAV switch light illuminates

[Option - With VNAV ALT enabled]

- pitch mode annunciates VNAV SPD, VNAV PTH, or VNAV ALT
- A/T mode annunciates FMC SPD, N1, RETARD, or ARM
- IAS/MACH display blanks and airspeed cursors positioned to FMC commanded airspeed.

VNAV Mode

The FMC commands AFDS pitch and autothrottle to fly vertical profile selected on FMC CDUs. Profile includes climb, cruise, descent, speeds, and can also include waypoint altitude constraints.

VNAV arm criteria on the ground:

- a valid flight plan has been entered
- performance data has been entered and executed
- both flight director switches have been switched on
- VNAV guidance becomes active at 400 feet AGL.

Climb –

- autothrottle holds FMC thrust limit
- AFDS holds FMC target speed
- automatic level-off occurs at MCP altitude or VNAV altitude, whichever is reached first

  [Option - With VNAV ALT enabled]
  - MCP constrained altitude annunciates VNAV ALT
  - VNAV constrained altitude annunciates VNAV PTH.

Cruise –

- autothrottle holds FMC target speed
- AFDS holds FMC altitude
- selecting a lower MCP altitude arms FMC to automatically begin descent upon arrival at FMC top of descent point.

Descent –

- VNAV SPD descent
  - autothrottle holds idle
  - AFDS holds FMC target speed.
- VNAV PTH descent
  - autothrottle holds idle but can command FMC SPD mode if ground speed becomes too low to maintain FMC vertical path
  - AFDS tracks FMC descent path.
- automatic level-off occurs at MCP altitude or VNAV altitude, whichever is reached first
  - MCP constrained altitude annunciates VNAV ALT
  - VNAV constrained altitude annunciates VNAV PTH.

Inhibited below 400 ft RA or if performance initialization not complete.

VNAV mode is terminated by any one of the following:

- selecting another pitch mode
- glideslope capture
- reaching end of LNAV route

[Option - FMC update 10.3 and later]
- transition of glideslope intercept waypoint if G/S is armed

[Option - FMC update 10.3 and later]
- crosstrack deviation exceeds twice the RNP value during PTH descent for an active leg with a database vertical angle and LNAV not engaged

In the event of glideslope intercept waypoint transition, VNAV can be re-engaged.

2 ALTITUDE Display

Displays selected altitude
- displayed altitude is reference for altitude alerting and automatic level–offs

[Option - With 100 foot increments]
- altitude range is 0 to 50,000 feet in 100 foot increments
- displays previously selected altitude when power first applied.

3 Vertical Speed (VERT SPEED) Display

Displays:
- blank when V/S mode not active
- present V/S when V/S mode is engaged with V/S switch
- selected V/S when V/S set with thumbwheel
- range is –7900 to +6000 fpm.

Display increments are:
- 50 fpm if V/S is less than 1000 fpm
- 100 fpm if V/S is 1000 fpm or greater.

4 Vertical Speed Thumbwheel

Rotate –
- DN –
  - sets vertical speed in VERT SPEED display
  - increases rate of descent or reduces rate of ascent.
- UP –
  - sets vertical speed in VERT SPEED display
  - increases rate of ascent or reduces rate of descent.

5 Level Change (LVL CHG) Switch

Push –
- LVL CHG switch light illuminates
- pitch mode annunciates MCP SPD for climb or descent

- autothrottle mode annunciates N1 for climb and RETARD followed by ARM for descent
- IAS/MACH display and airspeed cursors display target speed.

LVL CHG Mode

The LVL CHG mode coordinates pitch and thrust commands to make automatic climbs and descents to preselected altitudes at selected airspeeds.

A LVL CHG climb or descent is initiated by:

- selecting a new altitude
- pushing LVL CHG switch
- setting desired airspeed.

Climb –

- autothrottle holds limit thrust
- AFDS holds selected airspeed.

Descent –

- autothrottle holds idle thrust
- AFDS holds selected airspeed.

Airspeed –

- if a speed mode is active when LVL CHG is engaged, this speed is retained as target speed
- if a speed mode is not active when LVL CHG is engaged, existing speed becomes target speed
- speed can be changed with MCP IAS/MACH Selector.

The LVL CHG mode is inhibited after glideslope capture.

6 Approach (APP) Switch

(See Lateral Navigation)

7 Altitude Selector (SEL)

Rotate –

- sets altitude in ALTITUDE display in 100 foot increments
- arms V/S mode if rotated while in ALT HOLD at selected altitude.

8 Altitude Hold (ALT HLD) Switch

Push –

- engages ALT HOLD command mode
- commands pitch to hold uncorrected barometric altitude at which switch was pressed
- annunciates ALT HOLD pitch mode and illuminates ALT HLD switch light.

Altitude Hold Command Mode

ALT HOLD mode commands pitch to hold either:

- MCP selected altitude
  - pitch mode annunciates ALT HOLD
  - ALT HLD switch light extinguishes.
- uncorrected barometric altitude at which ALT HLD switch was pressed if not at MCP selected altitude
  - pitch mode annunciates ALT HOLD
  - ALT HLD switch light illuminates.

When in ALT HOLD at selected MCP altitude:

- selecting a new MCP altitude illuminates the ALT HLD switch light and arms V/S mode
- LVL CHG, V/S, and VNAV climb and descent functions are inhibited until a new MCP altitude is selected.

ALT HOLD mode is inhibited after G/S capture.

The selected MCP altitude is referenced to:

- Captain's barometric altimeter setting for A A/P and F/D
- First Officer's barometric altimeter setting for B A/P and F/D.

Note: After ALT HOLD engages, changes in altimeter barometric settings do not change the selected altitude reference.

9 Vertical Speed (V/S) Switch

Push –

- arms or engages V/S command mode
- commands pitch to hold vertical speed
- engages A/T in speed mode to hold selected airspeed
- annunciates V/S pitch mode and illuminates V/S switch light.

Vertical Speed Command Mode

The V/S mode commands pitch to hold selected vertical speed and engages A/T in SPEED mode to hold selected airspeed. V/S mode has both an armed and an engaged state.

Engaged –

- annunciates V/S pitch mode
- vertical speed display changes from blank to present vertical speed
- desired vertical speeds can be selected with vertical speed thumbwheel.

V/S becomes armed if:

- pitch mode is ALT HLD at selected MCP altitude and
- new MCP altitude is selected (more than 100 feet from current altitude).

With V/S armed, V/S mode is engaged by moving vertical speed thumbwheel.

V/S mode automatically engages if ALT ACQ mode is engaged and a new MCP altitude is selected which is more than 100 feet different from previously selected altitude.

- vertical speeds can be selected which command flight toward or away from selected altitude.

Inhibited if:

- ALT HOLD mode is active at selected MCP altitude
- glideslope captured in APP mode.

[Option - With speed and altitude intervention]

10 Altitude Intervention (ALT INTV) Switch

Allows manual deletion of next FMC altitude constraint via altitude SEL and ALT INTV switch.

Push – (during VNAV climb)

- lowest FMC altitude constraint below selected MCP altitude is deleted
- if airplane is currently at an FMC altitude constraint, deletion allows airplane to resume climb. MCP altitude must be set above current altitude
- for each press of switch, one deletion occurs
- if MCP altitude is set above current FMC altitude, FMC cruise altitude resets to MCP altitude. FMC cruise altitude cannot be decreased using ALT INTV switch.

Push – (during VNAV cruise)

- if MCP altitude is set above current FMC cruise altitude, FMC resets cruise altitude to MCP altitude and initiates a cruise climb
- if MCP altitude is set below current FMC cruise altitude, an early descent is initiated. Lower FMC cruise altitude cannot be entered using ALT INTV switch.
- if an MCP ALT is set to a lower altitude, but at or above any descent constraint, a CRZ DES occurs if the airplane is further than 50 nm from the top of descent at the current cruise altitude. The result will be a cruise altitude reset to the MCP ALT and vertical speed commands of -1000 fpm to the new cruise altitude. If within 50 nm of the top of descent, the Early Descent mode will be invoked.
- if more than 50 NM to T/D with VNAV engaged and the MCP ALT below current altitude and below a descent constraint altitude, the result will be Early Descent vertical speed commands of -1000 fpm until path intercept or MCP ALT level off occurs.

Push – (during VNAV descent)

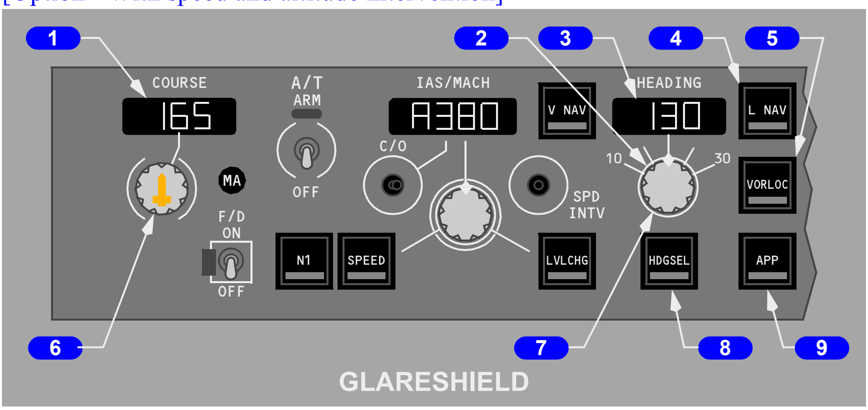
- the highest FMC altitude constraint above MCP altitude is deleted
- if airplane is currently at an FMC altitude constraint, deletion allows airplane to continue descent. MCP altitude must be set below current altitude

[Option - FMC U10.6 and above]

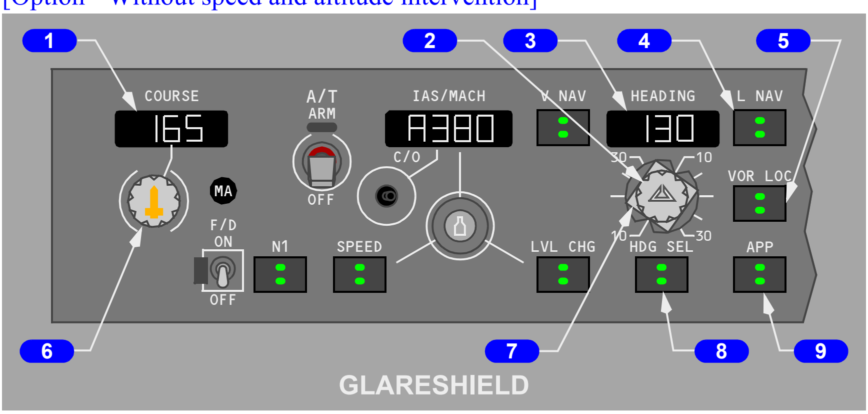
- if all FMC altitude constraints are deleted during VNAV path descent, an automatic transition to a VNAV speed descent is made.

Lateral Navigation

[Option - With speed and altitude intervention]



[Option - Without speed and altitude intervention]



1 COURSE Display

Displays course set by course selector.

Note: Different courses and frequencies on two VHF NAV receivers can cause disagreement between Captain and FO F/D displays and affect A/P operation.

2 Heading Selector

Rotate –

- sets heading in HEADING display
- positions selected heading bugs on the DUs.

3 HEADING Display

Displays selected heading.

4 LNAV Switch

Push –

- commands AFDS roll to intercept and track the active FMC route
- annunciates LNAV as roll mode and illuminates LNAV switch light.

LNAV Mode

In LNAV mode, the FMC controls AFDS roll to intercept and track active FMC route. Active route is entered and modified through FMC CDUs and can include SIDs, STARs, and instrument approaches.

LNAV arming criteria on the ground:

- origin runway in flight plan
- active route entered in FMC
- track of first leg within 5 degrees of runway heading
- both flight director switches have been switched on.
- LNAV selected prior to TO/GA.
  - LNAV guidance becomes active at 50 feet AGL

  [Option - Bank angle limit is 30 degrees above 200 AGL]
  [Option - Honeywell FCC -708 and on]
  - bank angle is limited to 8 degrees below 200 feet and 30 degrees above 200 feet AGL.

[Option - FCC P8.0 or greater Software]
- bank angle is limited to 15 degrees below 200 feet and 30 degrees above 200 feet AGL.

Note: The LNAV FMA is white when it is armed, and green when it is engaged. If LNAV is selected on the ground, it will be displayed as armed in white. If the required FMC data (e.g., valid radio altitude) is not available, it will flash white.

LNAV engagement criteria in flight:
- active route entered in FMC
- within 3 NM of active route, LNAV engagement occurs with any airplane heading
- outside of 3 NM, airplane must:
  - be on intercept course of 90 degrees or less
  - intercept route segment before active waypoint.

LNAV automatically disconnects for following reasons:
- reaching end of active route
- reaching a route discontinuity
- intercepting a selected approach course in VOR LOC or APP modes (VOR/LOC armed)
- selecting HDG SEL
- loss of capture criteria.

5 VOR Localizer (LOC) Switch

Push –
- commands AFDS roll to capture and track selected VOR or LOC course
- annunciates VOR/LOC armed or engaged as roll mode and illuminates VOR LOC switch light.

VOR LOC Mode

Pushing the VOR LOC switch selects VOR mode if a VOR frequency is tuned or selects LOC mode if a localizer frequency is tuned.

The VOR mode provides roll commands to track selected VOR course.

The LOC mode provides roll commands to track selected localizer course along inbound front course bearing.

The selected course can be intercepted while engaged in:
- LNAV
- HDG SEL
- CWS R if an autopilot is engaged in CMD.

The capture point is variable and depends on intercept angle and closure rate. Localizer capture occurs not later than 1/2 dot deviation. Course capture is indicated when VOR/LOC annunciation changes from armed to engaged.

While engaged in VOR or LOC modes:

- A autopilot and Captain's F/D use information from Captain's course selector and No. 1 VHF NAV receiver
- B autopilot and First Officer's F/D use information from First Officer's course selector and No. 2 VHF NAV receiver
- different courses and/or frequencies for two VHF NAV receivers can cause disagreement between the Captain's and First Officer's F/D displays and affect A/P operation.

Note: When a localizer frequency is selected, VHF NAV radios automatically switch from tail antenna to nose antenna when VOR/LOC is annunciated (armed or engaged). If antenna switching does not occur, LOC mode is inhibited.

Note: Localizer backcourse tracking is not available.

6 Course Selector

Sets course in COURSE display for related VHF NAV receiver, AFDS and DU. Two course selectors and COURSE displays are located on the MCP.

Rotate Captain's course selector – provides selected course information to:

- A FCC
- No. 1 VHF NAV receiver
- Captain's course pointer and course deviation bar.

Note: In VOR LOC or APP mode, the A A/P and Captain's F/D use selected course and navigation data from the No. 1 VHF NAV receiver.

Rotate First Officer's course selector – provides selected course information to:

- B FCC
- No. 2 VHF NAV receiver
- First Officer's course pointer and course deviation bar.

Note: In VOR LOC or APP mode, B A/P and First Officer's F/D use selected course and navigation data from No. 2 VHF NAV receiver.

7 Bank Angle Selector

Rotate –

- sets maximum bank angle for AFDS operation in HDG SEL or VOR modes
- commanded bank angle can be selected at 10, 15, 20, 25, or 30 degrees.

8 Heading Select (HDG SEL) Switch

Push –

- engages HDG SEL command mode
- commands roll to follow selected heading
- annunciates HDG SEL as FMA roll mode and illuminates HDG SEL switch light.

Heading Select Command Mode

The HDG SEL mode commands roll to turn to and maintain heading shown in MCP HEADING display:

- initial selection commands turn in shortest direction toward selected heading bug
- after mode engagement, roll commands are given to turn in same direction as rotation of heading selector
- bank angle limit is established by bank angle selector
- HDG SEL mode automatically disengages upon capture of selected radio course in VOR LOC and APP modes (VOR/LOC armed).

9 Approach (APP) Switch

Push –

- illuminates APP switch light
- arms the AFDS for localizer and glideslope capture
- roll mode annunciates VOR/LOC armed
- pitch mode annunciates G/S armed
- enables engagement of both autopilots.

APP Mode

The approach mode arms AFDS to capture and track localizer and glideslope and can be engaged for dual or single autopilot operation.

One VHF NAV receiver must be tuned to an ILS frequency before approach mode can be engaged. With one VHF NAV receiver tuned, onside AFDS is enabled for guidance and operation.

For dual autopilot operation, both VHF NAV receivers must be tuned to the ILS frequency and both autopilots must be selected in CMD prior to 800 feet RA.

APP mode operation:

[Option - G/S capture inhibited before LOC capture]

- localizer must be captured prior to glideslope
- localizer can be intercepted in HDG SEL, LNAV, or CWS R

[Option - EFIS/MAP]

- 1 CH annunciates in A/P Status Display after localizer capture
  - for single autopilot approach, 1 CH remains annunciated for entire approach
  - for dual autopilot approach, 1 CH annunciation extinguishes when second autopilot engages and FLARE armed is annunciated

[Option - PFD/ND]

- SINGLE CH annunciates in A/P Status Display after localizer capture
  - for single autopilot approach, SINGLE CH remains annunciated for entire approach

  [Option - Fail-Operational Autoland]
  - for dual autopilot approach, SINGLE CH annunciation extinguishes when second autopilot engages and ROLLOUT armed and FLARE armed are annunciated
  - for dual autopilot approach, SINGLE CH annunciation extinguishes when second autopilot engages and FLARE armed is annunciated
- glideslope capture occurs at 2/5 dot below glideslope
- APP switch light extinguishes after localizer and glideslope capture.

After localizer and glideslope capture, APP mode can be disengaged by:

- pushing a TO/GA switch
- disengaging autopilot(s) and turning off both F/D switches
- retuning the VHF NAV receiver.

While engaged in the APP mode:

- the A autopilot and Captain’s F/D use information from Captain’s Course Selector and No. 1 VHF NAV receiver
- the B autopilot and First Officer’s F/D use information from First Officer’s Course Selector and No. 2 VHF NAV receiver
- different courses and/or frequencies for the two VHF NAV receivers can cause disagreement between Captain’s and First Officer’s F/D displays and affect A/P operation.

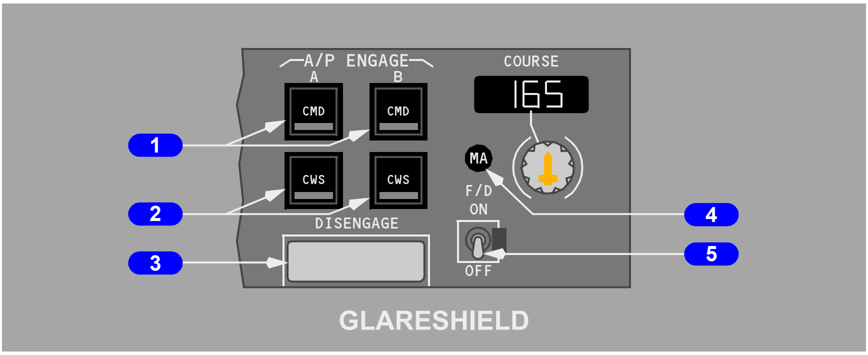
[Option - CWS deactivated on approach]

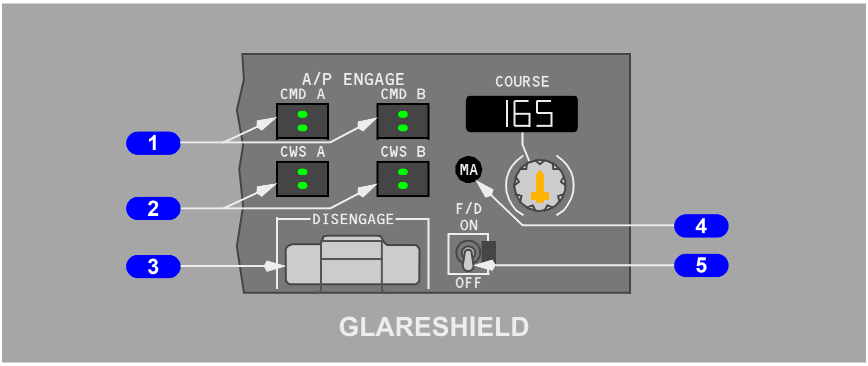
Note: After localizer or glideslope capture, during a single channel autopilot approach, CWS cannot be engaged by manually overriding pitch and/or roll control forces. Manually overriding pitch and/or roll will cause autopilot disengage. At autopilot disengage, the active Autopilot modes will remain engaged.

Note: During a dual autopilot approach and after FLARE ARM annunciation, any attempted manual override of the autopilots may result in an autopilot disengage.

Autopilot / Flight Director

Pushing a CMD or CWS switch engages related A/P in CMD or CWS and illuminates switch lights. A/P can operate in CMD, CWS, or a combination of CMD and CWS.





1 Command Engage (CMD ENGAGE) Switch (A or B):

Push –

- engages A/P
- enables all command modes
- displays CMD in A/P status display
- pushing an engage switch for second A/P, while not in approach mode, engages second A/P and disengages first A/P
- enables CWS operation

- CWS engages if:
  - pitch or roll mode not selected
  - pitch or roll mode deselected
  - pitch or roll mode manually overridden with control column or wheel force
- CWS engaged displays:
  - CWS P and/or CWS R in A/P status display
  - blank in pitch and/or roll mode FMA
- when approaching a selected altitude in CWS P, the pitch mode engages in ALT ACQ and ALT HOLD when reaching selected altitude
- when approaching a selected radio course in CWS R with VOR/LOC or approach mode armed, VOR/LOC engages when course is intercepted
- if pitch is manually overridden while in ALT HOLD and control force is released within 250 feet of selected altitude, A/P pitch mode engages in ALT ACQ and returns to selected altitude in ALT HOLD mode.

Note: During F/D only operation, while pitch or roll commands are more than 1/2 scale from center, pushing a CMD A or B switch engages the A/P in CWS for pitch and/or roll and the related F/D bar(s) retract.

[Option - FCC P8.0 or greater Software]

Note: During F/D only operation, while a pitch command is more than 1/2 scale from center, pushing a CMD A or B switch engages the A/P in CWS for pitch and the related F/D bar(s) retract.

2 Control Wheel Steering Engage (CWS ENGAGE) Switch (A or B):

Push –

- engages A/P
- engages pitch and roll modes in CWS. Other pitch and roll modes not enabled
- displays CWS P and CWS R in A/P status display
- CMD not displayed in A/P status display
- F/Ds, if ON, display guidance commands and FD annunciates in A/P status display. A/P does not follow commands while in CWS
- A/P pitch and roll controlled by pilot with control wheel pressure
- when control pressure released, A/P holds existing attitude. If aileron pressure released with 6 degrees or less bank, the A/P rolls wings level and holds existing heading. Heading hold feature inhibited:
  - below 1500 feet RA with gear down
  - after LOC capture in APP mode
  - after VOR capture with TAS 250 knots or less.

3 Autopilot Disengage (DISENGAGE) Bar

Pull down –

- exposes yellow background
- disengages both A/Ps
- prevents A/P engagement.

Lift up –

- conceals yellow background
- enables A/P engagement.

4 Master (MA) Flight Director Indicators (white letters)

If a F/D switch is ON, the light indicates which FCC is controlling the F/D modes.

- illuminated – related FCC is controlling F/D modes.
- extinguished – F/D modes are controlled from opposite FCC
- both lights illuminated – each FCC is controlling modes for related F/D.

5 Flight Director (F/D) Switch

[Option - Split Axis]
Left F/D switch activates command bars on the Captain's attitude indicator. Right F/D switch activates command bars on the First Officer's attitude indicator.

[Option - Integrated Cue]
Left F/D switch activates the command bar on the Captain's attitude indicator. Right F/D switch activates the command bar on the First Officer's attitude indicator.

ON –

- in flight with A/P ON and F/Ds OFF, turning a F/D switch ON engages F/D in currently selected A/P modes
- displays FD in A/P status display if A/P is OFF or engaged in CWS
- enables command bar display on related pilot's attitude indicator

[Option - Split Axis]
- command bars are displayed if command pitch and/or roll modes are engaged

[Option - Integrated Cue]
- command bar is displayed if command pitch and roll modes are engaged

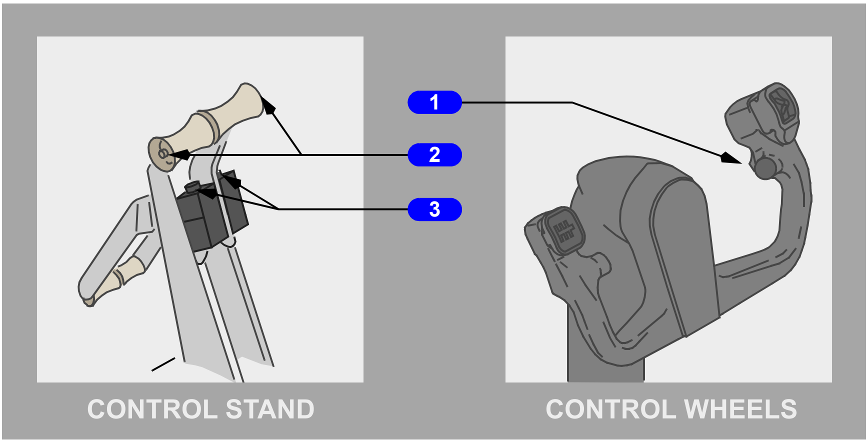
[Option - Wings Level Takeoff Roll Mode]
- on ground, arms pitch and roll modes for engagement in TO/GA and wings level when TO/GA switch is pushed.

[Option - Heading Select Takeoff Roll Mode]
- on ground, arms pitch and roll modes for engagement in TO/GA and HDG SEL when TO/GA switch is pushed.

[Option - Split Axis]
OFF – command bars retract from related pilot’s attitude indicator.

[Option - Integrated Cue]
OFF – command bar retracts from related pilot’s attitude indicator.

Autopilot / Autothrottle Controls



1 Autopilot Disengage Switch

Push –

- disengages both autopilots
- A/P disengage lights flash
- A/P disengage warning tone sounds for a minimum of two seconds
- second push extinguishes disengage lights and silences disengage warning tone
- if autopilot automatically disengages, extinguishes A/P Disengage lights and silences A/P warning tone.

2 Autothrottle Disengage Switches

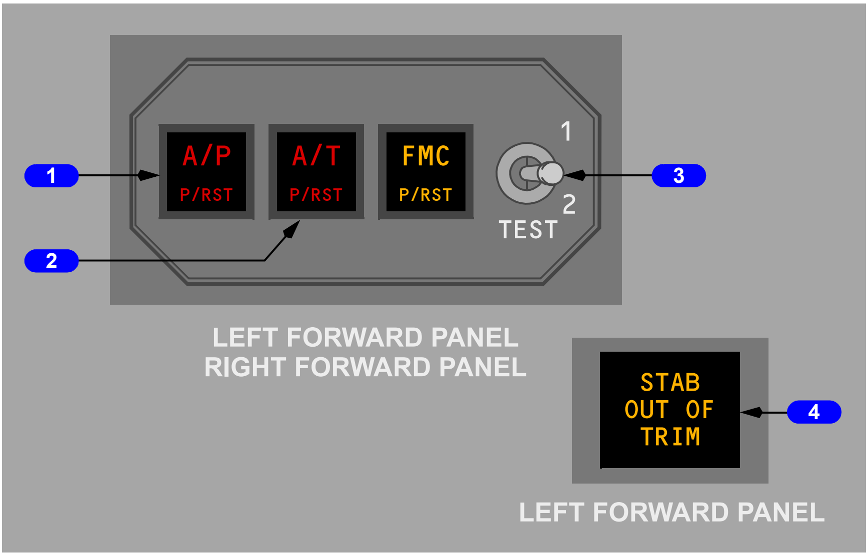
Push –

- disengages autothrottle
- A/T disengage lights flash
- A/T ARM switch trips OFF
- second press extinguishes A/T disengage lights
- extinguishes A/T disengage lights after automatic A/T disengagement.

3 Takeoff/Go–Around (TO/GA) Switches

Push – engages AFDS and A/T in takeoff or go–around mode if previously armed.

Autopilot / Autothrottle Indicators



1 Autopilot (A/P) Disengage Light

Illuminated (red) –

- flashes and tone sounds when autopilot has disengaged.
- reset by pushing either disengage light or either A/P disengage switch.
- steady for any of following conditions:
  - stabilizer out of trim below 800 feet RA on dual channel approach
  - ALT ACQ mode inhibited during A/P go–around if stabilizer not trimmed for single A/P operation
  - disengage light test switch held in position 2
  - automatic ground system tests fail.

Illuminated (amber) –

- steady – disengage light test switch held in position 1.

[Option - CWS warning activated]
- flashing – A/P automatically reverts to CWS pitch or roll while in CMD. Resets by pushing either light or selecting another mode.

[Option - Fail-Operational Autoland]
- steady – with disengage light test switch not held in position 1, indicates a downgrade in autoland capability.

2 Autothrottle (A/T) Disengage Light

Illuminated (red) –

- flashing – autothrottle has disengaged
- steady – disengage light test switch held in position 2.

Illuminated (amber) –

- steady – disengage light test switch held in position 1

[Option - Airspeed deviation warning activated]

- flashing – indicates A/T airspeed error under following conditions:
  - inflight
  - flaps not up
  - airspeed differs from commanded value by +10 or -5 knots and is not approaching commanded value.

3 Disengage Light Test (TEST) Switch

TEST 1 – illuminates autopilot/autothrottle disengage and FMC alert lights steady amber.

TEST 2 – illuminates autopilot/autothrottle disengage lights steady red and FMC alert light steady amber.

Spring–loaded to center position.

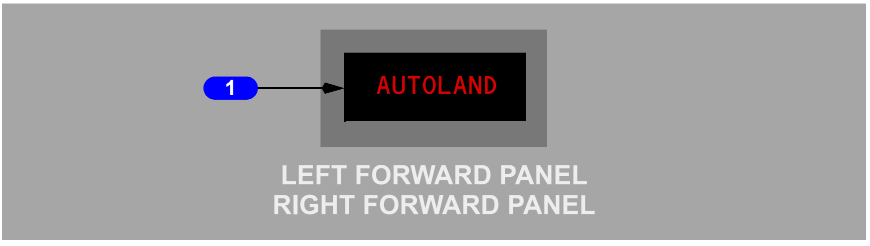
4 Stabilizer Out Of Trim (STAB OUT OF TRIM) Light

Operates only with autopilot engaged. Remains extinguished with autopilot not engaged.

Illuminated (amber) – autopilot not trimming stabilizer properly.

Autoland Warning

[Option]



1 AUTOLAND Warning Light

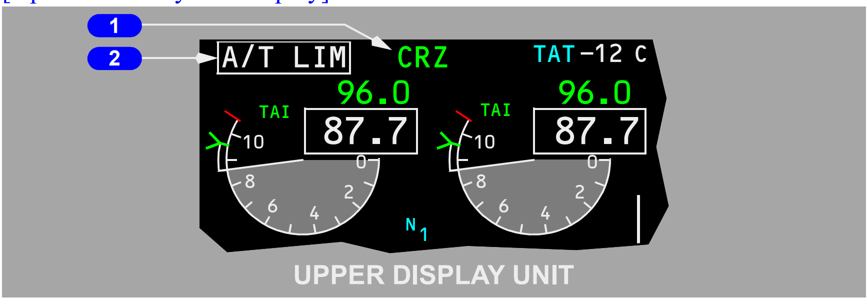
Armed during dual ILS A/P approach below 500 feet

Flashes (red) if:

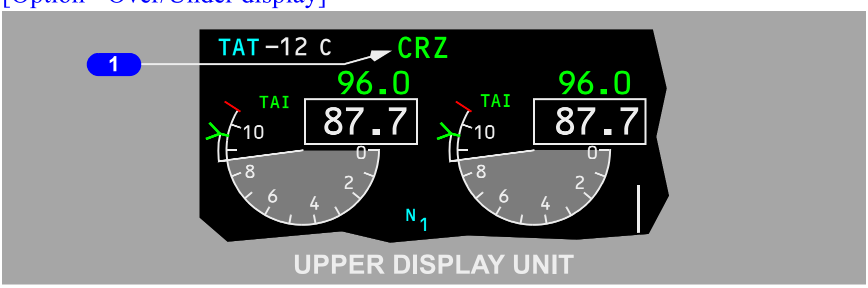
- A/P disengages
- stabilizer trim warning occurs
- ILS deviation occurs below 200 feet.

Thrust Mode Display

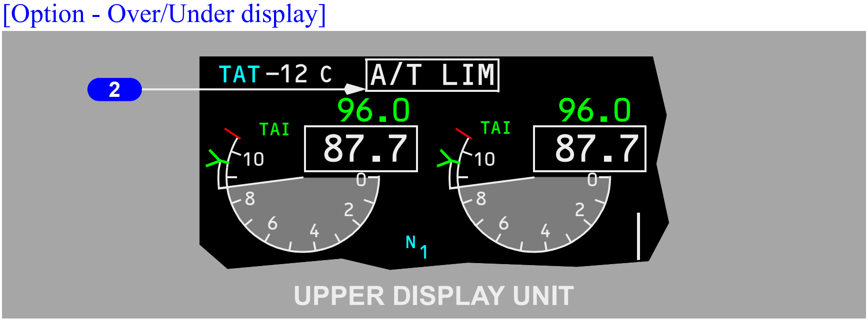
[Option - Side by side display]



[Option - Over/Under display]



[Option - Over/Under display]



1 Thrust Mode Display

N1 limit reference is the active N1 limit for autothrottle and manual thrust control.

N1 limit reference is also displayed by N1 reference bugs with N1 SET control in AUTO position.

N1 limit reference is normally calculated by the FMC.

[Option]
Thrust mode display annunciations are:

- TO – takeoff
- TO 1 – derated takeoff one
- TO 2 – derated takeoff two
- D-TO – assumed temperature reduced thrust takeoff
- D-TO 1 – derate one and assumed temperature reduced thrust takeoff
- D-TO 2 – derate two and assumed temperature reduced thrust takeoff

[Option]

- TO B – takeoff bump thrust
- CLB – climb
- CLB 1 – derated climb one
- CLB 2 – derated climb two
- CRZ – cruise
- G/A – go–around
- CON – continuous
- —— – FMC not computing thrust limit.

Thrust mode display annunciations are:

- TO – takeoff
- R-TO – reduced takeoff
- R-CLB – reduced climb

[Option]

- TO B – takeoff bump thrust
- CLB – climb
- CRZ – cruise
- G/A – go–around
- CON – continuous
- —— – FMC not computing thrust limit.

Note: The TO 2 and D-TO 2 thrust mode annunciations are only visible and selectable for aircraft equipped with engines that are authorized two fixed derates.

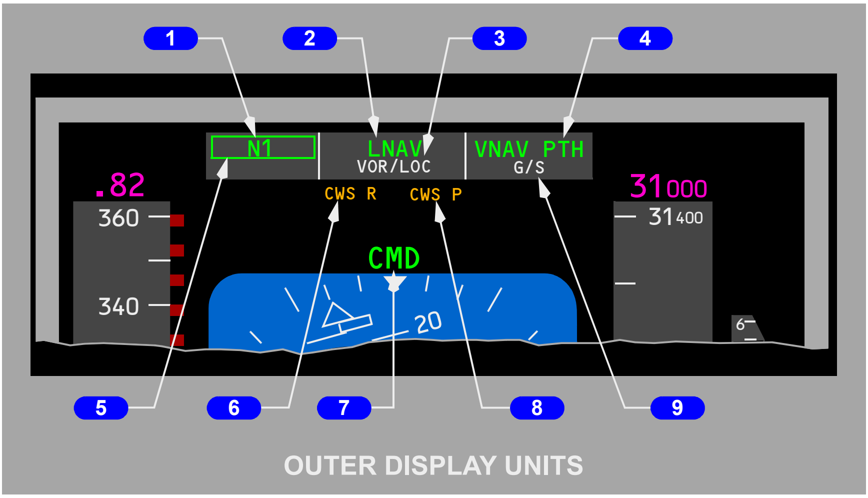
Note: R-TO does not indicate the type of reduced takeoff. The N1 limit may be reduced due to the entry of an assumed temperature, a takeoff thrust derate or a combination of both assumed temperature and takeoff thrust derate.

2 Autothrottle Limit (A/T LIM) Indication

Illuminated (white) – the FMC is not providing the A/T system with N1 limit values. The A/T is using a degraded N1 thrust limit from the related EEC.

Flight Mode Annunciations (FMAs)

[Option – PFD/ND]



1 Autothrottle (A/T) Engaged Mode

- N1 (green)
- GA (green)
- RETARD (green)
- FMC SPD (green)
- MCP SPD (green)
- THR HLD (green)
- ARM (white)

2 Roll Engaged Mode

- HDG SEL (green)
- VOR/LOC (green)
- FAC (green)
- LNAV (green)

[Option – Fail-Operational Autoland]
- ROLLOUT (green)
- B/CRS (green)

3 Roll Armed Mode

- VOR/LOC (white)

[Option – BP_04 or later Software Upgrade]
- LNAV VOR/LOC (white)

[Option – Fail-Operational Autoland]
- ROLLOUT (white)
- B/CRS (white)
- LNAV (white)
- FAC (white)

4 Pitch Engaged Mode

- TO/GA (green)
- V/S (green)
- MCP SPD (green)
- ALT/ACQ (green)
- ALT HOLD (green)
- G/P (green)
- G/S (green)
- FLARE (green)
- VNAV SPD (green)
- VNAV PTH (green)

[Option]
- VNAV ALT (green)

5 Mode Change Highlight Symbol

A mode change highlight symbol (rectangle) is drawn around each pitch, roll, CWS, A/P status, and thrust engaged mode annunciation for a period of 10 seconds after each engagement.

A mode change highlight symbol (rectangle) is drawn around each pitch, roll, A/P status, and thrust engaged mode annunciation for a period of 10 seconds after each engagement. The mode change highlight symbol for CWS Mode annunciations (CWS R and CWS P) will flash for 10 seconds when CWS mode engages.

6 CWS Roll Engaged

- CWS R (amber)

7 Autopilot Status

- CMD (green)

[Option – Fail-Operational Autoland]
- ▷LAND 2◁ (green)

[Option]
- SINGLE CH (amber)
- SINGLE CH (green-IAN)
- FD (green)

[Option – Fail-Operational Autoland]
- LAND 3 (green)

[Option – Fail-Operational Autoland]
- NO AUTOLAND (amber)
- AUTOPILOT (amber)

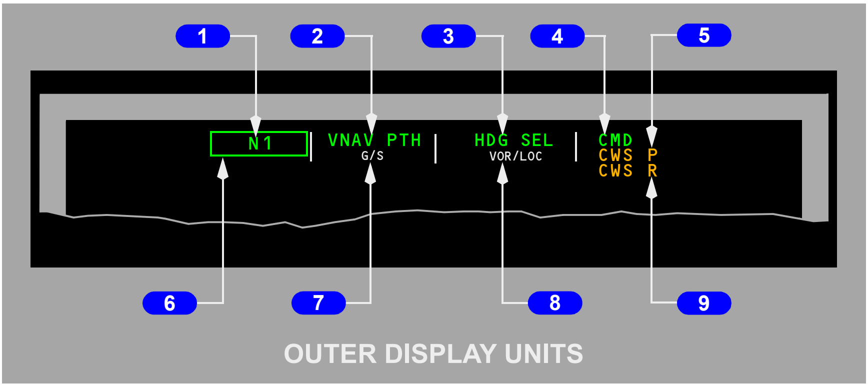
8 **CWS Pitch Engaged**

- CWS P (amber)

9 **Pitch Armed Mode**

- G/S (white)
- V/S (white)
- VNAV (white)
- G/P (white)
- FLARE (white)
- G/S V/S (white)
- G/P V/S (white)

[Option – EFIS/MAP]



1 **Autothrottle (A/T) Engaged Mode**

- N1 (green)
- GA (green)
- RETARD (green)
- FMC SPD (green)
- MCP SPD (green)
- THR HLD (green)
- ARM (white)

2 **Pitch Engaged Mode**

- TO/GA (green)
- V/S (green)
- MCP SPD (green)
- ALT ACQ (green)
- ALT HOLD (green)
- G/S (green)
- FLARE (green)
- VNAV PTH (green)
- VNAV SPD (green)

[Option]
- VNAV ALT (green)

3 Roll Engaged Mode

- HDG SEL (green)
- VOR/LOC (green)
- LNAV (green)

4 Autopilot Status

- CMD (green)
- FD (green)

[Option]
- 1 CH (amber)

5 CWS Pitch Engaged

- CWS P (amber)

6 Mode Highlight Change Symbol

A mode change highlight symbol (rectangle) is drawn around each pitch, roll, CWS, A/P status, and thrust engaged mode annunciation for a period of 10 seconds after each engagement.

7 Pitch Armed Mode

- G/S (white)
- V/S (white)
- VNAV (white)
- G/S V/S (white)
- FLARE (white)

8 Roll Armed Mode

- VOR/LOC (white)
- LNAV (white)

[Option – BP_04 or later Software Upgrade]
- LNAV VOR/LOC (white)

9 CWS Roll Engaged

- CWS R (amber)

General

The automatic flight system (AFS) consists of the autopilot flight director system (AFDS) and the autothrottle (A/T). The flight management computer (FMC) provides N1 limits and target N1 for the A/T and command airspeeds for the A/T and AFDS.

The AFDS and A/T are controlled using the AFDS mode control panel (MCP) and the FMC. Normally, the AFDS and A/T are controlled automatically by the FMC to fly an optimized lateral and vertical flight path through climb, cruise and descent.

AFS mode status is displayed on the flight mode annunciation on each pilot's primary display.

Autopilot Flight Director System (AFDS)

The AFDS is a dual system consisting of two individual flight control computers (FCCs) and a single mode control panel.

The two FCCs are identified as A and B. For A/P operation, they send control commands to their respective pitch and roll hydraulic servos, which operate the flight controls through two separate hydraulic systems.

For F/D operation, each FCC positions the F/D command bars on the respective attitude indicator.

MCP Mode Selector Switches

The mode selector switches are pushed to select desired command modes for the AFDS and A/T. The switch illuminates to indicate mode selection and that the mode can be deselected by pushing the switch again. While a mode is active, deselection can be automatically inhibited and is indicated by the switch being extinguished.

When engagement of a mode would conflict with current AFS operation, pushing the mode selector switch has no effect. All AFDS modes can be disengaged either by selecting another command mode or by disengaging the A/P and turning the F/Ds off.

Autopilot Engagement Criteria

Each A/P can be engaged by pushing a separate CMD or CWS engage switch. A/P engagement in CMD or CWS is inhibited unless both of the following pilot–controlled conditions are met:

- no force is being applied to the control wheel
- the STAB TRIM AUTOPILOT cutout switch is at NORMAL.

Only one A/P can be engaged at a given time unless the approach (APP) mode is engaged. Approach mode allows both A/Ps to be engaged at the same time. Dual A/P operation provides control through landing flare and touchdown or an automatic go–around.

In single A/P operation, full automatic flare and touchdown capability and A/P go–around capability are not available.

Autopilot Disengagement

The A/P automatically disengages when any of the following occurs:

- pushing either A/P disengage switch

[Option - FCC P8.0 or greater Software]
- column or wheel force override

[Option - A/P auto-disengages for TO/GA above 2000 feet RA]
[Option - Honeywell -708 FCC and on]
- pushing either Takeoff/Go-around (TO/GA) switch with a single A/P engaged in CWS or CMD at or above 2000 feet RA with flaps not up or G/S engaged

[Option - Fail-Operational Autoland]
- pushing either TO/GA switch after touchdown with both A/Ps engaged in CMD (except with LAND 3 or LAND 2 annunciated)
- pushing either TO/GA switch after touchdown with both A/Ps engaged in CMD
- pushing an illuminated A/P ENGAGE switch
- pushing the A/P DISENGAGE bar down

[Option - Fail-Operational Autoland]
- activating either pilot’s control wheel trim switch (except with LAND 3 or LAND 2 annunciated)
- activating either pilot’s control wheel trim switch
- moving the STAB TRIM AUTOPILOT cutout switch to CUTOUT

[Option - FCC P8.0 or greater Software]
- for a column and/or wheel force override of a single or dual channel CMD engaged autopilot, in approach or non-approach phase of flight. The AFDS will maintain the active pitch and roll modes with flight director guidance

- either left or right IRS system failure or FAULT light illuminated
- loss of electrical power or a sensor input which prevents proper operation of the engaged A/P and mode
- the stick shaker activates in flight and persists for longer than five minutes. The autopilot will not be capable of re-engagement until stick shaker activity ceases
- loss of respective hydraulic system pressure.

Note: Loss of the system A engine-driven hydraulic pump, and a heavy demand on system A, may cause A/P A to disengage.

[Option - Fail-Operational Autoland]
Note: During a fail-operational autoland as indicated by a LAND 3 annunciation or a degraded fail-passive landing with an accompanying NO LAND 3/LAND 2 annunciation, pressing the TO/GA switch after touchdown or activating the manual electric trim will be ignored by both autopilot channels, both flight directors, and the autothrottle system. This ensures that an inadvertent press of the TO/GA switch does not affect rollout.

AFS Failures

Power interruption or loss may cause disengagement of the AFDS and/or A/T. Re–engagement is possible after power is restored.

Dual channel A/P operation is possible only when two generators are powering the busses.

Two independent radio altimeters provide radio altitude to the respective FCCs. With a radio altimeter inoperative, the autopilot will disengage two seconds after LOC and GS capture.

Flight Director Display

Turning a F/D switch ON displays command bars on the respective pilot’s attitude indicator if command pitch and roll modes are engaged. If command pitch and roll modes are not engaged, the F/D command bars do not appear. The F/Ds can be operated with or without the A/P and A/T. F/D command modes can be used with an A/P engaged in CWS.

F/D commands operate in the same command modes as the A/P except:

- the takeoff mode is a F/D only mode
- dual F/D guidance is available for single engine operation
- the F/D has no landing flare capability. F/D command bars retract from view at approximately 50 feet RA on an ILS approach.
- During a Fail Operational autoland flare with FLARE engaged and LAND 3 annunciated, F/D command bars center.

Normally, FCC A drives the captain's command bars and FCC B drives the first officer's command bars. With both F/D switches ON, the logic for both pilots' F/D modes is controlled by the master FCC, and both FMA displays show the same mode status.

The master FCC is indicated by illumination of the respective master (MA) F/D indicator light. The master FCC is determined as follows:

- with neither A/P engaged in CMD, the FCC for the first F/D turned on is the master
- with one or both A/Ps engaged in CMD, the FCC for the first A/P in CMD is the master FCC, regardless of which F/D is turned on first.

F/D modes are controlled directly from the respective FCC under certain conditions. This independent F/D operation occurs when neither A/P is engaged in CMD, both F/D switches are ON and one of the following mode conditions exists:

- APP mode engaged with LOC and G/S captured
- GA mode engaged and below 400 feet RA
- TO mode engaged and below 400 feet RA.

[Option - FCC P8.0 or greater Software]
For non-approach modes, if the pilot is flying manually but not following the flight director guidance in the roll mode and then selects autopilot CMD engagement, the autopilot will engage into the current flight director roll mode.

Independent F/D operation is indicated by illumination of both MA lights. When independent operation terminates, the MA light extinguishes on the slaved side.

If a generator is lost during a F/D TO or GA, or while in dual F/D APP mode below 800 feet, the FCC on the unaffected side positions the F/D command bars on both attitude indicators. If the F/D MA light on the affected side had been illuminated, it extinguishes upon electrical bus transfer.

AFDS Status Annunciation

The following AFDS status annunciations are displayed in the A/P status display located above the attitude indicator on the outboard display unit:

- CMD (one or both autopilots are engaged)
- FD (the flight director is ON and the autopilot is either OFF or engaged in CWS)
- CWS P (pitch mode engaged in CWS)
- CWS R (roll mode engaged in CWS)

[Option - EFIS/MAP]
- 1 CH (for single A/P ILS approach, annunciates after localizer capture and remains on for entire approach. For dual A/P ILS approach, annunciates after localizer capture and extinguishes after pitch monitor confidence test is successfully completed).

[Option - PFD/ND]

- SINGLE CH (for single A/P ILS approach, annunciates after localizer capture and remains on for entire approach. For dual A/P ILS approach, annunciates after localizer capture and extinguishes after pitch monitor confidence test is successfully completed).

Fail-Operational Autoland Status Annunciations

[Option - Fail-Operational Autoland]

The following annunciations provide the flight crew with autoland system mode and status:

- LAND 3 – two autopilots, three inertial sources, and the associated sensors are operating normally for an automatic landing and rollout.
- LAND 2 – a failure has occurred above Alert Height and redundancy is reduced; but the autoland system is still capable of making an automatic landing and rollout.
- NO AUTOLAND – the system is unable to make an automatic landing.

With a LAND 3 (fail-operational) indication, the autoland system level of redundancy is such that a single fault cannot prevent the autopilot system from making an automatic landing.

With a LAND 2 (fail passive) indication, the level of redundancy is such that a single fault cannot cause a significant deviation from the flight path.

The NO AUTOLAND status is annunciated if a system failure has occurred. FLARE and ROLLOUT will not arm when NO AUTOLAND is annunciated.

An advisory message is displayed on the Engine Display for any fault which limits the capability of the automatic landing system. NO LAND 3 indicates the autoland system does not have the required redundancy for LAND 3 operations. NO AUTOLAND indicates autoland is not available.

Should any single failure occur below Alert Height and the system is still capable of continuing the autoland and rollout, LAND 3 will remain displayed and the airplane will land and roll out normally without failure annunciation. Failure or autoland downgrade annunciations will then be displayed when the airplane has decelerated below 40 kts and the autopilots have been disengaged.

AFDS Flight Mode Annunciations

The flight mode annunciations are displayed just above the attitude indicator on the outboard display unit. The mode annunciations, from left to right, are:

[Option - EFIS/MAP]

- autothrottle
- pitch
- roll
- autopilot status

[Option - PFD/ND]

- autothrottle
- roll
- pitch

Engaged or captured modes are shown at the top of the flight mode annunciation boxes in large green letters. Armed modes are shown in smaller white letters at the bottom of the flight mode annunciation boxes.

Autothrottle Modes

- N1 – the autothrottle maintains thrust at the selected N1 limit displayed on the thrust mode display, including full go-around N1 limit
- GA – the autothrottle maintains thrust at reduced go–around setting
- RETARD – displayed while autothrottle moves thrust levers to the aft stop. RETARD mode is followed by ARM mode
- FMC SPD – the autothrottle maintains speed commanded by the FMC. The autothrottle is limited to the N1 value shown on the thrust mode display
- MCP SPD – the autothrottle maintains speed set in the MCP IAS/MACH display. The autothrottle is limited to the N1 value shown on the thrust mode display
- THR HLD – the thrust lever autothrottle servos are inhibited; the pilot can set the thrust levers manually
- ARM – no autothrottle mode engaged. The thrust lever autothrottle servos are inhibited; the pilot can set thrust levers manually. Minimum speed protection is provided.

Pitch Modes

- TO/GA – Takeoff

  Engaged for takeoff by turning both F/D switches ON and pushing either TO/GA switch. Both F/Ds must be ON to engage TO/GA prior to starting takeoff.

  The AFDS commands pitch attitude in the following order:

  - 10 degrees nose down until 60 knots IAS
  - 15 degrees nose up after 60 knots IAS
  - 15 degrees nose up after lift–off until a sufficient climb rate is acquired. Then, pitch is commanded to maintain MCP speed plus 20 knots.

  TO/GA can also be engaged for takeoff with F/D switches OFF if a TO/GA switch is pushed after 80 knots IAS below 2000 feet AGL and prior to 150 seconds after lift–off.

- TO/GA – Go–around

Engaged for go–around by pushing the TO/GA switch under the following conditions:

- inflight below 2000 feet radio altitude

[Option - A/P auto-disengages for TO/GA above 2000 feet RA]
[Option - Honeywell -708 FCC and on]

- inflight above 2000 feet radio altitude with flaps not up or G/S captured
- not in takeoff mode
- either F/D ON or OFF.

When engaged, the F/Ds command roll to hold the ground track, and 15 degrees nose up pitch. After reaching a programmed rate of climb, pitch commands the target airspeed for each flap setting based on maximum takeoff weight calculations.

- VNAV (armed) - displayed when VNAV is armed prior to takeoff. After takeoff, VNAV automatically engages at 400 feet AGL
- VNAV (engaged) – VNAV is engaged by pushing the VNAV switch. With a VNAV mode engaged, the FMC commands AFDS pitch and A/T modes to fly the vertical profile
  - VNAV SPD – the AFDS maintains the FMC speed displayed on the airspeed indicator and/or the CDU CLIMB or DESCENT pages
  - VNAV PTH – the AFDS maintains FMC altitude or descent path with pitch commands
  - VNAV ALT – when a conflict occurs between the VNAV profile and the MCP altitude, the airplane levels at the MCP altitude and the pitch flight mode annunciation becomes VNAV ALT. VNAV ALT maintains altitude.
- V/S (armed) – V/S mode can be engaged by moving Vertical Speed thumbwheel
- V/S (engaged) – commands pitch to hold selected vertical speed
- ALT ACQ – transition maneuver entered automatically from a V/S, LVL CHG, or VNAV climb or descent to selected MCP altitude. Engages but does not annunciate during VNAV transition
- ALT HOLD – commands pitch to hold MCP selected altitude or uncorrected barometric altitude at which ALT HOLD switch was pushed
- MCP SPD – pitch commands maintain IAS/MACH window airspeed or Mach
- G/S (armed) – the AFDS is armed for G/S capture
- G/S (engaged) – the AFDS follows the ILS glideslope
- G/P (armed) – the AFDS is armed for G/P capture
- G/P (engaged) – the AFDS follows the IAN glide path

- FLARE (armed) – during a dual A/P ILS approach, FLARE is displayed after LOC and G/S capture and below 1500 feet RA. The second A/P couples with the flight controls and A/P go–around mode arms
- FLARE (engaged) – during a dual A/P ILS approach, flare engages at 50 feet radio altitude. FLARE accomplishes the autoland flare maneuver.

Roll Modes

- LNAV (armed) – the AFDS is armed (prior to takeoff) to engage LNAV at 50 feet RA
- LNAV (armed) – in the approach phase and a missed approach exists in the flight plan
- LNAV (engaged) – the AFDS intercepts and tracks the active FMC route. Either of the following capture criteria must be met:
  - on any heading and within 3 NM of the active route segment
  - if outside of 3 NM of active route segment, airplane must be on an intercept course of 90 degrees or less and intercept the route segment before the active waypoint.
- HDG SEL – the airplane is turning to, or is on the heading selected in the MCP Heading Display
- VOR/LOC (armed) – AFDS is armed to capture selected VOR or LOC COURSE
- VOR/LOC (engaged) – AFDS tracks selected VOR course or tracks selected localizer course along the inbound front course bearing
- FAC (armed) – the AFDS is armed to capture the IAN final approach course
- FAC (engaged) – the AFDS tracks the IAN final approach course along the inbound course bearing.
- B/CRS (armed) – the AFDS is armed to capture the localizer final approach back course
- B/CRS (engaged) – the AFDS tracks the localizer final approach course along the inbound back course bearing.

[Option - Fail-Operational Autoland]
- ROLLOUT (armed) – annunciates below 1500 feet radio altitude.

[Option - Fail-Operational Autoland]
- ROLLOUT (engaged) – at touchdown the AFDS uses rudder and nose wheel steering to keep the airplane on the localizer centerline.

Autopilot Control Wheel Steering

CWS Engage Switch Selected

Pushing a CWS engage switch engages the A/P pitch and roll axes in the CWS mode and displays CWS P and CWS R on the FMAs.

With CWS engaged, the A/P maneuvers the airplane in response to control pressures applied by either pilot. The control pressure is similar to that required for manual flight. When control pressure is released, the A/P holds existing attitude.

If aileron pressure is released with 6 degrees or less bank, the A/P rolls the wings level and holds existing heading. This heading hold feature with bank less than 6 degrees is inhibited when any of the following conditions exists:

- below 1,500 feet RA with the landing gear down
- after F/D VOR capture with TAS 250 knots or less
- after F/D LOC capture in the APP mode.

Pitch CWS with a CMD Engage Switch Selected

The pitch axis engages in CWS while the roll axis is in CMD when:

- a command pitch mode has not been selected or was deselected
- A/P pitch has been manually overridden with control column force. The force required for override is greater than normal CWS control column force.
- selecting CMD while not following a large deviation in the pitch flight director command.

CWS P is annunciated on the FMAs while this mode is engaged. Command pitch modes can then be selected.

When approaching a selected altitude in CWS P with a CMD engage switch selected, CWS P changes to ALT ACQ. When at the selected altitude, ALT HOLD engages.

If pitch is manually overridden while in ALT HOLD at the selected altitude, ALT HOLD changes to CWS P. If control force is released within 250 feet of the selected altitude, CWS P changes to ALT ACQ, the airplane returns to the selected altitude, and ALT HOLD engages. If the elevator force is held until more than 250 feet from the selected altitude, pitch remains in CWS P.

Roll CWS with a CMD Engage Switch Selected

The roll axis engages in CWS while the pitch axis is in CMD when:

- a command roll mode has not been selected or was deselected
- A/P roll has been manually overridden with control wheel force. The force required for override is greater than the normal CWS control wheel force.
- flying beyond FMS end of route or into a route discontinuity.

CWS R is annunciated on the FMAs while this mode is engaged.

CWS R with a CMD engage switch illuminated can be used to capture a selected radio course while the VOR/LOC or APP mode is armed. Upon intercepting the radial or localizer, the F/D and A/P annunciations change from CWS R to VOR/LOC engaged, and the A/P tracks the selected course.

Autothrottle System

The A/T system provides automatic thrust control from the start of takeoff through climb, cruise, descent, approach and go–around or landing. In normal operation, the FMC provides the A/T system with N1 limit values.

The A/T moves the thrust levers with a separate servo motor on each thrust lever. Following manual positioning, the A/T may reposition the thrust levers to comply with computed thrust requirements except while in the THR HLD and ARM modes.

The A/T system operates properly with the EECs ON or in ALTN. In either case, the A/T uses the FMC N1 limits. During A/T operation, it is recommended that both EECs be ON or both be in ALTN, as this produces minimum thrust lever separation.

Autothrottle Engagement

Moving the A/T Arm switch to ARM, arms the A/T for engagement in the N1, MCP SPD or FMC SPD mode. The A/T Arm switch is magnetically held at ARM and releases to OFF when the A/T becomes disengaged.

When the A/T is initially engaged in MCP SPD, the MCP speed target is updated to the current airspeed.

A general summary of A/T mode engagement is as follows:

- A/T SPD or N1 modes automatically engage when AFDS command pitch modes become engaged
- engaging LVL CHG or VNAV climb modes automatically engages the A/T N1 mode
- engaging LVL CHG or VNAV descent modes automatically engages the A/T in RETARD and then ARM when thrust is at idle
- if not in a VNAV mode, engagement of ALT ACQ or ALT HOLD automatically engages the A/T in the MCP SPD mode; otherwise the A/T remains in FMC SPD
- engagement of G/S capture automatically engages the A/T in the MCP SPD mode

- alpha floor automatically engages the A/T when armed
- if V/S is engaged during takeoff and below the thrust reduction height the A/T may not activate until reaching thrust reduction height, at that point the MCP speed target may be updated to the current airspeed, which may be different than the airspeed previously selected on the MCP.

Autothrottle Disengagement

Any of the following conditions or actions disengages the A/T:

- moving the A/T Arm switch to OFF
- pushing either A/T Disengage switch
- an A/T system fault is detected
- two seconds have elapsed since landing touchdown

The thrust levers should normally be aligned to no more than one full knob width difference during all ranges of normal operation with symmetrical thrust.

The autothrottle also disengages if it is engaged in a Speed mode, Retard for descent mode, or an N1 mode other than A/T GA mode AND;

[Option - Throttle Split Monitor, Honeywell MCP and Smiths A/T computer, with or without Quiet Climb]

- thrust levers become separated more than 10 degrees during a dual channel approach after FLARE armed is annunciated

[Option - Throttle Split Monitor, Collins MCP with integrated A/T, without Quiet Climb]

- thrust levers become separated more than 10 degrees

[Option - Throttle Split Monitor, Collins MCP with integrated A/T, with Quiet Climb]

- thrust levers become separated more than 10 degrees, except during takeoff, with a cutback N1 selected

[Option - Thrust Split Monitor, Honeywell MCP and Smiths A/T computer]

- significant thrust difference along with control wheel roll input of 10 degrees or more, and flap position up through 10

[Option - Thrust Split Monitor, Collins MCP with integrated A/T, without Quiet Climb]

- significant thrust difference along with control wheel roll input of 10 degrees or more at any point throughout the entire flight envelope

[Option - Thrust Split Monitor, Collins MCP with integrated A/T, with Quiet Climb]

- significant thrust difference along with control wheel roll input of 10 degrees or more throughout the entire flight envelope, except during takeoff, with a cutback N1 selected.

A/T disengagement is followed by A/T Arm switch releasing to OFF and flashing red A/T Disengage lights. The A/T Disengage lights do not illuminate when the A/T automatically disengages after landing touchdown.

Automatic Flight Operations

The phases of flight for automatic flight operations are:

- Takeoff and climb
- Enroute
- Approach and landing
- Go–around

Automatic Flight Takeoff and Climb

Takeoff is a flight director only function of the TO/GA mode. Flight director pitch and roll commands are displayed and the autothrottle maintains takeoff N1 thrust limit as selected from the FMC. The autopilot may be engaged after takeoff.

[Option - Flight director commands wings level on takeoff]
Both F/Ds must be ON to engage the takeoff mode prior to starting the takeoff. The F/D takeoff mode is engaged by pushing the TO/GA switch on either thrust lever. The FMAs display FD as the A/P status, TO/GA as the pitch mode, and blank for the roll mode.

[Option - Flight director commands HDG SEL on takeoff]
Both F/Ds must be ON to engage the takeoff mode prior to starting the takeoff. The F/D takeoff mode is engaged by pushing the TO/GA switch on either thrust lever. The FMAs display FD as the A/P status, TO/GA as the pitch mode, and HDG SEL as the roll mode.

During takeoff, pushing a TO/GA switch engages the autothrottle in the N1 mode. The A/T annunciation changes from ARM to N1 and thrust levers advance toward takeoff thrust.

The F/D can also be engaged in the takeoff mode with the F/D switches off. If a TO/GA switch is pushed after 80 knots below 2000 feet AGL and prior to 150 seconds after lift–off, the F/D command bars automatically appear for both pilots.

[Option - Flight director commands wings level on takeoff]
During takeoff, prior to 60 KIAS:

- the pitch command is 10 degrees nose down
- the roll command is wings level
- the autothrottle is engaged in the N1 mode
- thrust levers advance until the engines reach takeoff thrust
- the FMAs display N1 for the autothrottle mode, TO/GA for the pitch mode, and blank for the roll mode.

[Option - Flight director commands HDG SEL on takeoff]
During takeoff, prior to 60 KIAS:

- the pitch command is 10 degrees nose down
- the roll command is HDG SEL
- the autothrottle is engaged in the N1 mode
- thrust levers advance until the engines reach takeoff thrust
- the FMAs display N1 for the autothrottle mode, TO/GA for the pitch mode, and HDG SEL for the roll mode.

At 60 KIAS, the F/D pitch commands 15 degrees nose up.

At 84 KIAS, the A/T mode annunciates THR HLD.

At LIFT-OFF:

- the pitch command continues at 15 degrees until sufficient climb rate is acquired. Pitch then commands MCP speed (normally V2) plus 20 knots
- if an engine failure occurs on the ground, the pitch command target speed at lift-off is V2 or airspeed at lift-off, whichever is greater.

[Option - Flight director commands wings level on takeoff]
- the roll command maintains wings level.

[Option - Flight director commands HDG SEL on takeoff]
- the roll command maintains HDG SEL. Bank angle is limited to 8 degrees below 400 feet, and 10–30 degrees selectable above 400 feet AGL.

After LIFT-OFF:

- if an engine failure occurs, the pitch command target speed is:
  - V2, if airspeed is below V2.
  - existing speed, if airspeed is between V2 and V2 + 20.
  - V2 + 20, if airspeed is above V2 + 20.
- the A/T remains in THR HLD until 800 feet above field elevation. A/T annunciation then changes from THR HLD to ARM and reduction to climb thrust can be made by pushing the N1 switch.

  Note: During a reduced thrust takeoff, a second press of the TO/GA switch below 800 feet above field elevation will change the thrust limit mode to GA and N1 reference bugs to increase to full GA thrust, thrust levers will not be in motion. A second press of the TO/GA switch above 800 feet above field elevation, thrust levers advance toward full GA thrust.

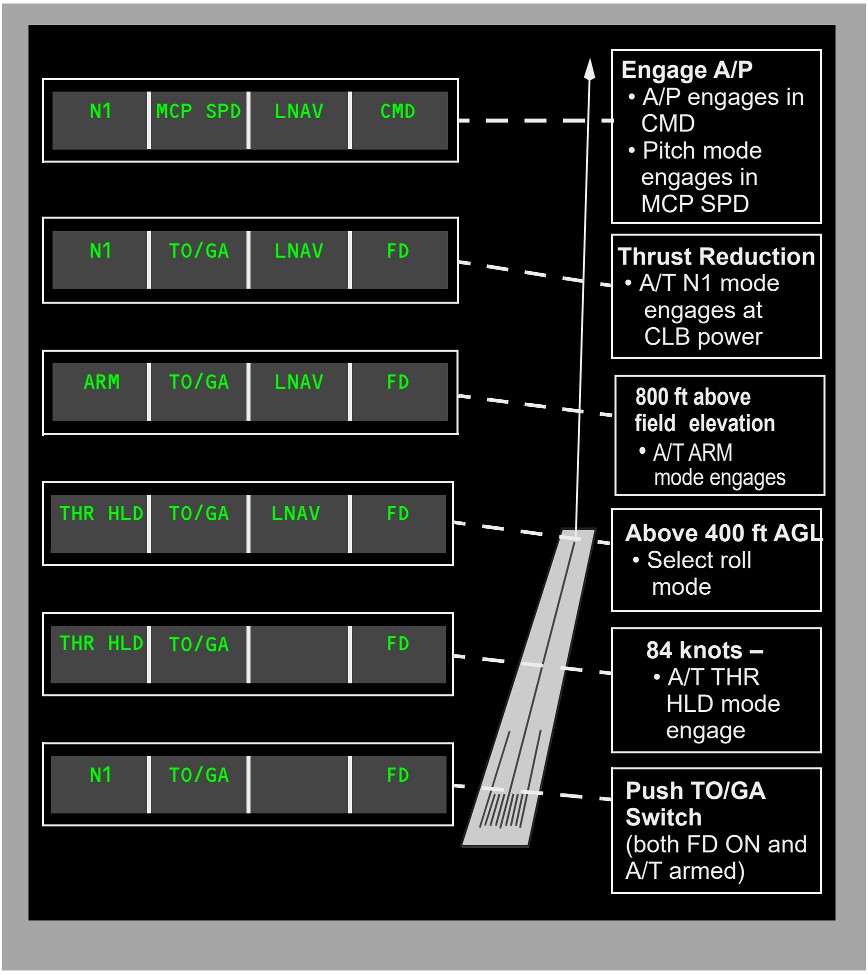
[Option - Without automatic thrust reduction after takeoff]
- automatic thrust reduction to climb power occurs when VNAV, ALT ACQ or ALT HOLD is engaged. Until 2 1/2 minutes after liftoff, automatic thrust reduction is inhibited when engaging LVL CHG or V/S modes.

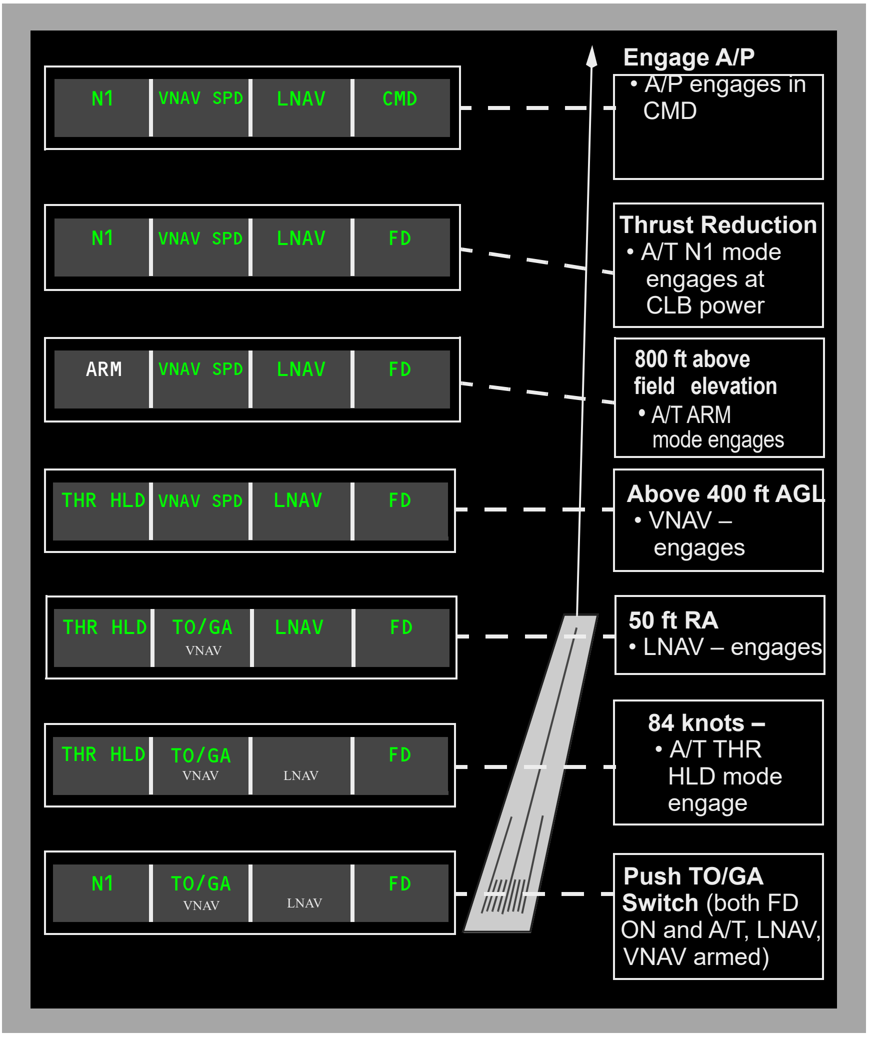
[Option - Automatic thrust reduction after takeoff, FMC update 10.1 and later]

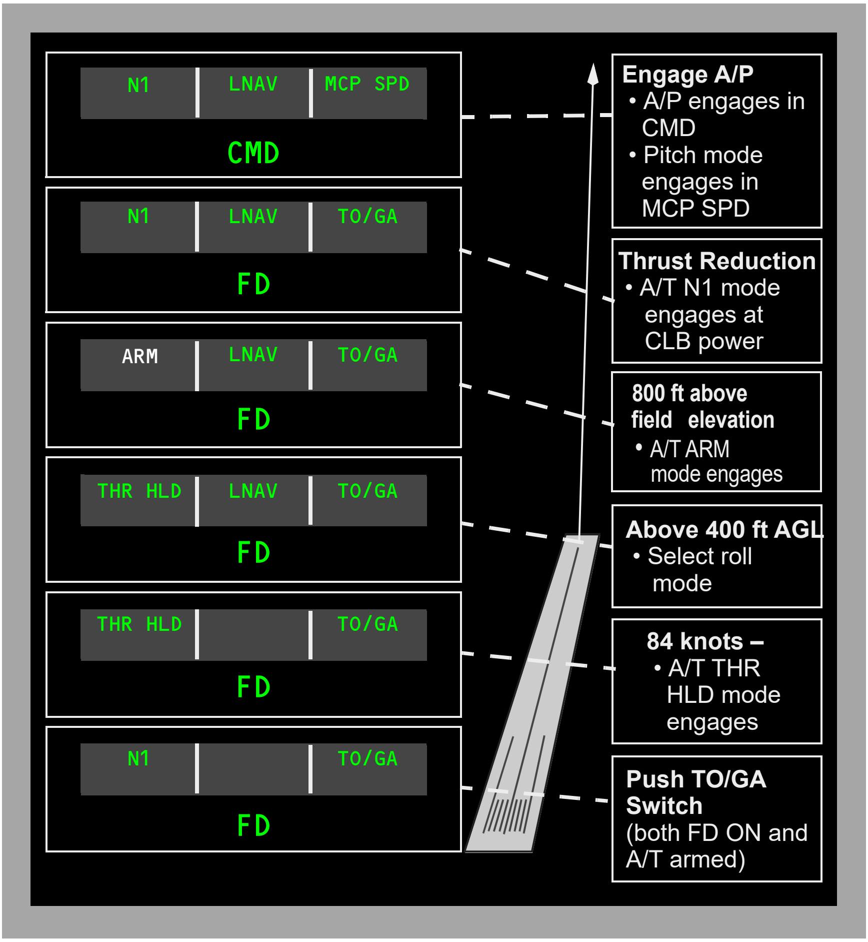
- automatic reduction to climb thrust occurs upon reaching the selected thrust reduction altitude which is shown on the FMC CDU TAKEOFF REF page 2/2 during preflight, or when the airplane levels off in ALT HOLD or VNAV PTH. Pilot entries can be made to override the default value. Allowable entries are 800 feet to 9999 feet
- flight director engaged status is terminated by engaging an autopilot in CMD (CMD replaces FD in A/P status display)
  - pitch engages in LVL CHG and pitch mode FMA is MCP SPD unless another pitch mode has been selected
  - MCP IAS/Mach display and airspeed cursor change to V2 + 20 knots
  - roll mode engages in HDG SEL unless another roll mode has been selected.

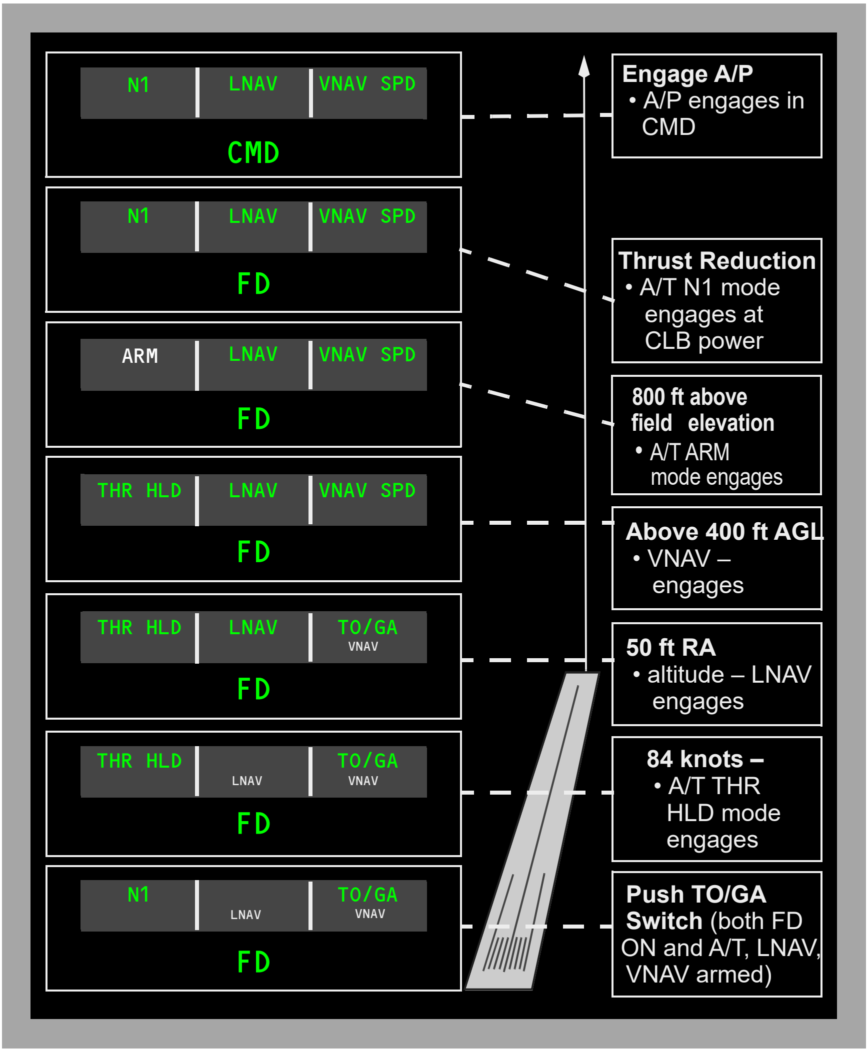
To terminate the takeoff mode below 400 feet RA, both F/D switches must be turned OFF. Above 400 feet RA, selection of another pitch mode or engaging an autopilot will terminate the takeoff mode; other F/D roll modes can be also selected.

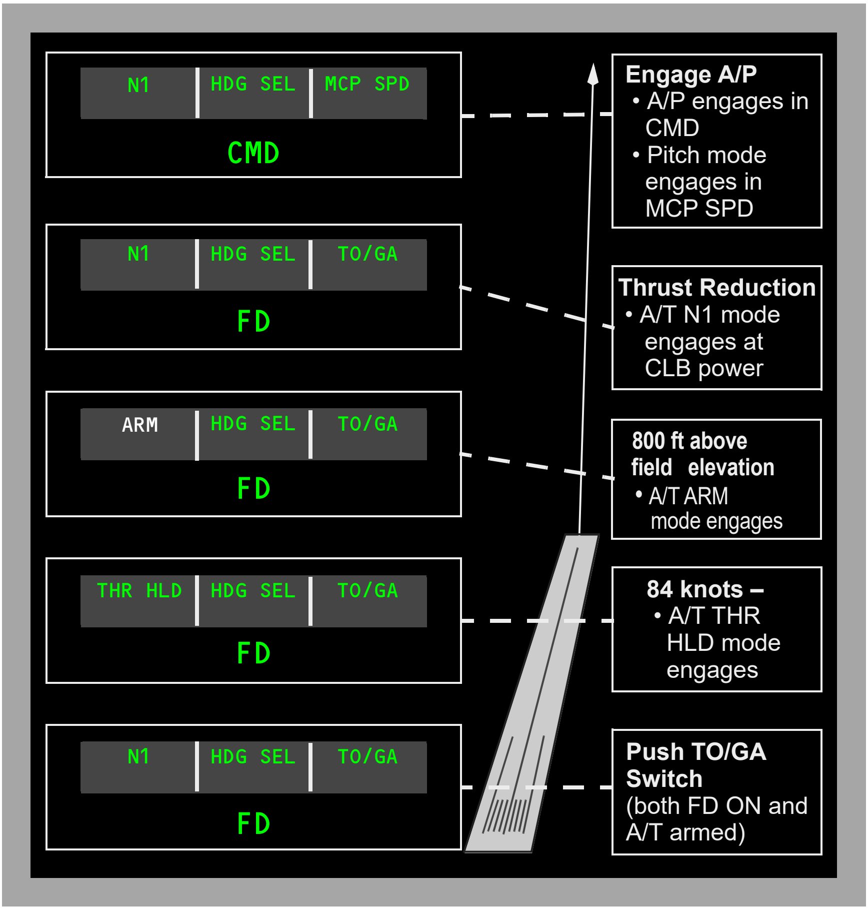
Automatic Flight Takeoff Profile

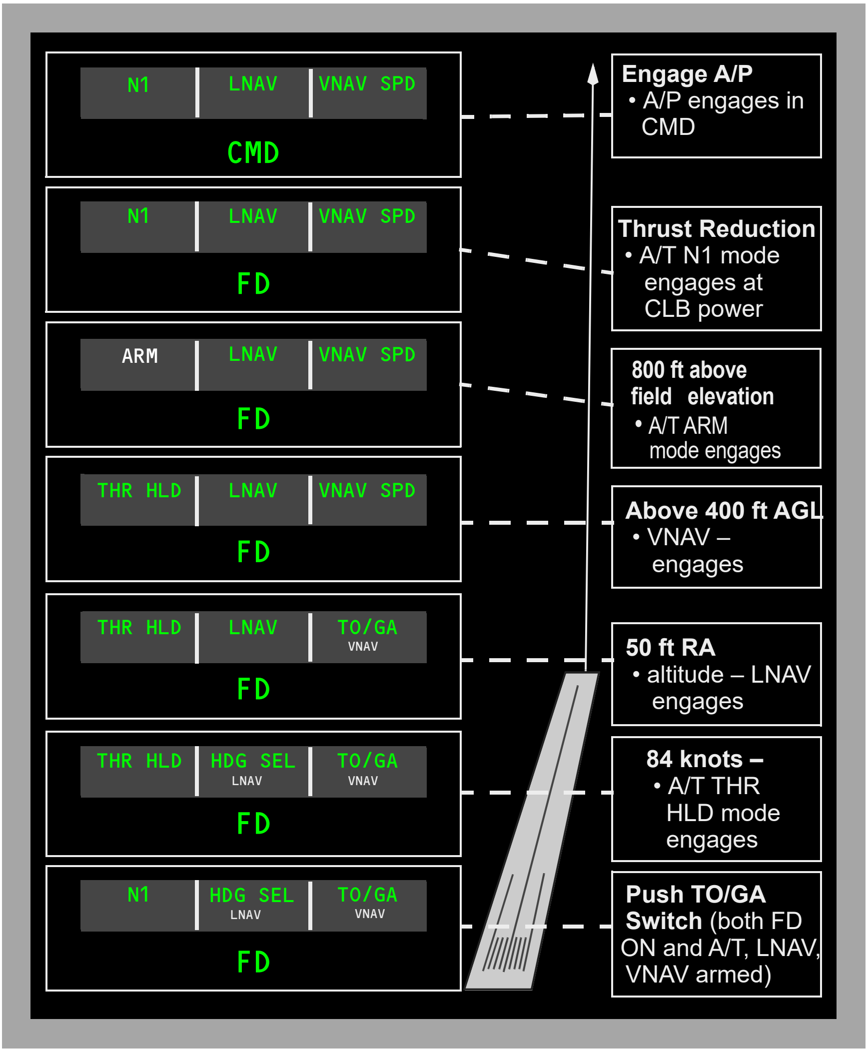



N1
VNAV SPD
LNAV
CMD
Engage A/P
• A/P engages in CMD
N1
VNAV SPD
LNAV
FD
Thrust Reduction
• A/T N1 mode engages at CLB power
ARM
VNAV SPD
LNAV
FD
800 ft above field elevation
• A/T ARM mode engages
THR HLD
VNAV SPD
LNAV
FD
Above 400 ft AGL
• VNAV – engages
THR HLD
TO/GA
VNAV
LNAV
FD
50 ft RA
• LNAV – engages
THR HLD
TO/GA
VNAV
LNAV
FD
84 knots –
• A/T THR HLD mode engage
N1
TO/GA
VNAV
LNAV
FD
Push TO/GA Switch (both FD ON and A/T, LNAV, VNAV armed)


N1
LNAV
MCP SPD
CMD
N1
LNAV
TO/GA
FD
ARM
LNAV
TO/GA
FD
THR HLD
LNAV
TO/GA
FD
THR HLD
TO/GA
FD
N1
TO/GA
FD
Engage A/P
• A/P engages in CMD
• Pitch mode engages in MCP SPD
Thrust Reduction
• A/T N1 mode engages at CLB power
800 ft above field elevation
• A/T ARM mode engages
Above 400 ft AGL
• Select roll mode
84 knots –
• A/T THR HLD mode engages
Push TO/GA Switch
(both FD ON and A/T armed)


N1
LNAV
VNAV SPD
CMD
N1
LNAV
VNAV SPD
FD
ARM
LNAV
VNAV SPD
FD
THR HLD
LNAV
VNAV SPD
FD
THR HLD
LNAV
TO/GA
VNAV
FD
THR HLD
LNAV
TO/GA
VNAV
FD
N1
LNAV
TO/GA
VNAV
FD
Engage A/P
• A/P engages in CMD
Thrust Reduction
• A/T N1 mode engages at CLB power
800 ft above field elevation
• A/T ARM mode engages
Above 400 ft AGL
• VNAV – engages
50 ft RA
• altitude – LNAV engages
84 knots –
• A/T THR HLD mode engages
Push TO/GA Switch (both FD ON and A/T, LNAV, VNAV armed)


N1
HDG SEL
MCP SPD
CMD
N1
HDG SEL
TO/GA
FD
ARM
HDG SEL
TO/GA
FD
THR HLD
HDG SEL
TO/GA
FD
N1
HDG SEL
TO/GA
FD
Engage A/P
• A/P engages in CMD
• Pitch mode engages in MCP SPD
Thrust Reduction
• A/T N1 mode engages at CLB power
800 ft above field elevation
• A/T ARM mode engages
84 knots –
• A/T THR HLD mode engages
Push TO/GA Switch
(both FD ON and A/T armed)



Automatic Flight En Route

The autopilot and/or the flight director can be used after takeoff to fly a lateral navigation track (LNAV) and a vertical navigation track (VNAV) provided by the FMC.

Other roll modes available are:

- VOR course (VOR/LOC)
- heading select (HDG SEL).

Other pitch modes available are:
- altitude hold (ALT HOLD)
- level change (MCP SPD)
- vertical speed (V/S).

Automatic Flight Approach and Landing

The AFDS provides guidance for single A/P non–precision approaches. The VOR/LOC switch arms the AFDS for VOR or localizer tracking. Descent may be accomplished using VNAV, LVL CHG, or V/S. VOR/LOC, LNAV, or HDG SEL may be used for the roll mode.

The AFDS provides guidance for single or dual A/P precision approaches. The approach mode arms the AFDS to capture and track the localizer and glideslope.

Approach (APP) Mode Dual A/Ps

Approach mode allows both A/Ps to be engaged at the same time. Dual A/P operation provides fail–passive operation through landing flare and touchdown or an automatic go–around. During fail passive operation, the flight controls respond to the A/P commanding the lesser control movement. If a failure occurs in one A/P, the failed channel is counteracted by the second channel such that both A/Ps disengage with minimal airplane maneuvering and with aural and visual warnings to the pilot.

[Option - Fail-Operational Autoland]
Approach mode allows both A/Ps to be engaged at the same time. Dual A/P operation provides either fail–operational or fail–passive operation through landing flare, touchdown and rollout, or through an automatic go–around. If a failure is detected, the flight controls respond to the A/P commanding the lesser control movement. If a failure occurs in one A/P, the failed channel is counteracted by the second channel such that both A/Ps disengage with minimal airplane maneuvering and with aural and visual warnings to the pilot.

One VHF NAV receiver must be tuned to an ILS frequency before the approach mode can be selected. For a dual A/P approach, the second VHF NAV receiver must be tuned to the ILS frequency and the corresponding A/P engaged in CMD prior to 800 feet RA.

If the pilot is flying manually but not following the approach flight director guidance and then selects an autopilot CMD engagement, the autopilot reverts to CWS for the pitch and roll mode.

[Option - FCC P8.0 Software]
If the pilot is flying manually but not following the approach flight director guidance and then selects an autopilot CMD engagement, the autopilot reverts to CWS for the pitch and roll mode. The approach mode(s) will then re-arm.

Localizer and Glideslope Armed

After setting the localizer frequency and course, pushing the APP switch selects the APP mode. The APP switch illuminates and VOR/LOC and G/S annunciate armed. The APP mode permits selecting the second A/P to engage in CMD. This arms the second A/P for automatic engagement after LOC and G/S capture and when descent below 1500 RA occurs.

The localizer can be intercepted in the HDG SEL, CWS R or LNAV mode.

[Option - G/S capture inhibited before LOC capture]
Glideslope (G/S) capture is inhibited prior to localizer capture.

Localizer Capture

[Option - EFIS/MAP]
The LOC capture point is variable and depends on intercept angle and rate of closure. Capture occurs no later than 1/2 dot. Upon LOC capture, VOR/LOC annunciates captured, 1 CH is annunciated for A/P status, the previous roll mode disengages and the airplane turns to track the LOC.

[Option - PFD/ND]
The LOC capture point is variable and depends on intercept angle and rate of closure. Capture occurs no later than 1/2 dot. Upon LOC capture, VOR/LOC annunciates captured, SINGLE CH is annunciated for A/P status, the previous roll mode disengages and the airplane turns to track the LOC.

Glideslope Capture

[Option - G/S capture inhibited before LOC capture]
Glideslope capture is inhibited prior to localizer capture.

The G/S can be captured from above or below. Capture occurs at 2/5 dot and results in the following:

- G/S annunciates captured
- previous pitch mode disengages
- APP light extinguishes if localizer has also been captured
- airplane pitch tracks the G/S
- GA displayed on thrust mode display (N1 thrust limit).

After VOR/LOC and G/S are both captured, the APP mode can be exited by:

- pushing a TO/GA switch
- disengaging A/P and turning off both F/D switches
- retuning a VHF NAV receiver.

After LOC and G/S Capture

Shortly after capturing LOC and G/S and below 1500 feet RA:

- the second A/P couples with the flight controls
- test of the ILS deviation monitor system is performed and the G/S and LOC display turns amber and flashes
- test of autopilot rudder servo is performed
- FLARE armed is annunciated
- ROLLOUT armed is annunciated

[Option - EFIS/MAP]
- the 1 CH annunciation extinguishes

[Option - PFD/ND]
- the SINGLE CH annunciation extinguishes
- A/P go–around mode arms but is not annunciated.

Note: During a dual autopilot approach and after FLARE ARM annunciation, any attempted manual override of the autopilots may result in an autopilot disengage.

The A/Ps disengage and the F/D command bars retract to indicate an invalid ILS signal.

800 Feet Radio Altitude

The second A/P must be engaged in CMD by 800 feet RA to execute a dual channel A/P approach. Otherwise, CMD engagement of the second A/P is inhibited.

500 Feet Radio Altitude

[Option – Fail-Operational Autoland]
The pilot is required to check for the presence of LAND 3 or LAND 2 in order to continue the autoland.

If the second autopilot in CMD remains armed and does not engage, LAND 2 or LAND 3 does not annunciate. Instead, the amber NO AUTOLAND annunciation alerts the pilot that dual control has not been established and the autoland is to be discontinued.

450 Feet Radio Altitude

[Option – Fail-Operational Autoland]
The alignment mode is enabled which provides rudder compensation for the purpose of decreasing large crab angles produced by crosswinds, and to control the adverse moments caused by an engine failure. The automatic correction for aircraft crab angle due to crosswinds and engine failure enhances flight crew runway perspective and provides optimal aircraft position for initiation of rollout control. In a strong crosswind, the airplane does not fully align with the runway but lands in a slight crab. Sideslip is limited to 5 degrees. This mode is not annunciated.

400 Feet Radio Altitude

The stabilizer is automatically trimmed an additional amount nose up. If the A/Ps subsequently disengage, forward control column force may be required to hold the desired pitch attitude.

If FLARE is not armed by approximately 350 feet RA, both A/Ps automatically disengage.

Flare

The A/P flare maneuver starts at approximately 50 feet RA and is completed at touchdown:

- FLARE engaged is annunciated and F/D command bars retract.
- FLARE engaged is annunciated and with LAND 3 annunciated, F/D command bars center
- the A/T begins retarding thrust at approximately 27 feet RA so as to reach idle at touchdown. A/T FMA annunciates RETARD
- the A/T automatically disengages approximately 2 seconds after touchdown.
- the A/P must be manually disengaged after touchdown. Landing roll-out is executed manually after disengaging the A/P.

Rollout

[Option - Fail-Operational Autoland]
ROLLOUT arms when LAND 2 or LAND 3 annunciates.

At approximately two feet radio altitude, rollout activates:

- ROLLOUT replaces the VOR/LOC roll flight mode annunciation
- the autopilot controls the rudder and nose wheel steering to keep the airplane on the localizer centerline
- rollout guidance continues until a full stop or until the autopilots are disengaged.

Approach (APP) Mode Single A/P

A single A/P ILS approach can be executed by engaging only one A/P in CMD after pushing the APP mode select switch. Single A/P approach operation is the same as dual, with the following exceptions:

- full automatic flare and touchdown capability is not available. FLARE is not annunciated and stabilizer trim bias is not applied
- if the pilot is flying manually but not following the approach flight director guidance and then selects an autopilot CMD engagement, the autopilot reverts to CWS for the pitch and/or roll mode

[Option - FCC P8.0 or greater Software]
- if the pilot is flying manually but not following the approach flight director guidance and then selects an autopilot CMD engagement, the autopilot reverts to CWS for the pitch and/or roll mode. The approach mode(s) will then re-arm

[Option - DEFIS/MAP]
- A/P status of 1 CH is annunciated for the entire approach after localizer capture

[Option - PDF/ND]
- A/P status of SINGLE CH is annunciated for the entire approach after localizer capture
- an A/P go–around is not available

[Option - CWS deactivated on approach]
- after localizer or glideslope capture CWS cannot be engaged by manually overriding pitch and/or roll control forces. Manually overriding pitch and/or roll will cause autopilot disengage. At autopilot disengage, the active Autopilot modes will remain engaged.

ILS Beam Anomaly/Ground Station Failure Detection

For a single channel or F/D only approach, the autopilot will disengage and/or the F/D bars will be removed if a persistent localizer/glideslope beam anomaly or ground station failure is detected.

[Option - Fail-Operational Autoland]
For a dual channel approach prior to annunciation of LAND 3 or LAND 2, the autopilot will disengage and/or the F/D bars will be removed if a persistent localizer/glideslope beam anomaly or ground station failure is detected.

If a beam anomaly is detected after annunciation of LAND 3 or LAND 2, the appropriate localizer or glideslope deviation scale will turn amber and flash, the corresponding deviation pointer will flash, and a horizontal amber line will be drawn through the appropriate roll (VOR/LOC) or pitch (G/S) mode on the primary FMA display indicating “mode fail”. The A/P will remain engaged until manually disengaged.

For ground station failures after annunciation of LAND 3 or LAND 2, the appropriate localizer or glideslope deviation scale will turn amber and flash, the corresponding deviation pointer will blank, and a horizontal amber line will be drawn through the appropriate roll (VOR/LOC) or pitch (G/S) mode on the primary FMA display indicating “mode fail”. The A/P will remain engaged until manually disengaged.

Single Engine Landing

[Option – Fail-Operational Autoland]

If an engine fails and the APU is used to provide a second electrical source prior to engagement of the second autopilot, LAND 3 will be displayed, as the autopilot is still capable of providing rudder compensation throughout the approach and landing rollout. An approach and autoland to a decision height below 50 ft is prohibited.

Automatic engine out rudder compensation is provided during A/P approach and landing.

In the event of a A/P go-around, the A/P will continue to compensate for asymmetric thrust until another roll mode is selected.

Approach (APP) Mode Integrated Approach Navigation

[Option – Integrated Approach Nav]

The Integrated Approach Navigation (IAN) modes are armed/engaged by selecting the APP button on the AFDS Mode Control Panel (MCP). Once armed, the autopilot/flight director will capture and track the localizer/final approach course and glideslope/glide path.

The following roll and pitch mode control annunciations of the FMA will be displayed:

- For an ILS approach, VOR/LOC and G/S will be the displayed roll and pitch modes
- For an FMC IAN approach, FAC and G/P will be the displayed roll and pitch modes
- For an ILS approach with G/S selected off or a localizer only approach, VOR/LOC and G/P will be the displayed roll and pitch modes
- For a backcourse localizer approach, B/CRS and G/P will be the displayed roll and pitch modes.

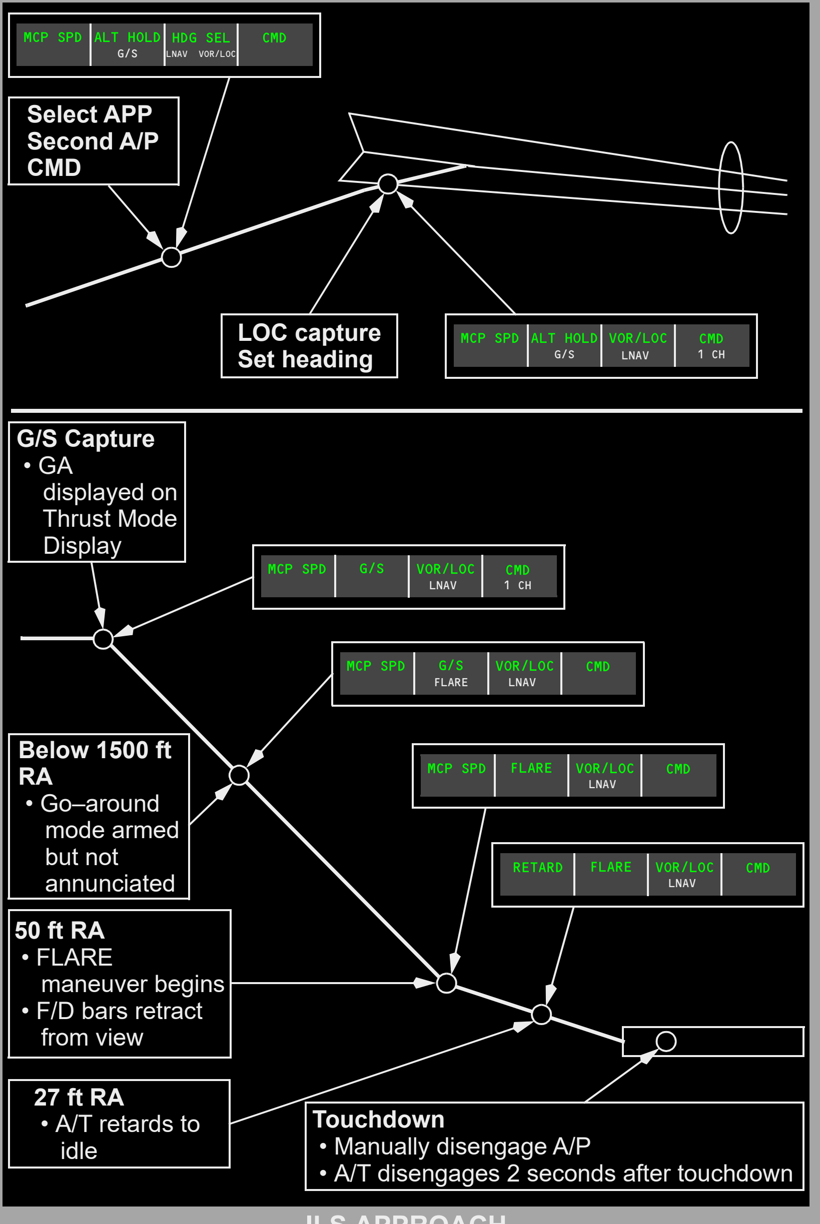
The armed and engaged states of FAC and G/P follow the established convention. The flight control system resets the FAC and G/P modes (the modes blank on the display) for the following cases:

- Loss of deviation signals
- Loss of validity
- Detection of a FAC or G/P failure.

When the modes are reset, the FCC will remove (bias out of view) the F/D bars, and disengage the A/P. These are analogous to the VOR/LOC and G/S reset modes.

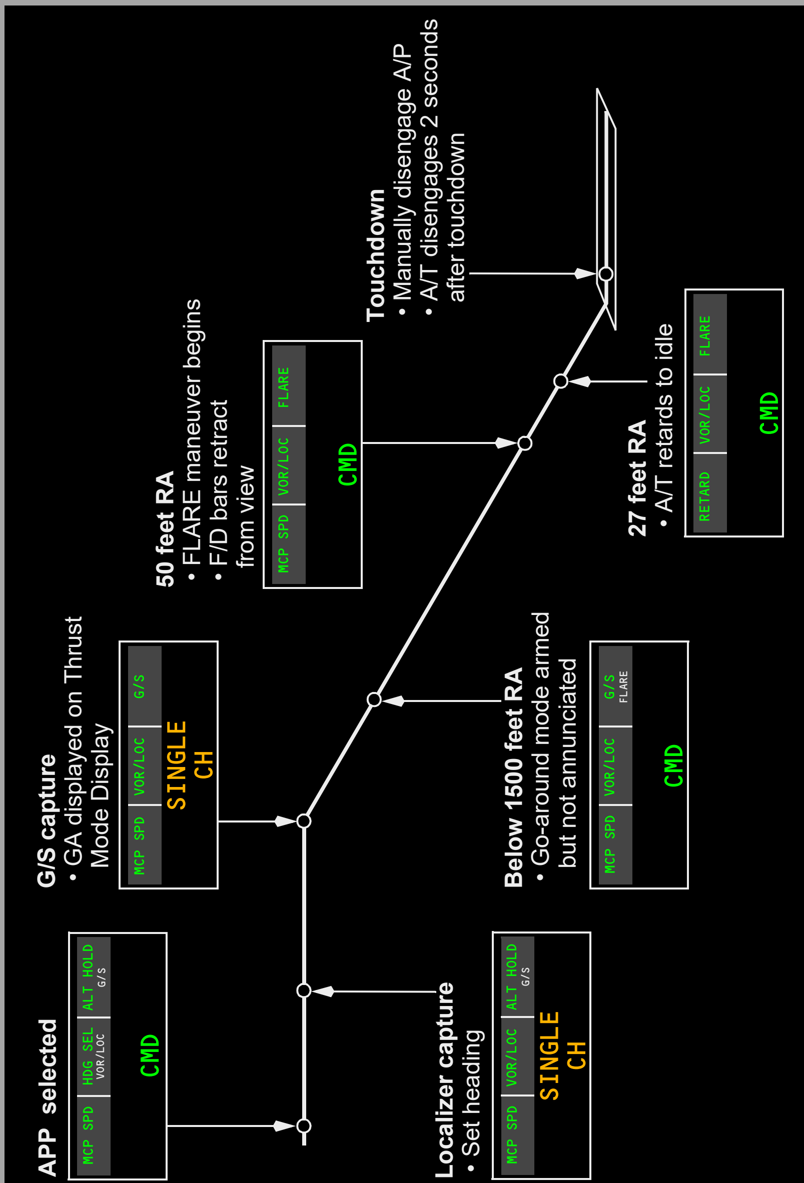
Automatic Flight Approach Profile

[Option - EFIS/MAP with TO/GO to LNAV Option]



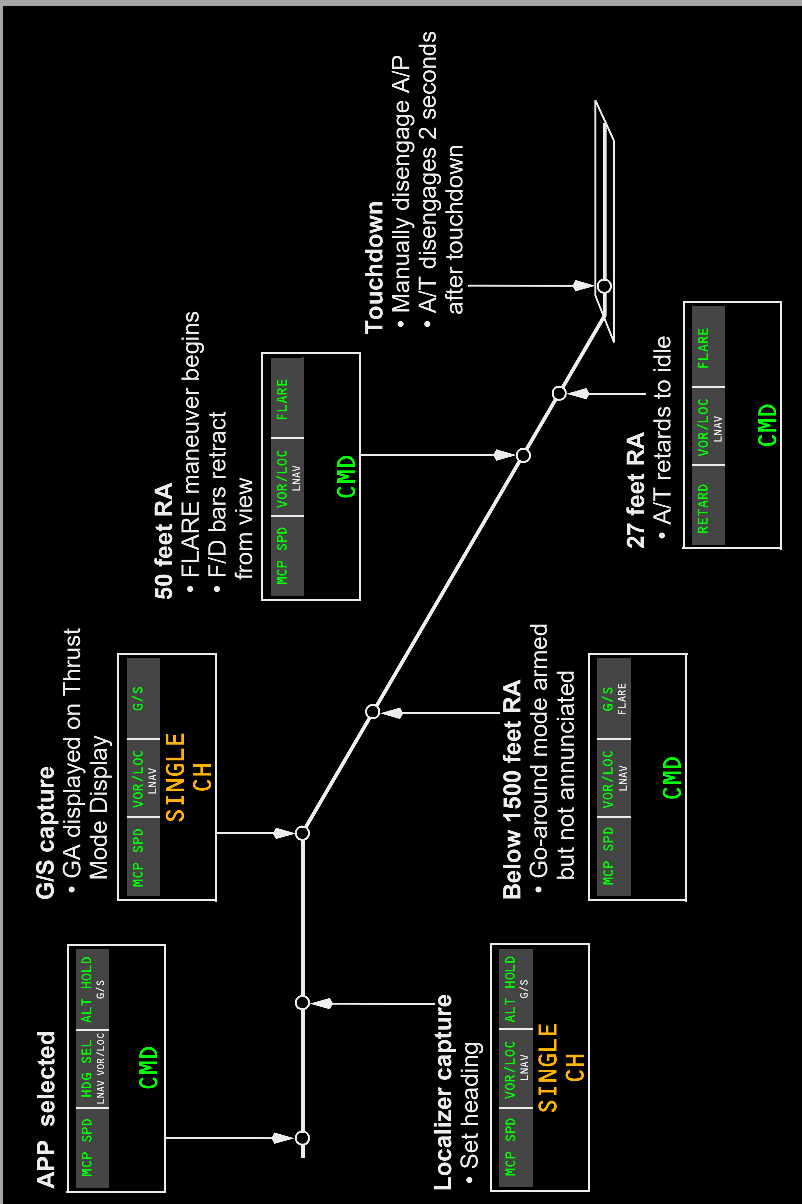
ILS APPROACH

[Option - PFD/ND]



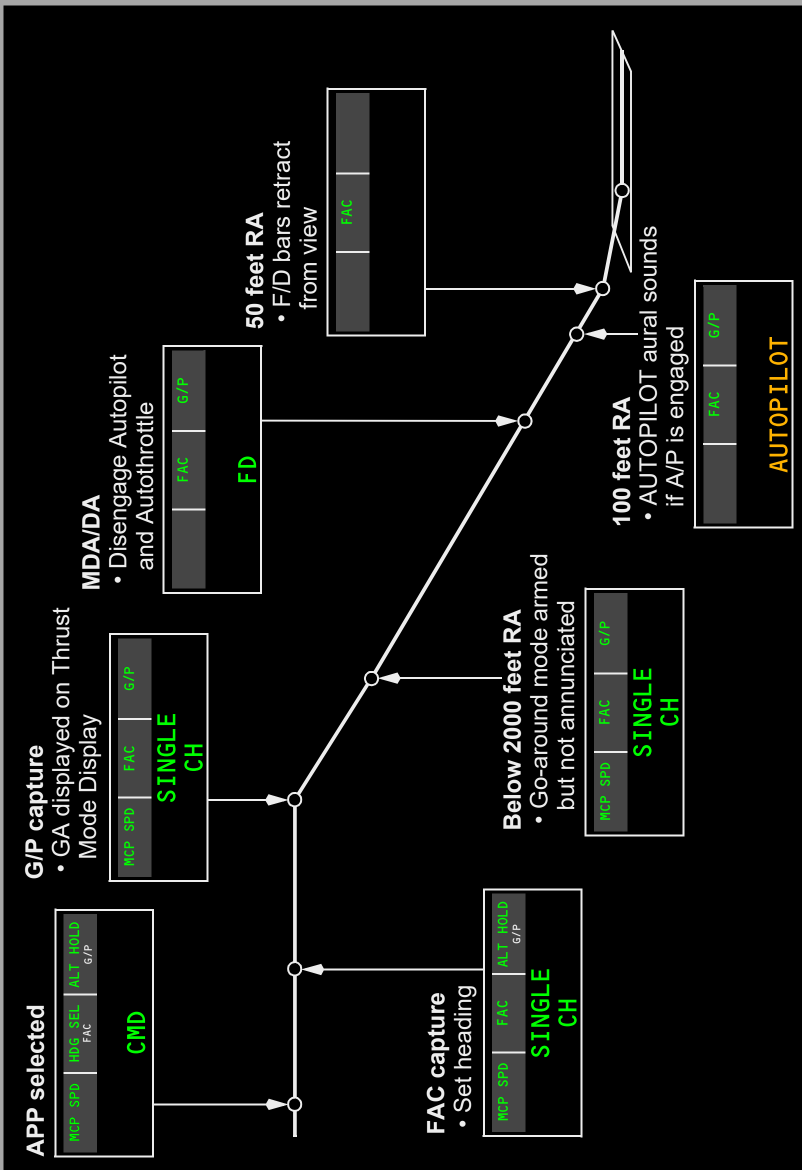
ILS APPROACH

[Option - PFD/ND with TO/GO to LNAV Option]



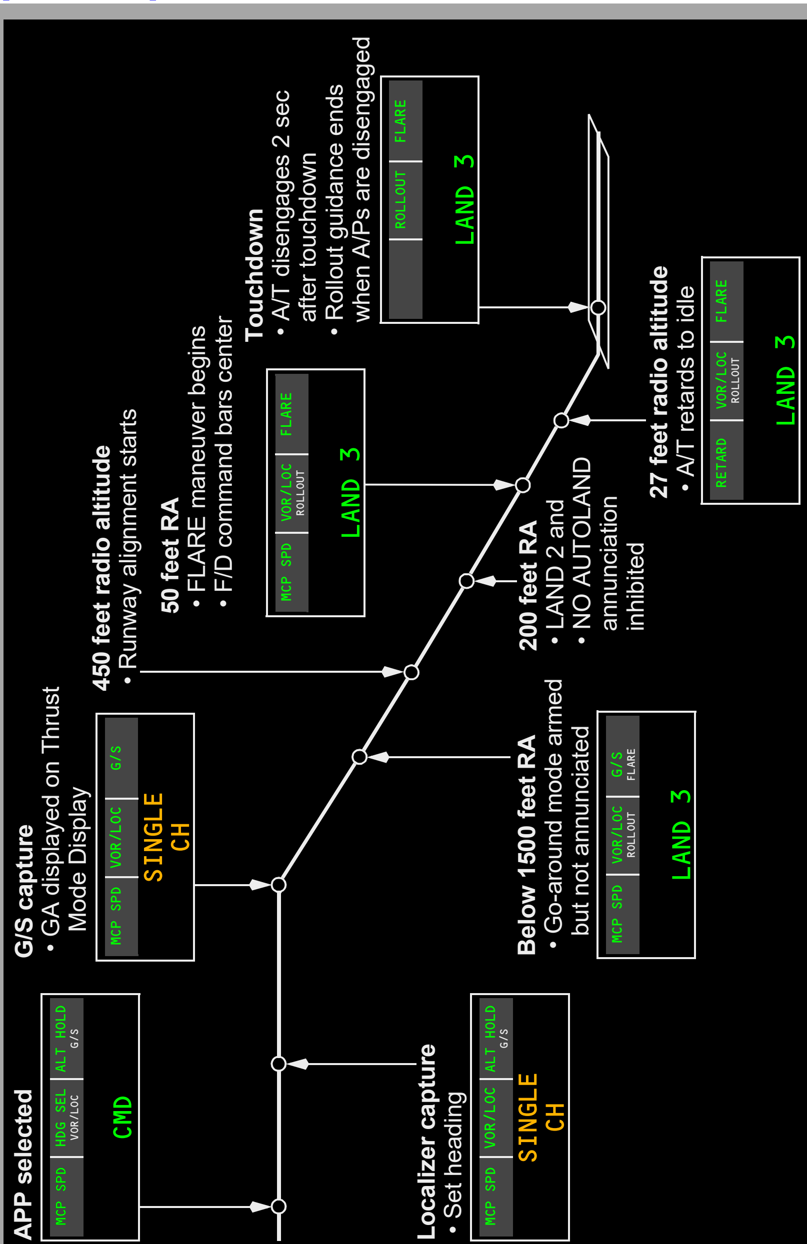
ILS APPROACH

[Option - IAN]



IAN APPROACH

[Option - Fail-Operational Autoland]



FAIL-OPERATIONAL APPROACH

Go–Around

Go–Around (GA) mode is engaged by pushing either TO/GA switch. An A/P go–around requires dual A/P operation and is armed when FLARE armed is annunciated. If both A/Ps are not operating, a manual F/D go–around is available.

With the A/T Arm switch at ARM, the A/T go–around mode is armed:

- when descending below 2000 feet RA (below 15,500 feet pressure altitude if both RA's have failed)
- with or without the AFDS engaged.

Note: With the A/T ARM switch at ARM, when at or above 2000 feet RA (at or above 15,500 feet pressure altitude if both RA's have failed), with flaps not up or G/S captured, the A/T will respond to a TO/GA switch push, but will engage in the A/T N1 thrust mode and not the reduced go around thrust mode.

A/P Go–Around

The A/P GA mode requires dual A/P operation and is available after FLARE armed is annunciated and prior to the A/P sensing touchdown.

Note: For go-arounds initiated at or above 2000 feet RA, either a single or a double button push will engage A/T N1 thrust mode and not the reduced go-around N1 thrust mode. During this time, the A/T FMA will show N1.

With the first push of either TO/GA switch:

- Below 2000 feet RA (below 15,500 feet pressure altitude if both RA's have failed):
  - A/T (if armed) engages in GA and the A/T Engaged Mode annunciation on the FMA indicates GA
  - thrust advances toward the reduced go–around N1 to produce 1000 to 2000 fpm rate of climb
- at or above 2000 feet RA (at or above 15,500 feet pressure altitude if both RA's have failed):
  - A/T (if armed) engages in N1 and the A/T Engaged Mode annunciation on the FMA indicates N1
  - thrust advances toward the full go-around N1 thrust limit
- pitch mode engages in TO/GA and the Pitch Engaged Mode annunciation on the FMA indicates TO/GA
- F/D pitch commands 15 degrees nose up until reaching programmed rate of climb. F/D pitch then commands target airspeed for each flap setting based on maximum takeoff weight calculations.
- F/D roll commands hold current ground track. The Roll Engaged Mode annunciation on the FMA is blank

- F/D roll commands hold current ground track at or below 400 feet RA. Above 400 feet RA LNAV will engage. The Roll Mode annunciation will display LNAV armed at or below 400 feet RA and LNAV engaged above 400 feet RA.
- the IAS/Mach display blanks
- the command airspeed cursor automatically moves to a target airspeed for the existing flap position based on maximum takeoff weight calculations.

If the TO/GA switch is pressed after touchdown and prior to A/T disengagement, A/P disengages and the A/T may command GA thrust.

[Option - Fail-Operational Autoland]
During a fail-operational autoland as indicated by a LAND 3 annunciation or a degraded fail-passive landing with an accompanying NO LAND 3/LAND 2 annunciation, pressing the TO/GA switch after touchdown or activating the manual electric trim will be ignored by both autopilot channels, both flight directors, and the autothrottle system. This ensures that an inadvertent press of the TO/GA switch does not affect rollout.

With the second push of either TO/GA switch after A/T reaches reduced go–around thrust, the A/T advances to the full go–around N1 limit.

TO/GA mode termination from A/P go–around:

- below 400 feet RA, the AFDS remains in the go–around mode unless both A/Ps and F/Ds are disengaged

  [Option - Fail-Operational Autoland]
- if the A/P is compensating for asymmetric thrust during the go-around, autopilot rudder control is disabled when a new pitch or roll mode is selected
- above 400 feet RA, select a different pitch or roll mode.
  - if the roll mode is changed first:
    - the selected mode engages in single A/P roll operation and is controlled by the A/P which was first in CMD
    - pitch remains in dual A/P control in TO/GA mode.
  - if the pitch mode is changed first:
    - the selected mode engages in single A/P pitch operation and is controlled by the A/P which was first in CMD
    - the second A/P disengages
    - the roll mode engages in CWS R.

- the A/T GA mode is terminated when:
  - another pitch mode is selected
  - ALT ACQ annunciates engaged.

  Note: The pitch mode cannot be changed from TO/GA until sufficient nose–down trim has been input to allow single channel A/P operation. This nose–down trim is automatically added by the A/P to reset the trim input made by the A/P at 400 feet RA and at 50 feet RA during the approach.

With pitch mode engaged in TO/GA, ALT ACQ engages when approaching the selected altitude and ALT HOLD engages at the selected altitude if the stabilizer position is satisfactory for single A/P operation.

- if stabilizer trim position is not satisfactory for single A/P operation:
  - ALT ACQ is inhibited
  - A/P disengage lights illuminate steady red
  - pitch remains in TO/GA.

  Note: To extinguish A/P disengage lights, disengage A/Ps or select higher altitude on MCP.

F/D Go–Around

If both A/Ps are not engaged, a manual F/D only go–around is available under the following conditions:

- inflight below 2000 feet RA

[Option - A/P auto disengages for TO/GA above 2000 feet RA]
[Option - Honeywell -708 FCC and on]

- inflight at or above 2000 feet RA with flaps not up or G/S captured
- not in takeoff mode.
- if the TO/GA switches are activated after touchdown (wheel spin-up)

With the first push of either TO/GA switch:

- below 2000 feet RA (below 15,500 feet pressure altitude if both RA’s have failed):
  - A/T (if armed) engages in GA and the A/T Engaged Mode annunciation on the FMA indicates GA
  - thrust advances toward the reduced go-around N1 to produce 1000 to 2000 fpm rate of climb
- at or above 2000 feet RA (at or above 15,500 feet pressure altitude if both RA’s have failed):
  - A/T (if armed) engages in N1 and the A/T Engage Mode annunciation on the FMA indicates N1
  - thrust advances toward the full go-around N1 thrust limit
- autopilot (if engaged) disengages

- pitch mode engages in TO/GA and the Pitch Engaged Mode annunciation on the FMA indicates TO/GA
- F/D pitch commands 15 degrees nose up until reaching programmed rate of climb. F/D pitch then commands target airspeed for each flap setting based on maximum takeoff weight calculations.
- F/D roll commands approach ground track at time of engagement. The Roll Engaged Mode annunciation on the FMA is blank
- F/D roll commands hold current ground track at or below 50 feet AGL. Above 50 feet AGL, LNAV will engage. The Roll Mode annunciation will display LNAV engaged above 50 feet AGL.
- the IAS/Mach display blanks
- the command airspeed cursor automatically moves to a target airspeed for the existing flap position based on maximum takeoff weight calculations.

With the second push of either TO/GA switch (if A/T engaged and after A/T reaches reduced go–around thrust):

- the A/T advances to the full go–around N1 limit

TO/GA mode termination from F/D go–around:

- below 400 feet RA, both F/D switches must be turned off.
- above 400 feet RA, select a different pitch or roll mode.
  - if the roll mode is changed first:
    - F/D roll engages in the selected mode
    - F/D pitch mode remains in TO/GA.
  - if the pitch mode is changed first:
    - F/D pitch engages in the selected mode.
    - F/D roll mode automatically changes to HDG SEL
  - the A/T GA mode (if engaged) is terminated when:
    - another pitch mode is selected
    - ALT ACQ annunciates engaged

Note: Engaging an A/P in CMD automatically engages the A/P and F/Ds in LVL CHG for pitch.

Single Engine F/D Go–Around

With a push of either TO/GA switch:

- F/D roll commands hold current ground track. The Roll Engaged Mode annunciation on the FMA is blank
- F/D roll commands hold current ground track at or below 50 feet AGL. Above 50 feet AGL, LNAV will engage. The Roll Mode annunciation will display LNAV engaged above 50 feet AGL.
- pitch mode engages in TO/GA and the Pitch Engaged Mode annunciation on the FMA indicates TO/GA

- the F/D target speed is displayed on IAS/Mach display
- the F/D target speed is displayed on the airspeed cursor
- F/D pitch commands 13 degrees nose up. As climb rate increases, F/D pitch commands maintain a target speed.
  - if engine failure occurs prior to go–around engagement, then F/D target speed is the selected MCP speed.
  - if engine failure occurs after go–around engagement, then F/D target speed depends on whether ten seconds have elapsed since go–around engagement:
    - if prior to ten seconds, the MCP selected approach speed becomes target speed
    - if after ten seconds and the airspeed at engine failure is within five knots of the go–around engagement speed, the airspeed that existed at go–around engagement becomes target speed
    - if after ten seconds and the airspeed at engine failure is more than five knots above go–around engagement speed, then the current airspeed becomes target speed.

    Note: The target speed is never less than V2 speed based on flap position unless in windshear conditions.

F/D commanded acceleration cannot occur until a higher speed is selected on the MCP IAS/Mach display.

Go-Around Roll Mode – LNAV in Lieu of Track Hold

[Option - TO/GA to LNAV Go-Around Roll Mode]

When multiple arm modes such as LNAV and VOR/LOC are set, they will appear on the FMA side by side in white.

When a missed approach exists in the flight plan and the FCCs are capable of entering go-around, LNAV arm will be annunciated on the FMA. The roll go-around track hold mode will automatically transition to LNAV during a missed approach.

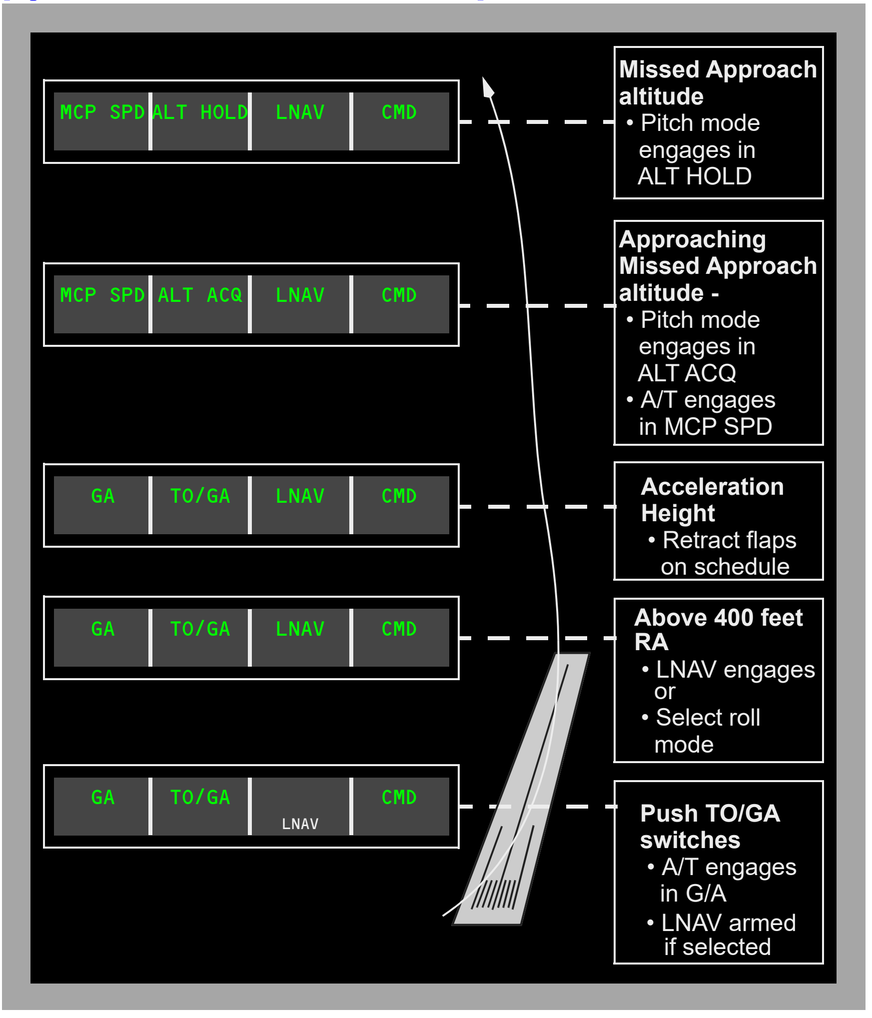
During autoland operations with FLARE arm or FLARE engage displayed, if TO/GA is pressed with LNAV arm annunciated on the FMA, then LNAV will engage when the airplane is above 400 feet. Below that altitude the roll mode will be track hold.

During an approach without FLARE arm or FLARE engage displayed, if TO/GA is pressed with LNAV arm annunciated on the FMA, the flight director LNAV mode will engage when the airplane is above 50 feet. Below that altitude the mode will be track hold.

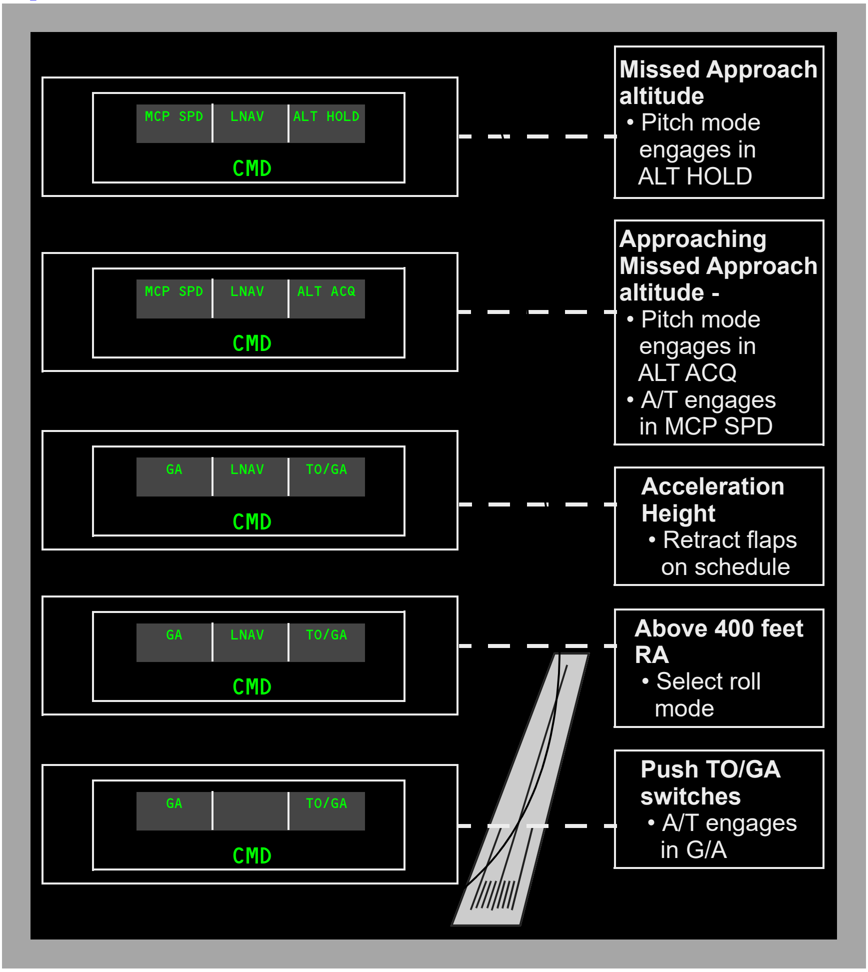
Single channel autopilot minimum engage and use heights are not affected. This feature is recommended to support RNP RNAV operations for terminal procedures requiring definitive course guidance.

Automatic Flight Go–Around Profile

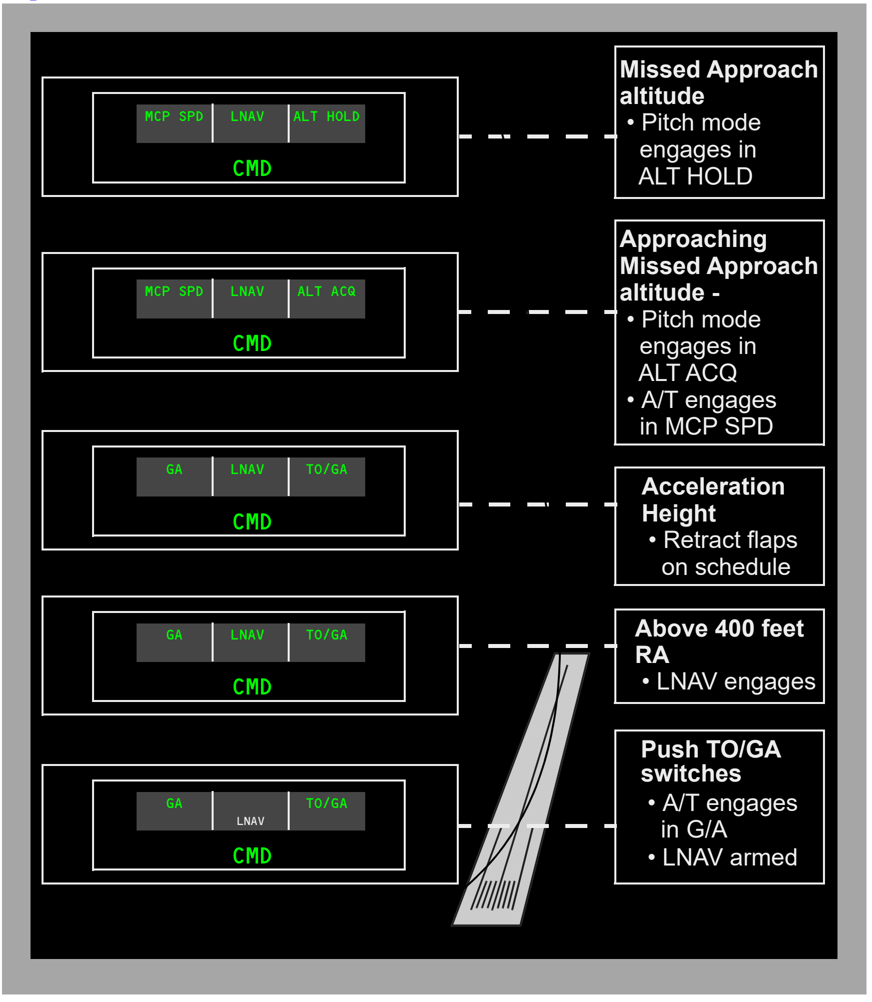
[Option - EFIS/MAP with TO/GO to LNAV]



[Option - PFD/ND]



[Option - PFD/ND]



AFS Operation in Windshear

General

The autopilot and flight director provide positive corrective action to counteract most windshears. The autothrottle system also aids in windshear recovery by providing quick response to any increase or decrease in speed. The commanded levels of power may be beyond what the average pilot considers necessary but, in fact, are required by the situation.

Takeoff or Go–Around

If windshear is encountered during F/D takeoff or go–around, the F/D provides commands to maintain the target speed until vertical speed decreases to approximately +600 fpm. At this point, the F/D commands a 15 degree nose–up pitch attitude. If vertical speed continues to decrease, the F/D continues to command a 15 degree pitch attitude until a speed of approximately stick shaker is reached. It then commands pitch attitudes which result in intermittent activation of the stick shaker. As the airplane transits the windshear condition, the F/D programming reverses. As climb rate increases above approximately +600 fpm, the F/D commands pitch attitudes which result in acceleration back to the target speed. The A/P and F/D both operate in a similar manner during A/P or F/D go–around.

Approach and Landing

If windshear is encountered during an ILS approach, both the F/D and A/P attempt to hold the airplane on altitude, or on glideslope after glideslope capture, without regard to angle of attack or stick shaker limitations. Airspeed could decrease below stick shaker and into a stall if the pilot does not intervene by pushing the TO/GA switch or disengaging the A/P and flying manually.

WARNING: Although the F/D, A/P and A/T may be performing as previously described, severe windshear may exceed the performance capability of the system and/or the airplane. In this situation, the flight crew must, if necessary to avoid ground contact, be prepared to disengage the autothrottle, advance thrust levers to the forward stop, disengage the autopilot and manually fly the airplane.

Command Speed Limiting and Reversion Modes

AFS command limiting and reversion operation is independent of the stall warning and mach warning systems.

Command Speed Limiting

The AFS provides speed, pitch and thrust commands to avoid exceeding the following limit speeds:

- Vmo/Mmo
- wing flap placards
- landing gear placard
- minimum speed.

The commanded speed can be equal to, but does not exceed a limit speed.

Speeds greater than Vmo/Mmo cannot be selected from the MCP. Speeds can be selected which exceed flap and gear placards or are less than minimum speed.

Minimum speed is based on angle of attack and is approximately 1.3 Vs for the current flap configuration. It is sensed by the angle of attack vanes, one on either side of the forward fuselage.

If a speed greater than a placard speed, or less than minimum speed is selected, the AFS allows acceleration or deceleration to slightly short of the limit, then commands the limit speed. The overspeed or underspeed limiting symbol appears in the MCP IAS/Mach display when the commanded speed cannot be reached.

Either pitch or thrust, whichever is engaged in a speed mode, attempts to hold the limit speed. The commanded limit speed and MCP speed condition symbol, remain until another speed is selected which does not exceed the limit. A speed 15 knots greater than the minimum speed must be selected to remove the underspeed limiting symbol.

Reversion Modes

During some flight situations, speed control by the AFDS or A/T alone could be insufficient to prevent exceeding a limit speed. If this occurs, AFDS or A/T modes automatically revert to a more effective combination. The reversion modes are:

- placard limit reversion
- minimum airspeed reversion.

Mode reversion occurs slightly before reaching the limit speed. Both the AFDS and A/T have reversion modes which activate according to the condition causing the reversion.

Placard Limit Reversion

When one of the placard limit reversions (gear, flap or Vmo/Mmo) is reached, the overspeed limiting symbol appears in the MCP IAS/Mach display and the following occurs:

- if the AFDS is engaged but not in speed or CWS mode, and the A/T is armed but not in speed control, the A/T reverts to SPEED and controls speed to slightly below the placard limit
- if the AFDS or A/T is in speed control, speed is maintained slightly below the placard limit
- for VMO/MMO only, if the A/T is engaged in a speed mode and the thrust levers are at idle, the AFDS, if in a V/S mode, will automatically engage to LVL CHG mode.

[Option - FCC P8.0 Software]

- for VMO/MMO only, if the A/T is engaged in a speed mode and the thrust levers are at idle, the AFDS, if in a V/S mode or CWS P, will automatically engage to LVL CHG mode.
- if the A/T is not available, no reversion response to gear or flap placard speeds is available. The AFDS reverts to speed control for Vmo/Mmo speed limiting.

Minimum Speed Reversion

The AFDS and A/T do not control to a speed which is less than minimum speed for the current flap configuration. This speed is approximately 1.3 Vs. Minimum speed, FMC speed, or selected speed, whichever is higher, becomes the AFS commanded speed. If actual speed becomes equal to or slightly less than the minimum speed, the underspeed limiting symbol appears in the MCP IAS/Mach Display, and if operating in the V/S mode, the AFDS reverts to LVL CHG. The AFDS will also revert to LVL CHG from VNAV PTH, except when flying a level segment.

[Option - FCC P8.0 or greater Software and HNYWL 710]
The AFDS and A/T do not control to a speed which is less than minimum speed for the current flap configuration. This speed is approximately 1.3 Vs. Minimum speed, FMC speed, or selected speed, whichever is higher, becomes the AFS commanded speed. If actual speed becomes equal to or slightly less than the minimum speed, the underspeed limiting symbol appears in the MCP IAS/Mach Display, and if operating in the V/S mode or CWS P, the AFDS reverts to LVL CHG. The AFDS will also revert to LVL CHG from VNAV PTH, except when flying a level segment. There is no reversion from Vertical Speed Modes (VNAV or MCP) to level change mode when MIN speed is reached and the flaps are greater than 12.5.

The AFS commands a speed 5 knots greater than minimum speed. Reaching a speed 5 knots greater than minimum speed reactivates normal MCP speed selection control. The AFDS commands nose down pitch to increase airspeed if the thrust levers are not advanced. When actual speed becomes 5 knots greater than minimum speed, the underspeed limiting symbol disappears.

The A/P disengages and the F/D command bars retract when in a LVL CHG climb with a command speed equal to minimum speed and a minimum rate of climb cannot be maintained without decelerating.

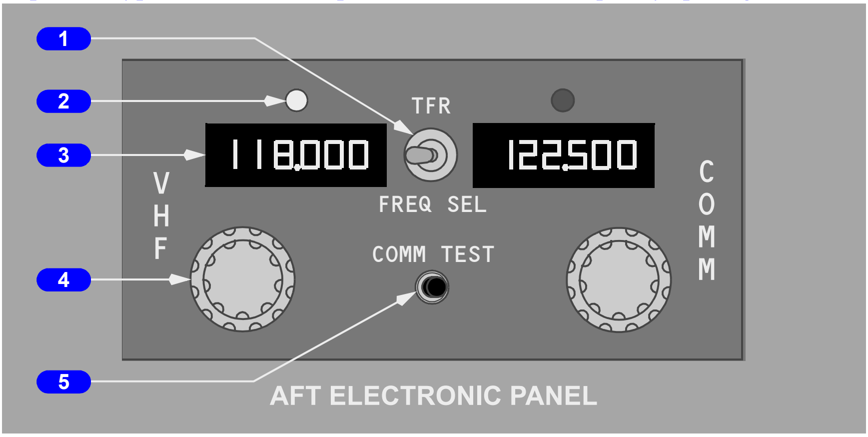
Minimum speed reversion is not available when the A/T is OFF and the AFDS is in ALT HOLD or after G/S capture. Minimum speed reversion is also not available when in VNAV PTH and flying a level segment.

Intentionally
Blank

Communications — Chapter 5
Table of Contents — Section TOC

VHF Communication Panel

[Option - Typical VHF control panel with 8.33 kHz frequency spacing]



1 VHF Communications Transfer (TFR) Switch

Left – selects left frequency as active for transceiver.

Right – selects right frequency as active for transceiver.

2 Active Frequency Light

Illuminated (white)– indicates the related frequency is selected.

3 Frequency Indicator

Indicates selected frequency.

4 Frequency Selector

Rotate – selects frequency in related indicator:

- outer selector changes three left digits
- inner selector changes three right digits

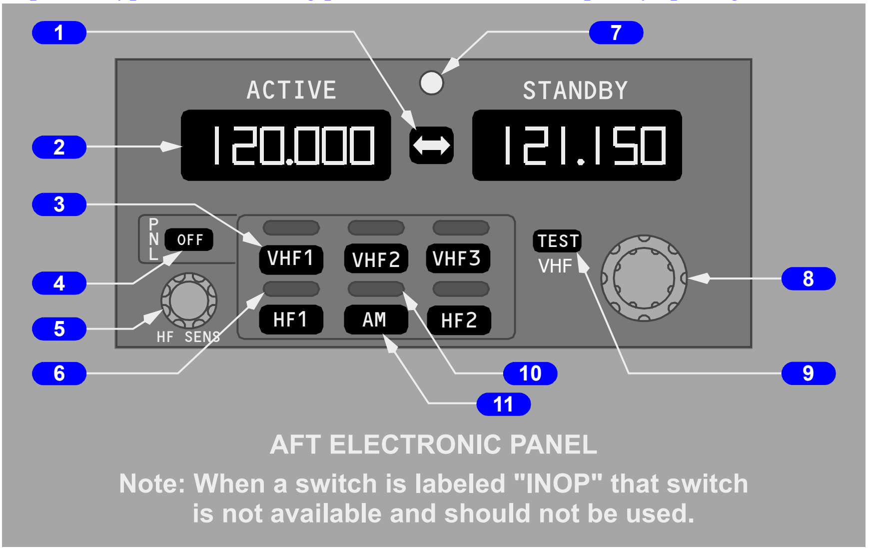
5 Communication Test (COMM TEST) Switch

Push –

- removes automatic squelch feature, permitting reception of background noise and thereby testing receiver operation
- improves reception of weak signals

Radio Tuning Panel

[Option -Typical radio tuning panel with 8.33 kHz frequency spacing]



1 Frequency Transfer Switch

Push –

- transfers the STANDBY window frequency to the ACTIVE window and tunes the selected radio to the new active frequency
- transfers the ACTIVE window frequency to the STANDBY window

2 Frequency Indicator

ACTIVE – displays the tuned frequency of the selected radio.

STANDBY – displays the preselected or previously tuned frequency of the selected radio

- displays DATA if the selected radio is in the data mode
- displays six digit frequency in 8.33 KHz spacing

3 Radio Tuning Switch

Push –

- selects the VHF or HF radio to be tuned
- the tuned frequency is displayed in the ACTIVE frequency indicator
- the standby frequency is displayed in the STANDBY frequency indicator

4 Radio Tuning Panel OFF Switch

Push –

- disconnects the panel from the communication radios

5 HF Sensitivity Control

Rotate – adjusts the sensitivity of the on–side HF receiver.

6 Radio Tuning Light

Illuminated (white) - indicates the selected radio.

7 Offside Tuning Light

Illuminated (white) –

- the radio normally associated with this panel is being tuned by another radio tuning panel, or
- the radio tuning panel is being used to tune a radio not normally associated with this radio tuning panel

8 Frequency Selector

Rotate - selects frequency in the STANDBY frequency indicator:

- first digit is always 1
- outer selector changes second and third digits in 1 MHz increments
- inner selector changes fourth, fifth, and sixth digits in 8.33 KHz increments
- For airplanes with ACARS, tuning above maximum or below minimum frequency displays DATA in Frequency Indicator

9 VHF TEST Switch

Push –

- removes automatic squelch feature, permitting reception of background noise and thereby testing receiver operation
- improves reception of weak signals

10 AM Light

Illuminated (white) – HF AM is selected.

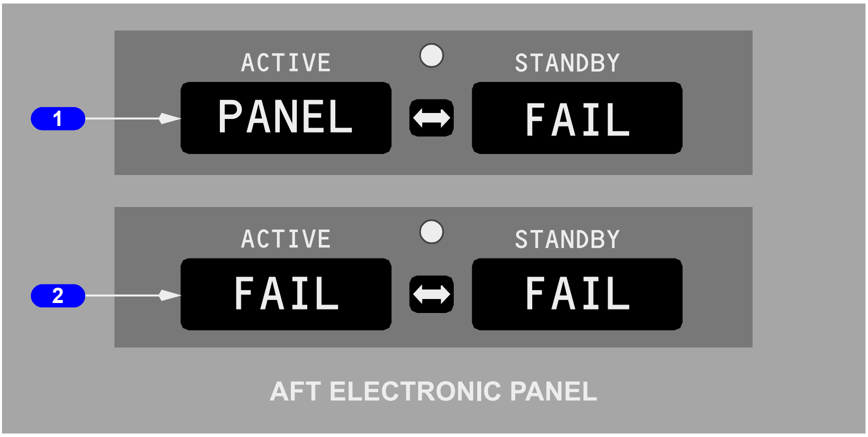
Extinguished – HF USB is selected.

11 AM Switch

Push – sets the AM (amplitude modulation) or USB (upper side band) mode for the selected HF.

Radio Tuning Panel Fail Modes

[Option -Typical Radio Tuning Panel Failure Modes]



1 PANEL FAIL

The radio tuning panel has failed.

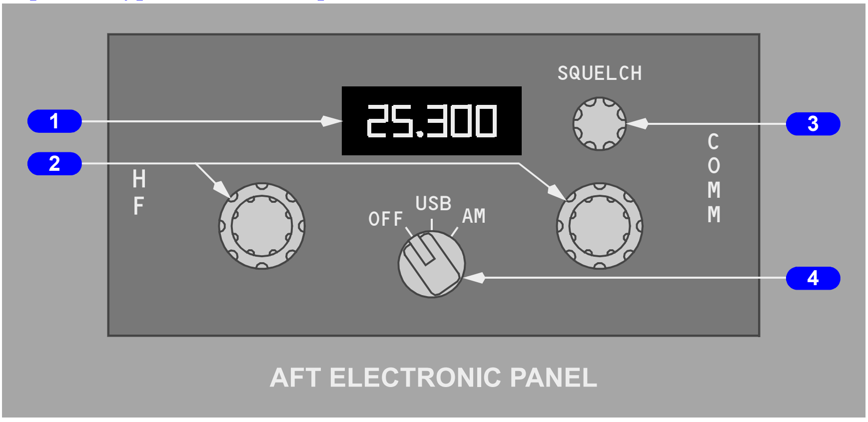
2 FAIL FAIL

The selected radio has failed.

Note: The selected frequencies may continue to be displayed in the frequency indicator when the radio is not available.

HF Communication Panel

[Option - Typical HF control panel]



1 Frequency Indicator

Displays tuned frequency

Frequency ranges from 2.000 to 29.999 megahertz.

2 Frequency Selectors

Rotate - selects desired frequency.

3 SQUELCH Control

Rotate - controls sensitivity of receiver

- clockwise increases sensitivity of weak or distant stations
- counterclockwise decreases sensitivity to reduce noise or static

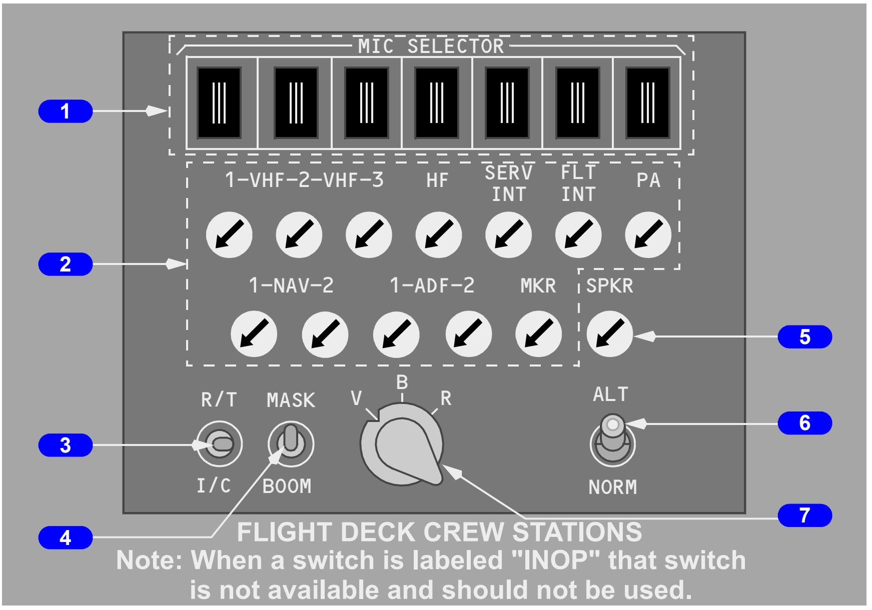
4 Mode Selector

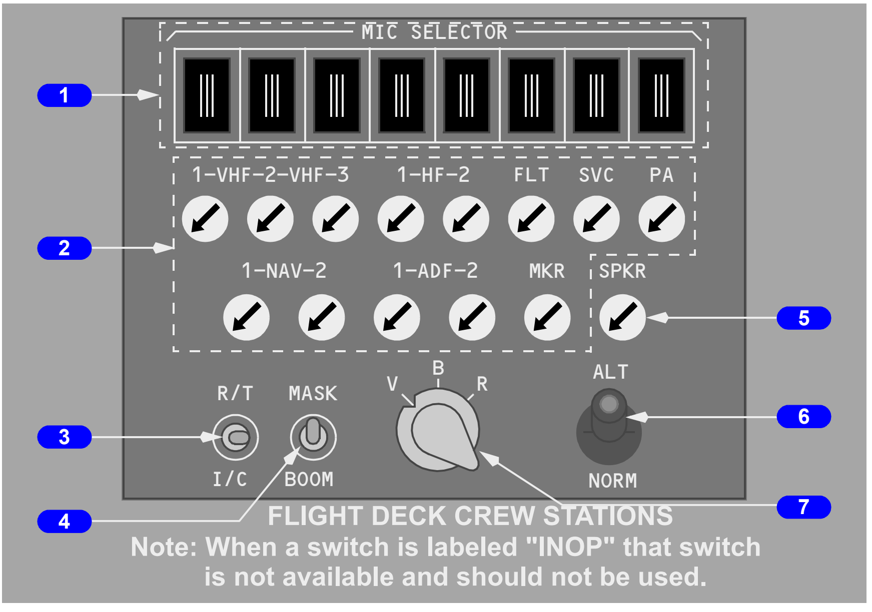
OFF - removes power to transceiver

USB (Upper Sideband) - transmits and receives on the higher side of the frequency

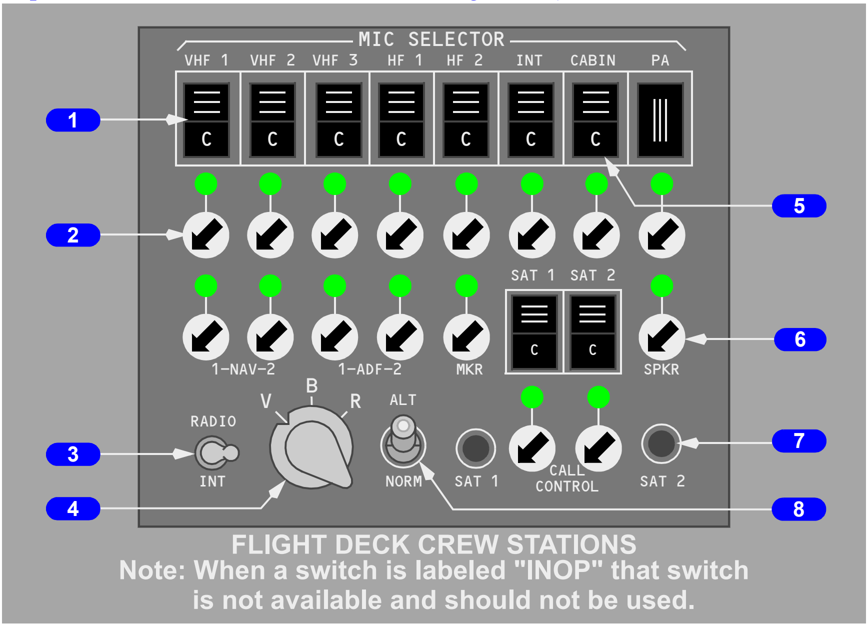
AM (Amplitude Modulation) - transmits and receives on the selected frequency, accompanied by a carrier wave.

Audio Control Panel (ACP)





[Option - Audio Control Panel with latching switch)



1 Transmitter Selector (MIC SELECTOR) Switches

Illuminated – related switch is active

Push –

- selects related communication system for subsequent transmission
- only one switch may be selected at a time; pushing a second switch deselects first switch
- reception possible over selected system regardless of whether related receiver switch is on

2 Receiver Switches

Illuminated (white) – related switch is active

Rotate – adjusts volume

Push –

- allows reception of related communication system or navigation receiver
- multiple switches may be selected

Push again – deselects related system or receiver.

3 Push–to–Talk Switch

(spring–loaded to neutral position)

R/T (radio–transmit) – keys oxygen mask or boom microphone for transmission as selected by transmitter selector.

I/C (Intercom) – keys oxygen mask or boom microphone for direct transmission over flight interphone and bypasses transmitter selector.

3 Push–to–Talk Switch

(spring–loaded (R/T) / manually latch (I/C) to neutral position)

R/T (radio–transmit) – keys oxygen mask or boom microphone for transmission as selected by transmitter selector.

I/C (Intercom) – keys oxygen mask or boom microphone for direct transmission over flight interphone and bypasses transmitter selector.

3 Push–to–Talk Switch

(spring–loaded to neutral position)

RADIO (radio–transmit) – keys oxygen mask or boom microphone for transmission as selected by transmitter selector.

INT (interphone) – keys oxygen mask or boom microphone for direct transmission over flight interphone and bypasses transmitter selector.

4 Filter Switch

V (Voice) – receive NAV and ADF voice audio.

B (Both) – receive NAV and ADF voice and range audio.

R (Range) – receive NAV and ADF station identifier range (code) audio.

4 MASK–BOOM Switch

MASK – selects oxygen mask microphone for transmissions.

BOOM – selects boom microphone for transmissions.

5 Speaker (SPKR) Switch

Illuminated (white) – SPKR switch is active.

Push – Adds or removes communication audio from the flight deck speaker.

Rotate – Controls the communication audio volume in the flight deck speaker.

5 Ground Crew Call Light

Illuminated - Indicates call to flight deck initiated by ground crew with Pilot Call Switch at external power receptacle. Light will extinguish when ground crew releases switch. Accompanied by single high tone chime.

6 Alternate–Normal (ALT–NORM) Switch

NORM (Normal) – ACP operates normally.

ALT (Alternate) – ACP operates in degraded mode.

6 Speaker (SPKR) Switch

Illuminated (white) – SPKR switch is active.

Push – Adds or removes communication audio from the flight deck speaker.

Rotate – Controls the communication audio volume in the flight deck speaker.

7 Filter Switch

V (Voice) – receive NAV and ADF voice audio.

B (Both) – receive NAV and ADF voice and range audio.

R (Range) – receive NAV and ADF station identifier range (code) audio.

7 SAT Switch

Push - Terminates the SATCOM call connection.

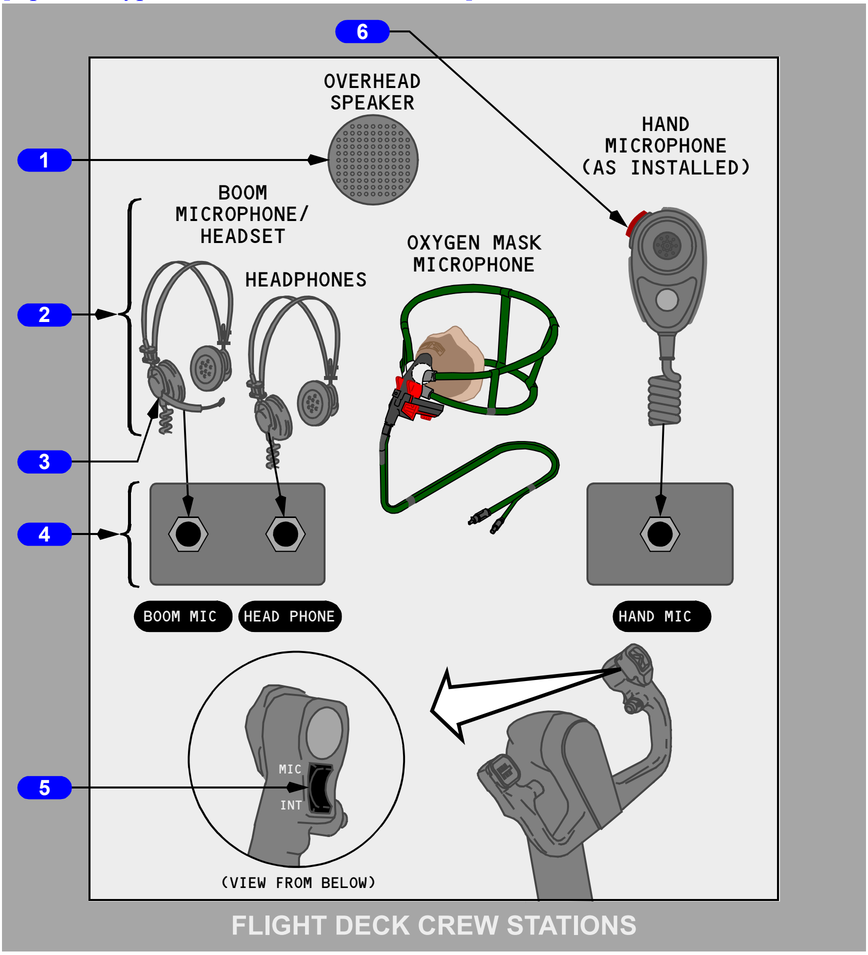
8 Alternate-Normal (ALT-NORM) Switch

NORM (Normal) – ACP operates normally.

ALT (Alternate) – ACP operates in degraded mode.

Miscellaneous Communication Controls (Typical)

[Option - Typical Communication Controls]



1 Overhead Speaker

Monitors audio from related pilot's ACP.

2 Headset or Headphones

Monitors audio from related ACP.

3 Standard Microphones

Choose desired microphone for voice transmission through selected radio, interphone system, or passenger address (PA).

4 Communication Jacks

Used for appropriate microphone or headphone plugs.

5 Push–To–Talk Switch

MIC (microphone) –

- selects oxygen mask or boom microphone for transmission, as selected by ACP transmitter selector
- same as using ACP PTT switch (R/T position)

OFF – center position.

INT (interphone) –

- selects oxygen mask or boom microphone for direct transmission over flight interphone
- bypasses ACP transmitter selector
- same as using ACP PTT switch (I/C position)

[Option]
- locks in INT position until selected to either OFF or MIC

[Option]
- switch is spring-loaded to return to OFF position

5 Push–To–Talk Switch

MIC (microphone) –

- selects oxygen mask or boom microphone for transmission, as selected by ACP transmitter selector
- same as using ACP PTT switch (RADIO position)

OFF – center position.

INT (interphone) –

- selects oxygen mask or boom microphone for direct transmission over flight interphone
- bypasses ACP transmitter selector
- same as using ACP PTT switch (INT position)

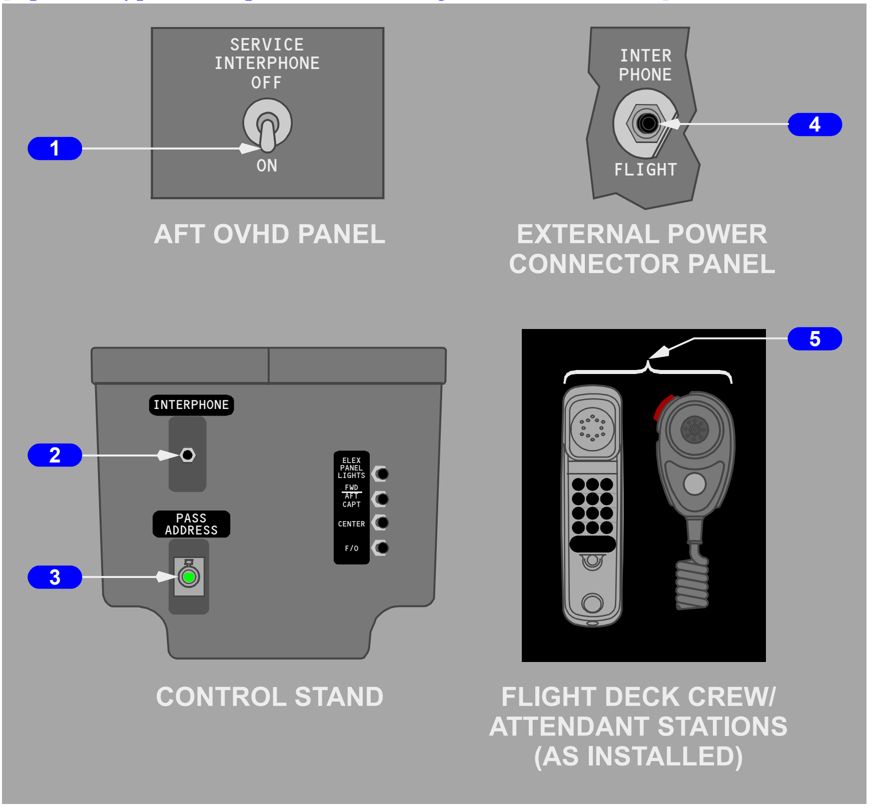
[Option]
- switch is spring-loaded to return to OFF position

6 Push–To–Talk Switch

Push – keys hand microphone for transmission, as selected by ACP transmitter selector.

Interphone and Passenger Address Controls

[Option - Typical Interphone and Passenger Address Controls]



1 SERVICE INTERPHONE Switch

OFF –

- external jacks are deactivated
- communication between flight deck and flight attendants is still possible
- communication between flight deck and supernumeraries is still possible

ON – adds external jacks to service interphone system.

2 Service INTERPHONE Handset Jack

With microphone installed, used to communicate with flight attendant stations:

With microphone installed, used to communicate with supernumerary station:

- with SERVICE INTERPHONE switch ON, also used to communicate with any external jack location
- bypasses ACP

3 Passenger Address (PASS ADDRESS) Hand Microphone Jack

With microphone installed:

- used to make PA announcements
- bypasses ACPs

4 INTERPHONE FLIGHT Jack

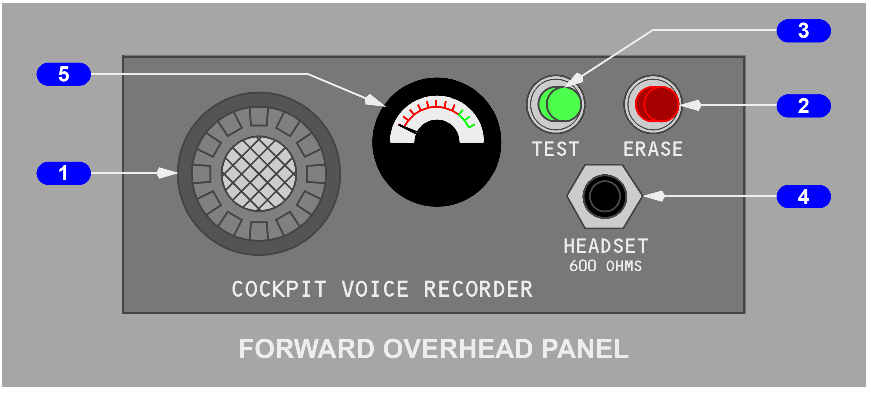
Connects ground crew to flight interphone system.

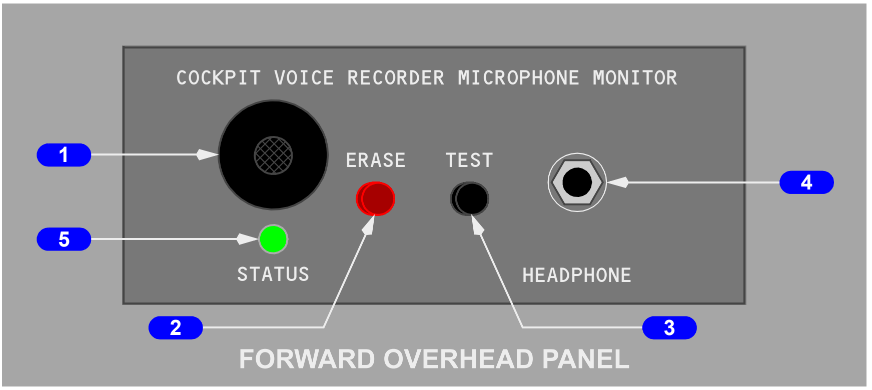
5 Flight Deck / Attendant PA Hand Microphone

Used to make PA announcements.

Cockpit Voice Recorder

[Option - Typical]





1 Area Microphone

Active anytime 115V AC is applied to airplane.

Activated when an engine is started or the VOICE RECORDER switch is placed in the ON position.

2 ERASE Switch (red)

Push (2 seconds) –

- all four channels are erased
- monitor indicator momentarily deflects
- operative only when airplane is on ground and parking brake is set

2 ERASE Switch (red)

Push (2 seconds) –

- all four channels are erased
- operative only when airplane is on ground and parking brake is set

3 TEST Switch

Push – after a slight delay and no faults are detected:

- monitor indicator rises into green band
- a tone may be heard through a headset plugged into HEADSET jack
- the indicator remains in the green band and the tone continues until the switch is released

3 TEST Switch

Push – for 5 seconds:

- STATUS light flashes once
- a tone may be heard through a headset plugged into HEADPHONE jack

4 **HEADSET Jack**

Headset may be plugged into jack to monitor tone transmission during test, or to monitor playback of voice audio.

4 **HEADPHONE Jack**

Headphone may be plugged into jack to monitor tone transmission during test, or to monitor playback of voice audio.

5 **Monitor Indicator**

Pointer deflection indicates:

- during normal operation – system is recording
- during ERASE – erasure on all four channels

(approximately a one second delay)

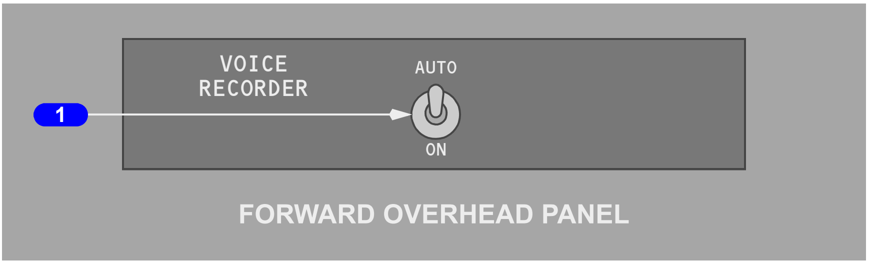
- during TEST – pointer rises into green band

5 **STATUS Light**

Illuminated (momentary green) – no faults are detected during recorder TEST.

Cockpit Voice Recorder Switch

[Option]



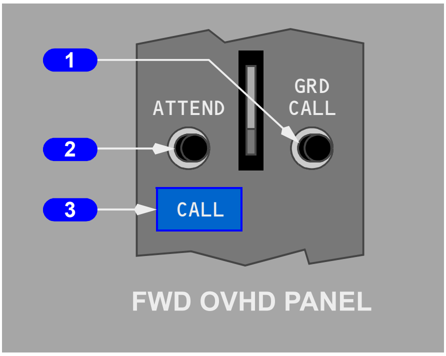
1 **VOICE RECORDER Switch**

AUTO - powers the cockpit voice recorder from first engine start until 5 minutes after last engine shutdown

ON - powers the cockpit voice recorder until first engine start, then trips the switch to AUTO.

Call System
Forward Overhead Panel

[Option - Typical Call System]



1 **Ground Call (GRD CALL) Switch**

Push – sounds a horn in nose wheel well until released.

2 **Attendant Call (ATTEND) Switch**

Push –

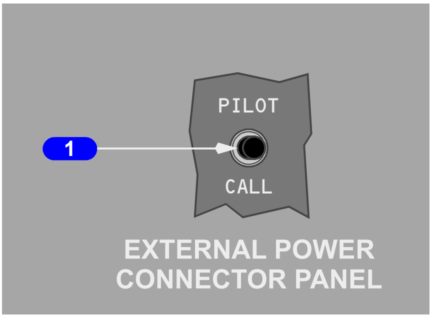
- sounds a two–tone chime in passenger cabin
- sounds a two–tone chime in supernumerary area
- illuminates pink master call lights

3 **Flight Deck CALL Light**

Illuminated (blue) – flight deck is being called by flight attendants or ground crew.

Illuminated (blue) – flight deck is being called by supernumerary or ground crew.

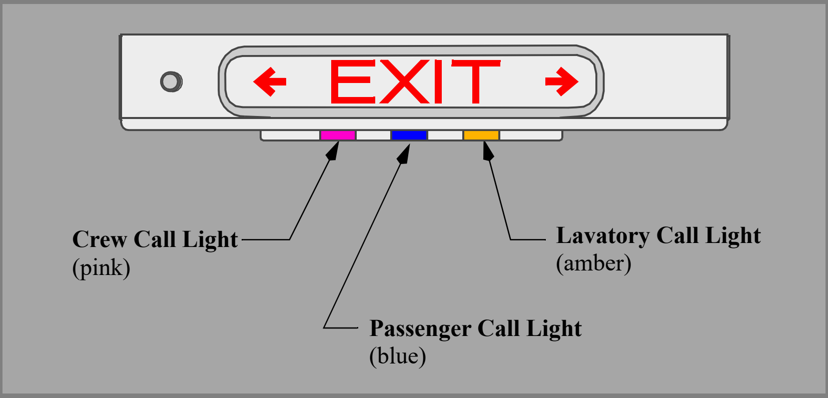
External Power Connector Panel



1 **PILOT CALL Switch**

Push – sounds a single–tone chime in flight deck.

Master Call Lights

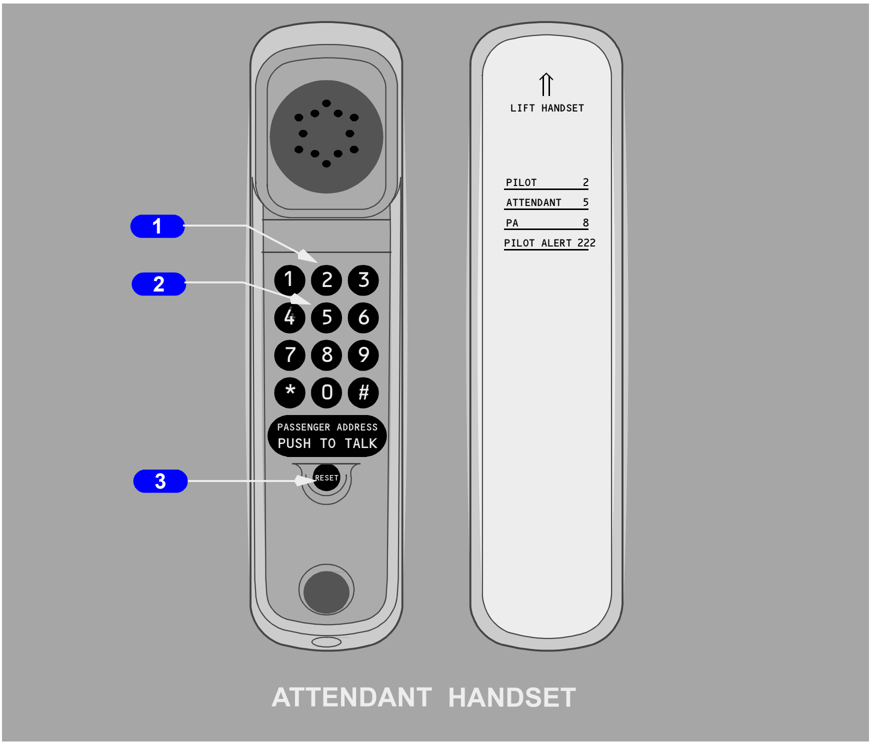


CALL LIGHT PANEL

Illuminated –

- pink – flight deck or other flight attendant station is calling
- pink – flight deck or supernumerary station is calling
- blue – a passenger seat call switch is activated
- blue – not used for 737-800BCF
- amber – a lavatory call switch is activated

Attendant Handset



1 CAPTAIN Call Switch

Push – sounds a single–tone chime in flight deck.

2 ATTENDANT Call Switch

Push –

- sounds a two–tone chime in passenger cabin
- sounds a two–tone chime in aft cabin
- illuminates both pink master call lights

3 Call RESET Switch

Push –

- extinguishes both pink master call lights
- cancels call
- disconnects the handset from the public address system

Introduction

The communication system includes:

- radio communication system
- interphone communication system
- cockpit voice recorder system
- communication crew alerting system

The communication systems are controlled using the:

- audio control panels

[Option - Radio Tuning Panel]
- radio tuning panels

[Option - VHF or HF control panels]
- radio communication panels

Audio Systems and Audio Control Panels

An ACP is installed at the Captain, First Officer, and Observer stations. Each panel controls an independent crew station audio system and allows the crewmember to select the desired radios, navigation aids, interphones, and PA systems for monitoring and transmission.

Transmitter selectors on each ACP select one radio or system for transmission by that crewmember. Any microphone at that crew station may then be keyed to transmit on the selected system.

Receiver switches select the systems to be monitored. Any combination of systems may be selected. Receiver switches also control the volume for the headset and speaker at the related crew stations. Audio from each ACP is monitored using a headset/headphones or the related pilot's speaker.

Audio warnings for ground proximity warnings, altitude alert warnings, traffic collision avoidance advisories and radar predictive windshear alerts are also heard through the speakers and headsets at preset volumes. They cannot be controlled or turned off by the crew.

Speakers and Headsets

Each crew station has a headset or headphone jack. The Captain and First Officer have speakers on the ceiling above their seats. There is no speaker at the observer station. Headset volume is controlled by the receiver switches. Speaker volume is controlled by the receiver switches and also the speaker switch. The speakers always operate during ground proximity warnings, altitude alert warnings, traffic collision avoidance advisories and radar predictive windshear alerts.

The two flight compartment speakers are muted for the captain's and first officer's push-to-talk microphone operation. The speakers are not muted for oxygen mask microphone operation.

Microphones

Hand microphones and boom microphones may be plugged into the related jacks at the flight deck crew stations. Each oxygen mask also has an integral microphone.

The MASK-BOOM switch allows selection of the oxygen mask microphone or the boom microphone. The MASK–BOOM switch does not affect the operation of the hand microphone.

An oxygen mask microphone is enabled and the boom microphone is disabled when the left oxygen mask panel door is open. The oxygen mask microphone is disabled and the boom microphone is enabled when the left oxygen mask panel door is closed and the RESET/TEST Switch is pushed.

Each hand microphone has a PTT switch to key the selected audio system. The PTT switches on the control wheel or ACP are used to key the oxygen mask or boom microphone, as selected by the R/T and I/C switch. The R/T and I/C switch does not affect the operation of the hand microphone.

Each hand microphone has a PTT switch to key the selected audio system. The PTT switches on the control wheel or ACP are used to key the oxygen mask or boom microphone, as selected by the RADIO/INT switch. The RADIO/INT switch does not affect the operation of the hand microphone.

Normal Audio System Operation

The Captain, First Officer, and Observer audio systems are located in a common remote electronics unit in the E/E compartment. They function independently and have separate circuit breakers. The audio systems are normally controlled by the related ACPs through digital or computerized control circuits.

Degraded Audio System Operation

If the remote electronics unit or ACP malfunctions, the ACP cannot control the remote electronics unit. Audio system operation can be switched to a degraded mode by placing the ALT–NORM switch to ALT. In this mode, the ACP at that station is inoperative and the crewmember can only communicate on one radio.

The ACP transmitter selectors are not functional. Any transmission from that station must be from the radio shown on the chart below. The transmitter selector for the usable radio illuminates when a station is operating in the degraded mode. The receiver switches are not functional, and only the usable radio is heard at a preset volume, through the headset. The speaker and speaker switch are not functional at that station. In addition, the flight interphone and service interphone cannot be used. The control wheel PTT switch INT position and the ACP PTT switch INT position are not functional since the flight interphone is not functional.

The ACP transmitter selectors are not functional. Any transmission from that station must be from the radio shown on the chart below. The transmitter selector for the usable radio illuminates when a station is operating in the degraded mode. The receiver switches are not functional, and only the usable radio is heard at a preset volume, through the headset. The speaker and speaker switch are not functional at that station. In addition, the flight interphone and service interphone cannot be used. The control wheel PTT switch INT position and the ACP PTT switch I/C position are not functional since the flight interphone is not functional.

The mask and boom microphones can be used for transmission on the usable radio. The MASK–BOOM switch works normally in the degraded mode. The mask and boom microphones can be keyed with the control wheel PTT switch MIC position or the ACP PTT switch R/T position. The hand microphone is not usable in the degraded mode of operation.

The mask and boom microphones can be used for transmission on the usable radio. The mask and boom microphones can be keyed with the control wheel PTT switch in the MIC position or the ACP PTT switch in the RADIO position. The hand microphone is not usable in the degraded mode of operation.

Audio warnings for altitude alert, GPWS, and windshear are heard on an audio system operating in the degraded mode.

An audio system operating in the degraded mode cannot access the passenger address system through the audio control panel. The crewmember can still use the service interphone handset and PA microphone if they are installed on the control stand.

CREW STATION AUDIO SYSTEM IN DEGRADED MODE	RADIO AVAILABLE FOR TRANSMISSION AND RECEPTION AT DEGRADED STATION
CAPTAIN	VHF–1
FIRST OFFICER	VHF–2
OBSERVER	VHF–1

Flight Interphone System

The flight interphone system is an independent communication network. Its primary purpose is to provide private communication between flight deck crewmembers without intrusion from the service interphone system. The ground crew may also use the flight interphone through a jack at the external power receptacle.

The pilots can transmit directly over the flight interphone by using the control wheel PTT switch. Alternately, any crewmember with an ACP can transmit/receive over the flight interphone by using their related ACP and normal PTT switches. Any standard microphone may be used with the flight interphone system.

Service Interphone System

The service interphone system provides intercommunication between the flight deck, Flight Attendants, and ground personnel. Flight deck crewmembers communicate using either a separate handset (if installed) or their related ACP and any standard microphone.

The service interphone system provides intercommunication between the flight deck, supernumeraries, and ground personnel. Flight deck crewmembers communicate using either a separate handset (if installed) or their related ACP and any standard microphone.

The Flight Attendants communicate between flight attendant stations or with the flight deck using any of the attendant handsets. Anyone who picks up a handset/microphone is automatically connected to the system.

External jacks for use by maintenance or service personnel can be added to the system by use of the service interphone switch.

Passenger Address System

The Passenger Address (PA) system provides audio inputs to speakers in the cabin, allowing announcements and music to be broadcast to the entire passenger cabin. The speakers are installed in lavatories, the forward galley, near the aft entry/service doors and in the Passenger Service Units (PSUs). Input is prioritized by source.

The highest priority audio input source is selected when the flight crew selects "PA" on the audio control panel and speaks through the boom microphone on a headset, the oxygen mask microphone or the hand-held microphone connected to the Passenger Address microphone jack on the P8 aft electronic panel. These methods will preempt all music and other announcements, including announcements in-progress being made using any Flight Attendant handset.

The second priority level is announcements made using the Flight Attendant handsets. A Flight Attendant handset announcement has priority over the PRAM and entertainment systems.

[Optional]
An optional Flight Attendant handset in the Flight Deck can be used to make PA system input, but does not have priority over any Flight Attendant handset which is currently making audio input to the PA system.

The third priority level is the PRAM. The PRAM provides pre-recorded messages and music over the PA system. Messages from the PRAM can be manually generated or automatically generated. Manually generated messages have priority over automatically generated messages, and both of these have priority over music being provided by the PRAM.

Call System

The call system is used as a means for various crewmembers to gain the attention of other crewmembers and to indicate that interphone communication is desired. Attention is gained through the use of lights and aural signals (chimes or horn). The system can be activated from the flight deck, either flight attendant station, or from the external power receptacle. Passengers may also use the system to call an attendant, through the use of individual call switches at each seat.

The call system is used as a means for various crewmembers to gain the attention of other crewmembers and to indicate that interphone communication is desired. Attention is gained through the use of lights and aural signals (chimes or horn). The system can be activated from the flight deck, supernumerary station, or from the external power receptacle.

The flight deck may be called from either flight attendant station or by the ground crew. The ground crew may only be called from the flight deck. Flight Attendants may be called from the flight deck, the other attendant station, or from any passenger seat or lavatory. Master call lights in the passenger cabin identify the source of incoming calls to the attendants.

The flight deck may be called from the supernumerary station or by the ground crew. The ground crew may only be called from the flight deck. Supernumeraries may be called from the flight deck.

Call system chime signals are audible in the passenger cabin through the PA system speakers. The PA speakers also provide an alerting chime signal whenever the NO SMOKING or FASTEN SEAT BELT signs illuminate or extinguish.

Location of Call Originator	Called Position	Visual Signal at Called Position	Aural Signal at Called Position
Flight deck	Attendant station	Pink master call light	Two–tone chime
Flight deck	Nose wheel well		Horn in nose wheel well
Attendant station	Flight deck	Blue flight deck call light	Single high–tone chime
External Power Connector Panel	Flight deck	Blue flight deck call light	Single high–tone chime
Flight deck	Passenger cabin	NO SMOKING or FASTEN BELT signs illuminate/ extinguish	Single low–tone chime

Location of Call Originator	Called Position	Visual Signal at Called Position	Aural Signal at Called Position
Flight deck	Supernumerary station	Pink master call light	Two–tone chime
Flight deck	Nose wheel well		Horn in nose wheel well
Supernumerary station	Flight deck	Blue flight deck call light	Single high–tone chime
External Power Connector Panel	Flight deck	Blue flight deck call light	Single high–tone chime

VHF Communications

Primary short–range voice communications is provided in the VHF range by three independent radios. Each radio provides for selection of an active frequency and an inactive (preselected) frequency. Voice transmission and reception are controlled at the related ACP.

[Option -Typical VHF control panel equipped airplanes]
VHF–1 control panel is located on the left side of the aft electronic panel, VHF–2 control panel is on the right and VHF–3 control panel is in the center. The VHF–2 and VHF-3 antennae are located on the lower fuselage, VHF–1 is on the upper fuselage.

[Option - Typical for radio tuning panel equipped airplanes]
The VHF/HF RTP-1 is located on the forward left side of the aft electronic panel, VHF/HF RTP–2 is on the forward right side and VHF/HF RTP–3 is on the aft portion of the panel. The VHF–2 and VHF-3 antennae are located on the lower fuselage, VHF–1 is on the upper fuselage.

Note: VHF antennae located on the lower fuselage are susceptible to multipath interference from nearby structures or vehicles. This may disrupt VHF communications. VHF antennae located on the upper fuselage are not as susceptible to this interference.

HF Communications

[Option - Typical for HF control panel equipped airplanes]
The HF radio communications control panel allows for frequency selection and adjustment of radio sensitivity.

The audio control panels are used to control voice transmission and receiver monitoring. When an HF transmitter is keyed after a frequency change, the antenna tunes. A steady or intermittent tone may be heard through the audio system. While tuning, the tone can last as long as 7 seconds. If the system fails to tune, the tone will last more than 7 seconds, to a maximum of 15 seconds. The antenna is located in the vertical stabilizer.

Cockpit Voice Recorder

The cockpit voice recorder uses four independent channels to record flight deck audio for 120 minutes. Recordings older than 120 minutes are automatically erased. One channel records flight deck area conversations using the area microphone. The other channels record individual ACP output (headset) audio and transmissions for the pilots and observer.

ACARS System

The ARINC Communications Addressing and Reporting System (ACARS) is an addressable digital data link system which permits exchange of data and messages between an airplane and a ground-based operation center utilizing an onboard VHF communications system.

The ACARS airborne subsystem provides for the manual entry of routine data such as departure/arrival information. Also possible is manual entry of addresses (telephone codes) of parties on the ground for voice communications.

The airborne system consists of a management unit in the E/E compartment, either an interactive display unit or multi-purpose control display unit (MCDU), and frequently a printer. Data is entered and transmitted to the ground operations center.

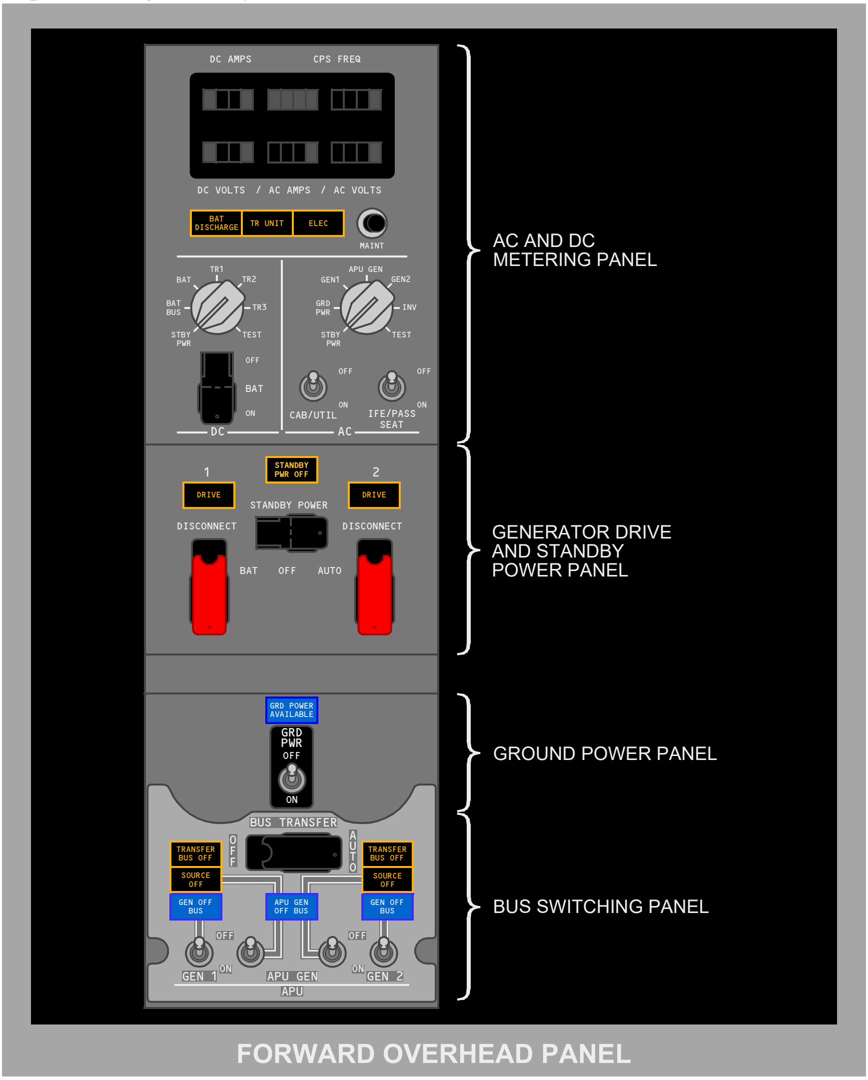
Electrical — Chapter 6

Table of Contents — Section TOC

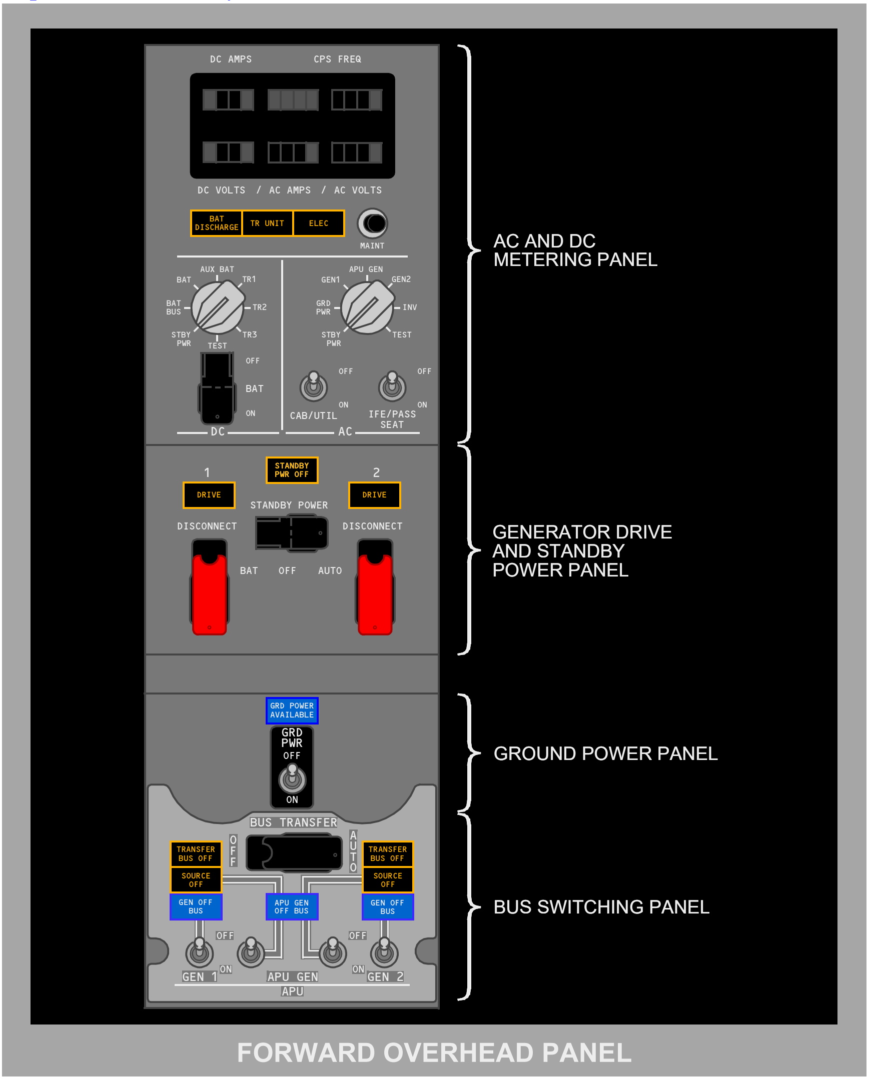
Electrical — Chapter 6
Controls and Indicators — Section 10

Electrical Panel

[Option - Single battery with CAB/UTIL switch]

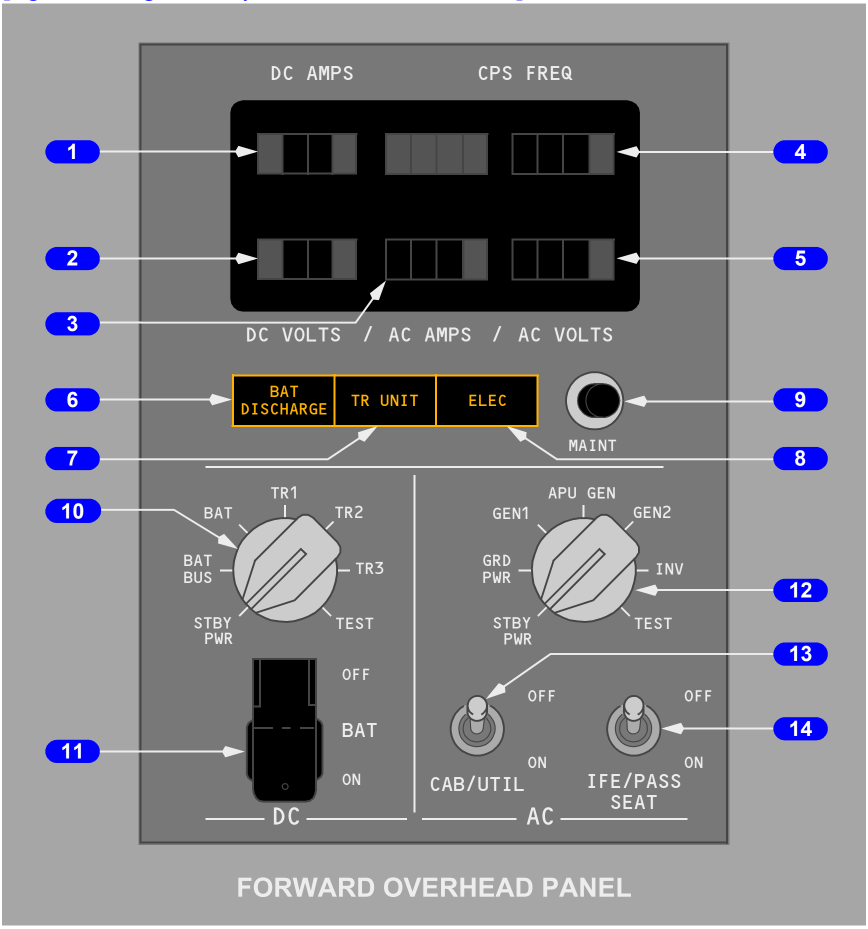


[Option - Dual battery with CAB/UTIL switch]

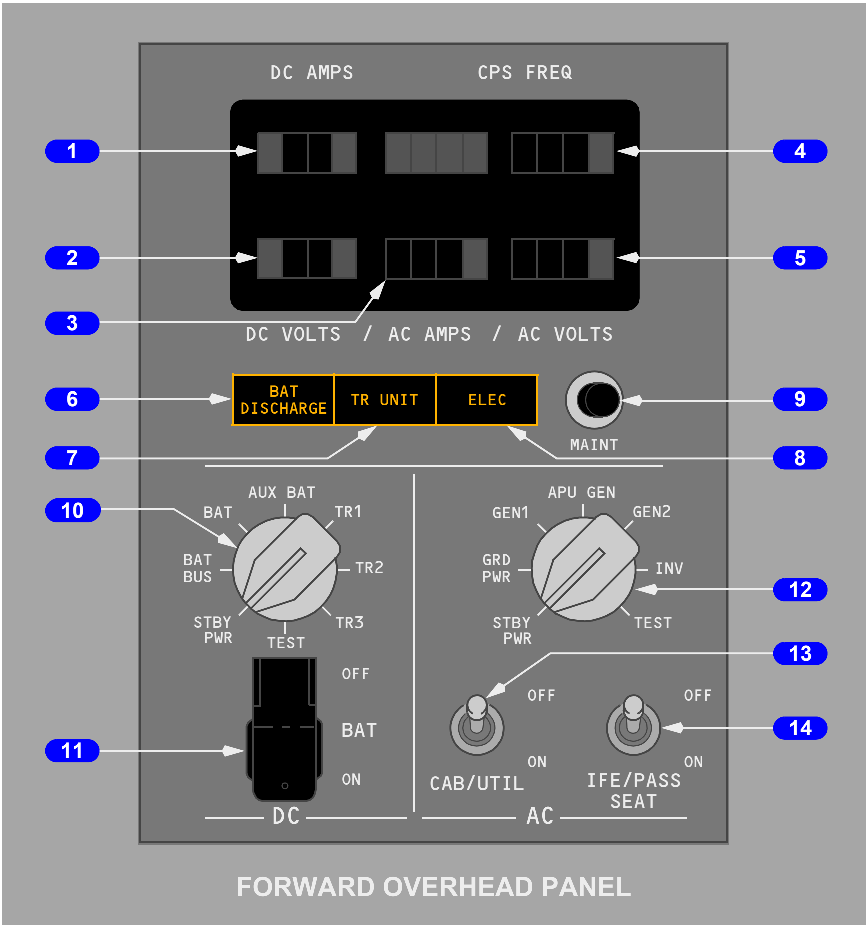


AC and DC Metering Panel

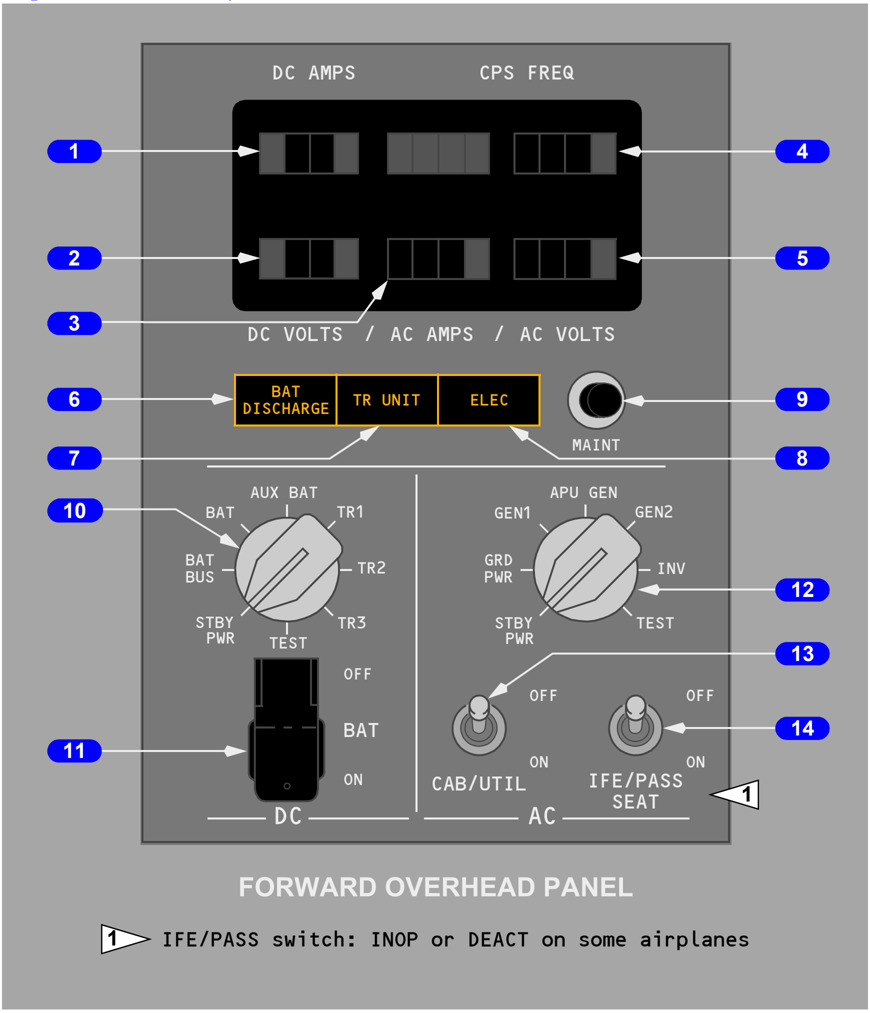
[Option - Single battery with CAB/UTIL switch]



[Option - Dual battery with CAB/UTIL switch]



[Option - Dual battery with INOP CAB/UTIL switch]



1 DC Ammeter

Indicates amperage of source selected by DC meters selector.

2 DC Voltmeter

Indicates voltage of source selected by DC meters selector.

3 AC Ammeter

Indicates amperage of source selected by AC meters selector.

4 Frequency Meter

Indicates frequency of source selected by AC meters selector.

5 AC Voltmeter

Indicates voltage of source selected by AC meters selector.

6 Battery Discharge (BAT DISCHARGE) Light

Illuminated (amber) – with BAT switch ON, excessive battery discharge detected.

7 TR UNIT Light

Illuminated (amber) –

- on the ground – any TR has failed.
- in flight –
  - TR1 failed; or
  - TR2 and TR3 failed

8 Electrical (ELEC) Light

Illuminated (amber) – a fault exists in DC power system or standby power system.

Note: Operates only with airplane on ground.

9 Maintenance Test (MAINT) Switch

Used by maintenance.

10 DC Meters Selector

Selects DC source for DC voltmeter and DC ammeter indications.

TEST – used by maintenance.

11 Battery (BAT) Switch

OFF –

- removes power from battery bus and switched hot battery bus when operating with normal power sources available
- removes power from battery bus, switched hot battery bus, DC standby bus, static inverter, and AC standby bus when battery is only power source

ON (guarded position) –

- provides power to switched hot battery bus
- energizes relays to provide automatic switching of standby electrical system to battery power with loss of normal power

12 AC Meters Selector

Selects AC source for AC voltmeter, AC ammeter and frequency meter indications

TEST – used by maintenance.

13 CAB/UTIL Switch

OFF – removes electrical power from galley and cabin equipment systems including:

- all 115V AC galley busses

[737-600/700]
- cabin recirculation fan

[737-800/900]
- left & right recirculation fans
- fwd and aft door area heaters
- drain mast heaters
- lavatory water heaters
- logo lights
- potable water compressor
- 115V AC shaver outlets when installed

[Option - Boeing Sky Interior]
- LED cabin lighting

ON – supplies electrical power to galley and cabin equipment systems.

14 IFE/PASS SEAT Switch

OFF – removes electrical power from installed components of the passenger seats, in-flight entertainment systems, and other power systems including:

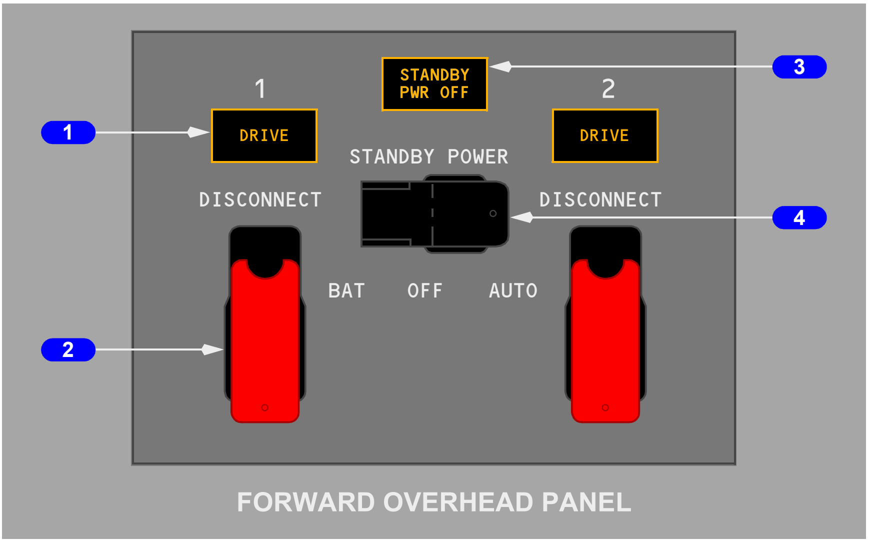
- 115V AC audio entertainment equipment
- 115V AC video entertainment equipment
- cabin telephone equipment
- FAX machine
- 28V DC video equipment and passenger seat electronic outlets
- 115V AC flight deck auxiliary power outlets

ON – supplies electrical power to installed components of the passenger seats, in-flight entertainment systems, and other power systems.

14 IFE/PASS SEAT Switch

Inoperative

Generator Drive and Standby Power Panel



1 Generator Drive (DRIVE) Lights

Illuminated (amber) – Integrated drive generator (IDG) low oil pressure caused by one of the following:

- IDG failure
- engine shutdown
- IDG automatic disconnect due to high oil temperature
- IDG disconnected through generator drive DISCONNECT switch

2 Generator Drive Disconnect (DISCONNECT) Switches (guarded)

Disconnects IDG if electrical power is available and engine start lever is in IDLE. IDG cannot be reconnected in the air.

3 STANDBY Power Off (PWR OFF) Light

Illuminated (amber) – one or more of the following busses are unpowered:

- AC standby bus
- DC standby bus
- battery bus

4 STANDBY POWER Switch

AUTO (guarded position) –

- In flight, or on the ground, and AC transfer busses powered:
  - AC standby bus is powered by AC transfer bus 1
  - DC standby bus is powered by TR1, TR2 and TR3
- In flight, or on the ground, loss of all AC power
  - AC standby bus is powered by battery through static inverter
  - DC standby bus is powered by battery
  - Battery bus is powered by battery

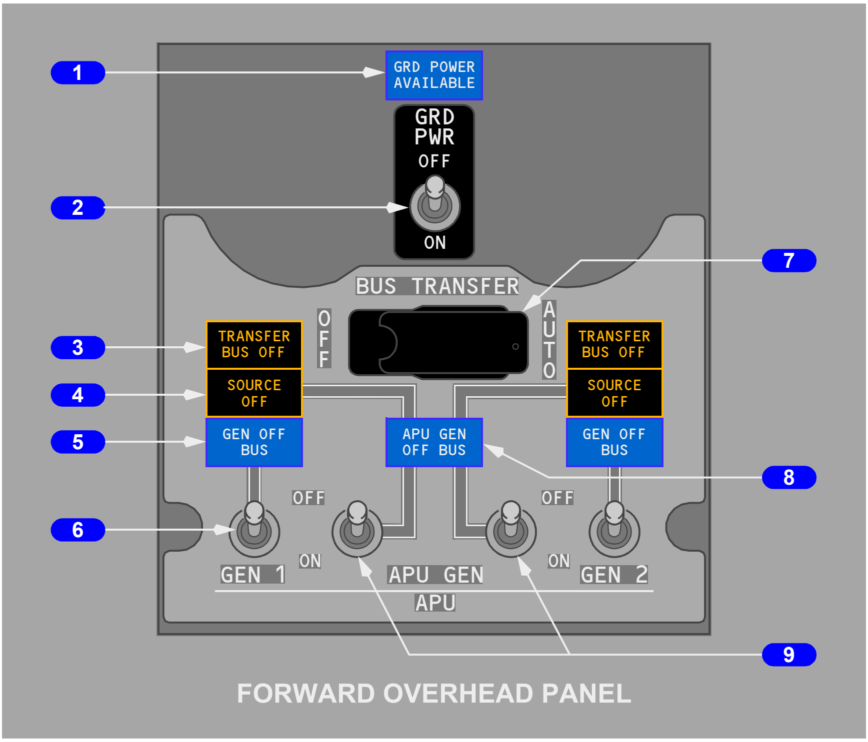
OFF (center position) –

- STANDBY PWR OFF light illuminates
- AC standby bus, static inverter, and DC standby bus are not powered

BAT (unguarded position) –

- AC standby bus is powered by battery through static inverter
- DC standby bus and battery bus are powered directly by battery

Ground Power Panel and Bus Switching Panel



1 Ground Power Available (GRD POWER AVAILABLE) Light

Illuminated (blue) – ground power is connected and meets airplane power quality standards.

2 Ground Power (GRD PWR) Switch

Three position switch, spring–loaded to neutral

OFF – disconnects ground power from AC transfer busses.

ON – if momentarily moved to ON position and ground power is available:

- removes previously connected power from AC transfer busses
- connects ground power to AC transfer busses if power quality is correct

3 TRANSFER BUS OFF Lights

Illuminated (amber) – related transfer bus is not powered.

4 SOURCE OFF Lights

Illuminated (amber) – no source has been manually selected to power the related transfer bus, or the manually selected source has been disconnected

- if a source has been selected to power the opposite transfer bus, both transfer busses are powered

5 Generator Off Bus (GEN OFF BUS) Lights

Illuminated (blue) – IDG is not supplying power to the related transfer bus.

6 Generator (GEN) Switches

Three position switch, spring–loaded to neutral.

OFF – disconnects IDG from related AC transfer bus by opening generator circuit breaker.

ON – connects IDG to related AC transfer bus by disconnecting previous power source and closing generator circuit breaker.

7 BUS TRANSFER Switch

AUTO (guarded position) – BTBs operate automatically to maintain power to AC transfer busses from any operating generator or external power

- DC cross tie relay automatically provides normal or isolated operation as required

OFF – isolates AC transfer bus 1 from AC transfer bus 2 if one IDG is supplying power to both AC transfer busses

- DC cross tie relay opens to isolate DC bus 1 from DC bus 2
- Inhibits TR3 input from connecting to AC transfer bus 1

8 APU Generator Off Bus (GEN OFF BUS) Light

Illuminated (blue) – APU is running and not powering a bus.

9 APU Generator (GEN) Switches

Three position switch, spring–loaded to neutral.

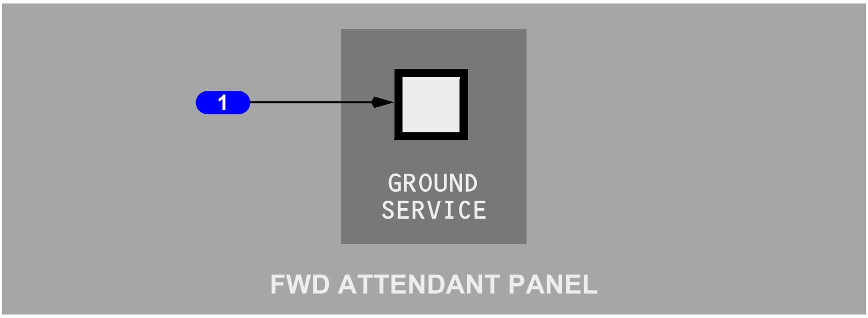
OFF –

- APU generator powering both AC transfer busses
  - moving a single APU GEN switch to OFF illuminates related SOURCE OFF light. APU continues to power AC transfer busses
  - subsequently moving other APU GEN switch to OFF disconnects APU generator from tie bus and removes APU power from AC transfer busses
- APU generator powering one AC transfer bus; IDG powering one AC transfer bus
  - moving related APU GEN switch to OFF disconnects APU generator from tie bus and AC transfer bus. IDG powers AC transfer busses

ON –

- Neither AC transfer bus powered by IDG – moving a single APU GEN switch to ON:
  - connects both AC transfer busses to the APU generator
  - disconnects external power, if connected
  - opposite SOURCE OFF light illuminates until the other APU GEN switch is moved to ON
- Both AC transfer busses powered by IDGs – moving an APU GEN switch ON:
  - powers the related AC transfer bus from the APU generator
  - other AC transfer bus continues to receive power from the IDG

Ground Service Switch



1 GROUND SERVICE Switch

Momentary push–button switch.

Provides manual control of ground service busses. Enables servicing airplane using external power without activating AC transfer busses.

Illuminated (white) –

- ON – connects external power to ground service busses
- OFF – disconnects external power from ground service busses

Introduction

Single Battery

[Option]

Primary electrical power is provided by two engine integrated drive generators (IDGs) which supply three-phase, 115 volt, 400 cycle alternating current. Each IDG supplies its own bus system in normal operation and can also supply essential and non-essential loads of the opposite side bus system when one IDG is inoperative. Transformer rectifier (TR) units and a battery/battery charger supply DC power. The battery also provides backup power for the AC and DC standby system. The APU operates a generator and can supply power to both AC transfer busses on the ground or in flight.

There are two basic principles of operation for the 737 electrical system:

- There is no paralleling of the AC sources of power
- The source of power being connected to a transfer bus automatically disconnects an existing source

The electrical power system may be categorized into three main divisions: the AC power system, the DC power system, and the standby power system.

Dual Battery

[Option]

Primary electrical power is provided by two engine integrated drive generators (IDGs) which supply three-phase, 115 volt, 400 cycle alternating current. Each IDG supplies its own bus system in normal operation and can also supply essential and non-essential loads of the opposite side bus system when one IDG is inoperative. Transformer rectifier (TR) units and the main battery/battery charger supply DC power. The main and auxiliary batteries also provide backup power for the AC and DC standby system. The APU operates a generator and can supply power to both AC transfer busses on the ground or in flight.

There are two basic principles of operation for the 737 electrical system:

- There is no paralleling of the AC sources of power
- The source of power being connected to a transfer bus automatically disconnects an existing source

The electrical power system may be categorized into three main divisions: the AC power system, the DC power system, and the standby power system.

Electrical Power Generation

Engine Generators

Primary power is obtained from two engine IDGs. The IDG maintains a constant generator speed throughout the normal operating range of the engine. An integral electro–mechanical disconnect device provides for complete mechanical isolation of the IDG.

APU Generator

The APU generator can supply power to both AC transfer busses on the ground or in flight. As the only power source, the APU generator can meet electrical power requirements for all ground conditions and most flight conditions.

External Ground Power

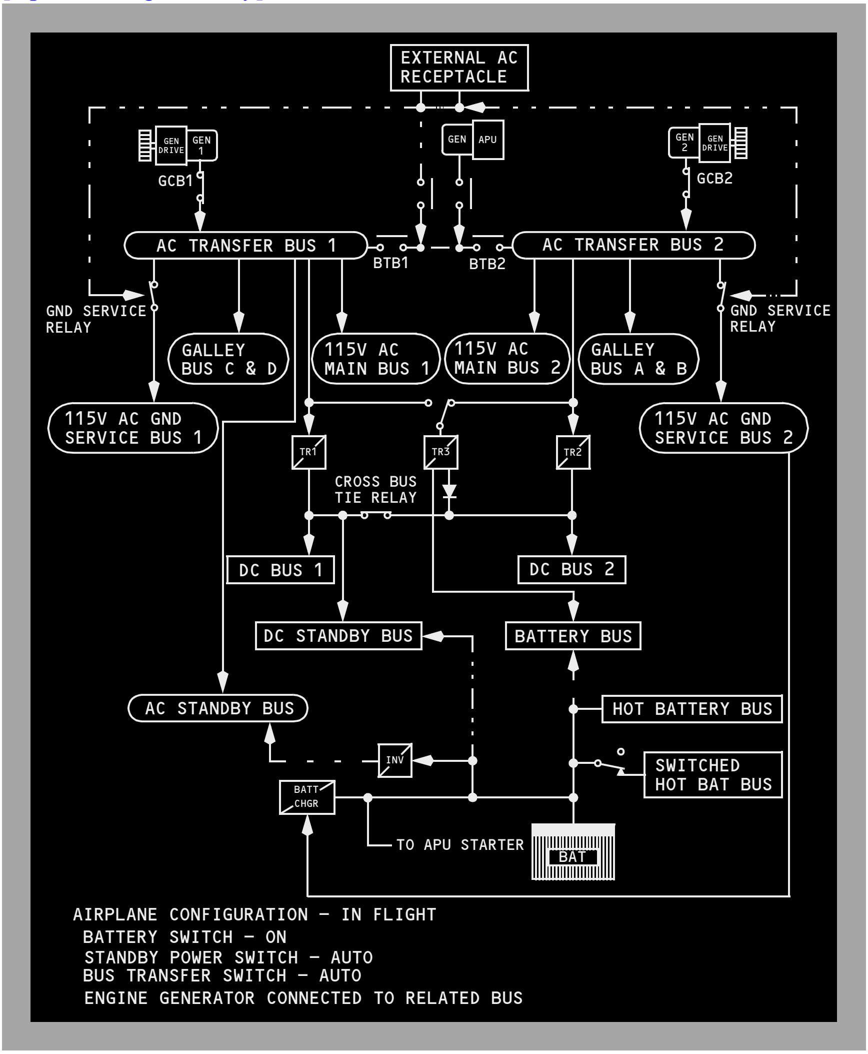
An external AC power receptacle located near the nose gear wheel well, on the lower right side of the fuselage, allows the use of an external power source. Status lights on a panel adjacent to the receptacle permit the ground crew to determine if external power is being used. When connected, external power can supply power to both transfer busses.

Ground Service

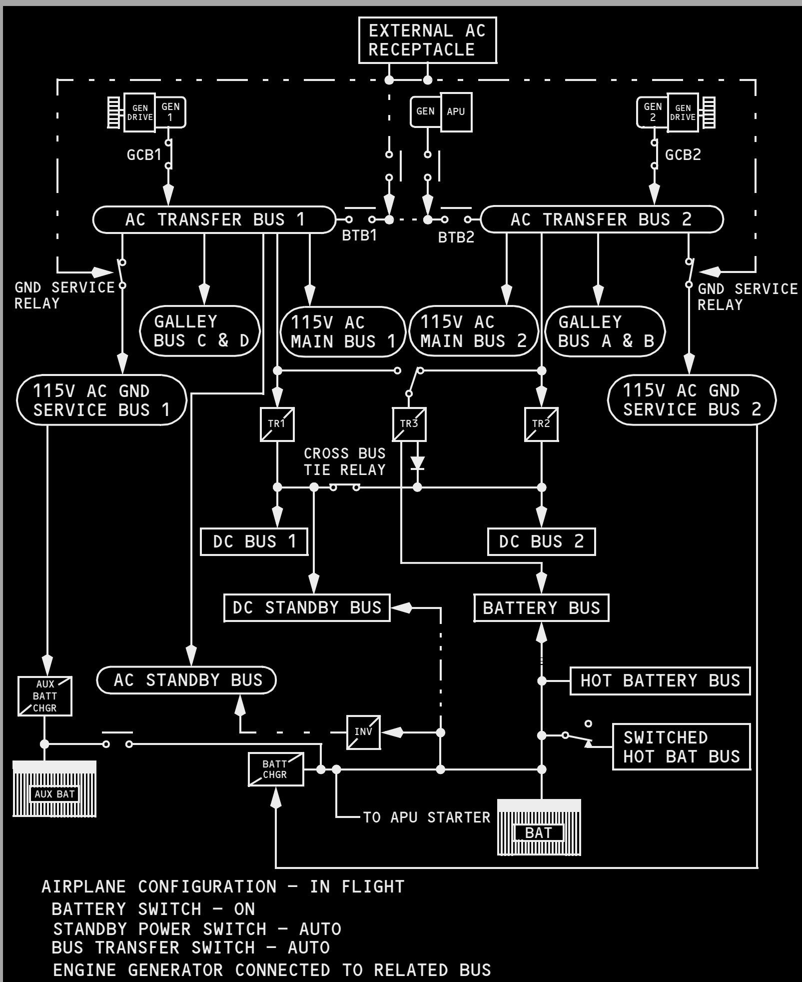
For ground servicing, a ground service switch is on the forward attendant's panel. The switch provides ground power directly to the AC ground service busses for utility outlets, cabin lighting and the battery charger without powering all airplane electrical busses. The ground service switch is a momentary push button and is overridden when both AC transfer busses are powered.

Electrical Power Schematic

[Option - Single battery]



[Option – Dual battery]



AC Power System

Each AC power system consists of a transfer bus, a main bus, two galley busses, and a ground service bus. Transfer bus 1 also supplies power to the AC standby bus. If the AC source powering either transfer bus fails or is disconnected, the transfer bus can be powered by any available source through the tie bus with the bus tie breakers (BTBs).

With the airplane on the ground and both generator control switches OFF, or with both engines shut down, selecting the GRD PWR switch ON connects external power to both transfer busses. Likewise, selecting either APU GEN switch ON connects APU power to both transfer busses. Whichever source is selected last powers both busses. It is not possible to power one transfer bus with external power and one transfer bus with APU power.

The transfer busses can be powered from the engine generators by momentarily positioning the related generator switch to ON. This closes the related generator circuit breaker (GCB) and connects the generator to the transfer bus. Whenever external power or APU is powering both transfer busses, and engine generator power is applied to its onside transfer bus, external power or APU continues to supply power to the remaining transfer bus.

In flight, each engine generator normally powers its own transfer bus. If an engine generator is no longer supplying power, the BTBs automatically close to allow the other engine generator to supply both transfer busses through the tie bus and BTBs. The APU can power either or both busses through the BTBs.

The system also incorporates an automatic generator on–line feature in case the airplane takes off with the APU powering both transfer busses. If the APU is either shut down or fails, the engine generators are automatically connected to their related transfer busses. This action occurs only once in flight and only under the circumstances described above.

Bus Tie System

Either generator or the APU can supply power to both transfer busses. If the BUS TRANS switch is in the AUTO position and the source powering the transfer bus is disconnected or fails, the source powering the opposite transfer bus automatically picks up the unpowered transfer bus through the BTBs.

Flight Deck Auxiliary Power System

The system is composed of a power converter and AC outlets on the P6 and P18 panels to provide power for Flight Deck Personal Electronic Devices (PEDs).

The system is composed of a power converter and AC outlets on the Captain and First Officer’s sidewall panels to provide power for Flight Deck Personal Electronic Devices (PEDs).

A protective device is a part of the safety aspect of the outlets to prevent tampering with foreign objects. PEDs that are plugged into the Flight Deck Auxiliary Power outlets must be fully inserted into the outlet with the prongs of the plug inserted simultaneously to activate the protective device. If a plug is not inserted correctly, electrical power will not be present at the outlet and the plug will need to be removed and reinserted.

Note: Plugs installed before power up will need to be removed and reinserted to achieve electrical power.

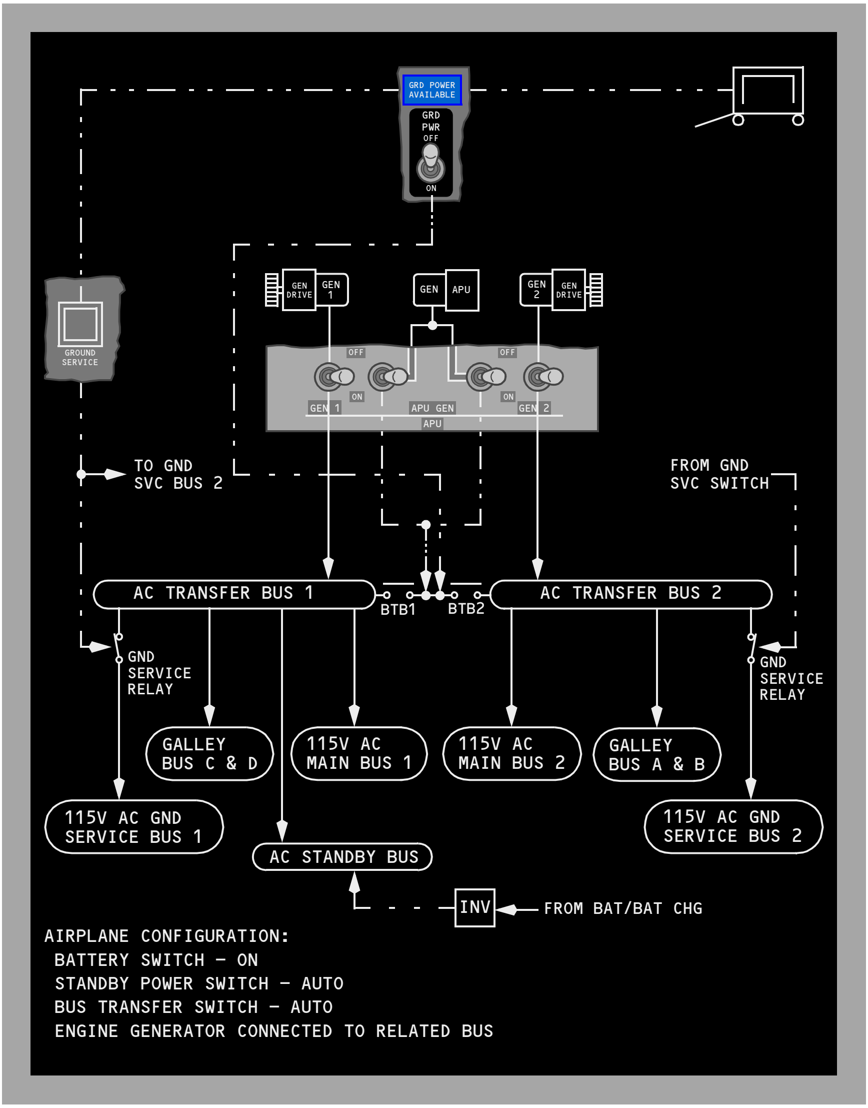
Automatic Load Shedding (Engine Generators)

[Option - CAB/UTIL Power Switch]
For single generator operation, the system is designed to shed electrical load incrementally based on actual load sensing. The galleys and main bus on transfer bus 2 are shed first; if an overload is still sensed, the galleys and main bus on transfer bus 1 are shed; if overload still exists, the IFE buses are shed. When configuration changes to more source capacity (two generator operation), automatic load restoration of the main busses, galley busses and IFE buses occurs; manual restoration of galley and main bus power can be attempted by moving the CAB/UTIL Power Switch to OFF, then back ON.

APU Automatic Load Shedding

[Option - CAB/UTIL Power Switch]
In flight, if the APU is the only source of electrical power, all galley busses and main buses are automatically shed. If electrical load still exceeds design limits, both IFE busses are also automatically shed. On the ground, the APU attempts to carry a full electrical load. If an overload condition is sensed, the APU sheds galley busses and main busses until the load is within limits. Manual restoration of galley and main bus power can be attempted by moving the CAB/UTIL Power Switch to OFF, then back ON.

AC Power Schematic



Electrical Power Controls and Monitoring

Generator Drive

The IDGs contain the generator and drive in a common housing, and are lubricated and cooled by a self–contained oil system. An integral electro–mechanical disconnect device provides for complete mechanical isolation of the IDG.

The generator drive (DRIVE) amber caution light is illuminated when low oil pressure is sensed in the IDG. IDG low oil pressure is caused by one of the following:

- IDG failure
- engine shutdown
- IDG automatic disconnect due to high oil temperature
- IDG disconnected through generator drive DISCONNECT switch

A generator drive disconnect switch is installed. This switch disconnects the generator from the engine in the event of a generator drive malfunction. Reactivation of the generator may be accomplished only on the ground by maintenance personnel.

AC Voltmeter, Ammeter and Frequency Meter

AC voltage and frequency may be read on the AC voltmeter and frequency meter for standby power, ground power, generator No. 1, APU generator, generator No. 2 and the static inverter. Frequency is indicated only when the generator is electrically excited. The voltage regulator automatically controls the generator output voltage.

Current readings for the two engine IDGs and the APU generator may be read on the AC ammeter.

The TEST position is used by maintenance and connects the voltage and frequency meter to the power systems test module for selection of additional reading points.

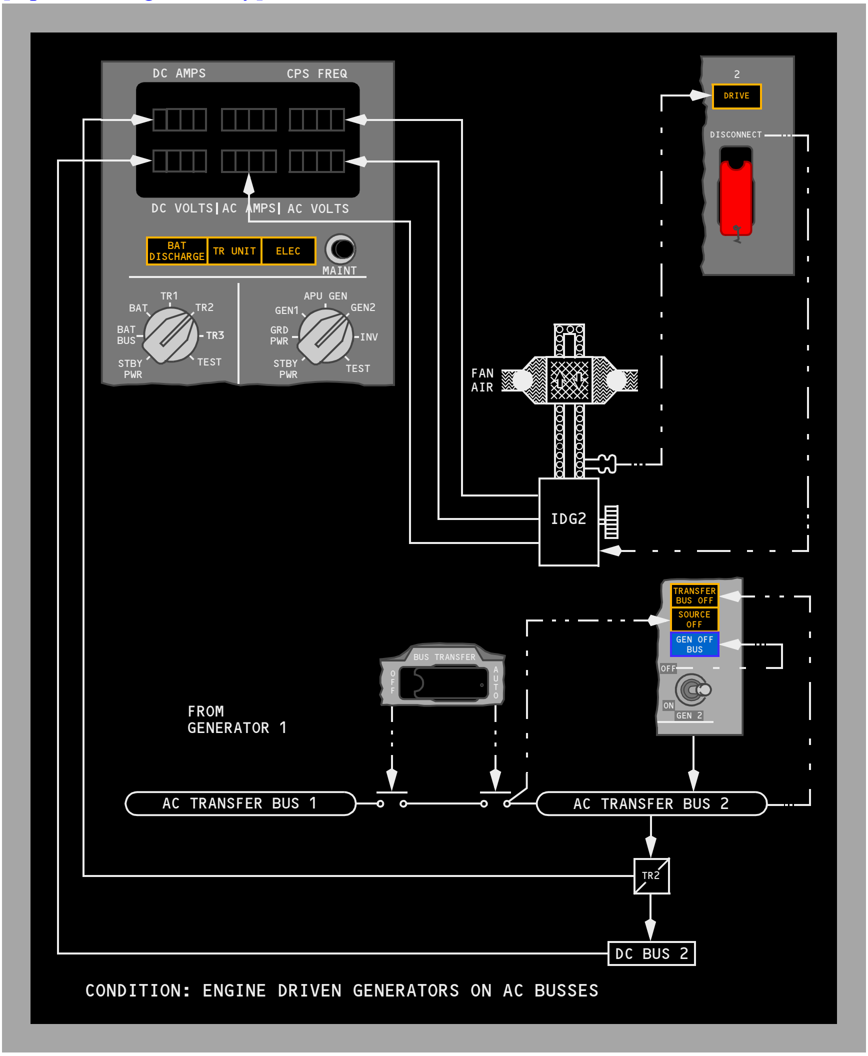
DC Voltmeter and Ammeter

DC voltage and amperage may be read on the DC voltmeter and ammeter for the battery and each of the three TRs. The standby power and battery bus displays only DC voltage.

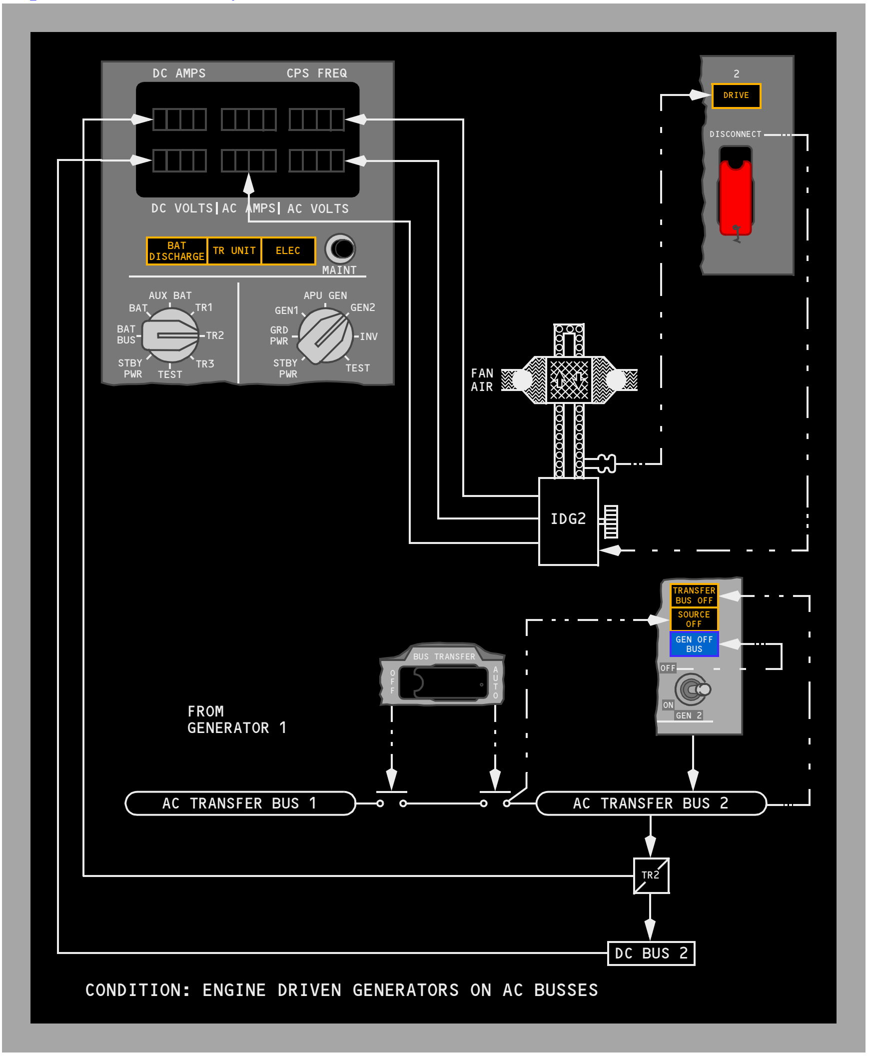
The TEST position is used by maintenance.

Electrical Power Controls and Monitoring Schematic

[Option - Single battery]



[Option – Dual battery]



DC Power System

28 volt DC power is supplied by three TR units, which are energized from the AC transfer busses. The battery provides DC power to loads required to be operative when no other source is available.

On the ground, an amber ELEC light comes on to indicate that a fault exists in DC power system or standby power system. The ELEC light is inhibited in flight.

Transformer Rectifier Units

The TRs convert 115 volt AC to 28 volt DC, and are identified as TR1, TR2, and TR3.

TR1 receives AC power from transfer bus 1. TR2 receives AC power from transfer bus 2. When Transfer Bus switch is set to AUTO, TR3 normally receives AC power from transfer bus 2 and has a backup source of AC power from transfer bus 1. Any two TRs are capable of supplying the total connected load.

Under normal conditions, DC bus 1, DC bus 2, and the DC standby bus are connected via the cross bus tie relay. In this condition, TR1 and TR2 are each powering DC bus 1, DC bus 2, and the DC standby bus. TR3 powers the battery bus and serves as a backup power source for TR1 and TR2.

The cross bus tie relay automatically opens, isolating DC bus 1 from DC bus 2, under the following conditions:

- At glide slope capture during a flight director or autopilot ILS approach. This isolates the DC busses during approach to prevent a single failure from affecting both navigation receivers and flight control computers
- Bus transfer switch positioned to OFF

In–flight, an amber TR UNIT light illuminates if TR1, or TR2 and TR3 has failed. On the ground, any TR fault causes the light to illuminate.

Battery Power

Single Battery

[Option]
A 24 volt nickel–cadmium battery is located in the electronics compartment. The battery can supply part of the DC system. Battery charging is automatically controlled. A fully charged battery has sufficient capacity to provide standby power for a minimum of 30 minutes. Battery voltage range is 22–30 volts.

DC busses powered from the battery following a loss of both generators are:

- battery bus
- DC standby bus
- hot battery bus
- switched hot battery bus

The switched hot battery bus is powered whenever the battery switch is ON.

The hot battery bus is always connected to the battery. There is no switch in this circuit. The battery must be above minimum voltage to operate units supplied by this bus. An amber BAT DISCHARGE light comes on when excessive battery discharge is detected.

Dual Battery

[Option]
Two 24 volt nickel–cadmium batteries, main and auxiliary, are located in the electronics compartment. The batteries can supply part of the DC system. The auxiliary battery operates in parallel with the main battery when the battery is powering the standby system. At all other times, the auxiliary battery is isolated from the power distribution system. Battery charging is automatically controlled. Two fully charged batteries have sufficient capacity to provide standby power for a minimum of 60 minutes. Battery voltage range is 22–30 volts.

DC busses powered from the battery following a loss of both generators are:

- battery bus
- DC standby bus
- hot battery bus
- switched hot battery bus

The switched hot battery bus is powered whenever the battery switch is ON.

The hot battery bus is always connected to the battery. There is no switch in this circuit. The battery must be above minimum voltage to operate units supplied by this bus. An amber BAT DISCHARGE light comes on when excessive battery discharge is detected.

Battery Charger Transformer/Rectifier

Single Battery

[Option]
The purpose of the battery charger is to restore and maintain the battery at full electrical power. The battery charger is powered through AC ground service bus 2.

The battery charger provides a voltage output tailored to maximize the battery charge. Following completion of the primary charge cycle, the battery charger reverts to a constant voltage TR mode. In the TR mode, Battery charger powers the loads of Hot Battery Bus and Switched Hot Battery Bus. In Battery Charge mode, the charger would be providing power to the Switched Hot Battery Bus and the Hot Battery Bus as well as providing enough power to charge the Battery. The battery charger TR also powers the battery bus if TR3 fails. With loss of AC transfer bus 1 or the source of power to DC bus 1, the AC and DC standby busses are powered by the battery/battery charger.

Dual Battery

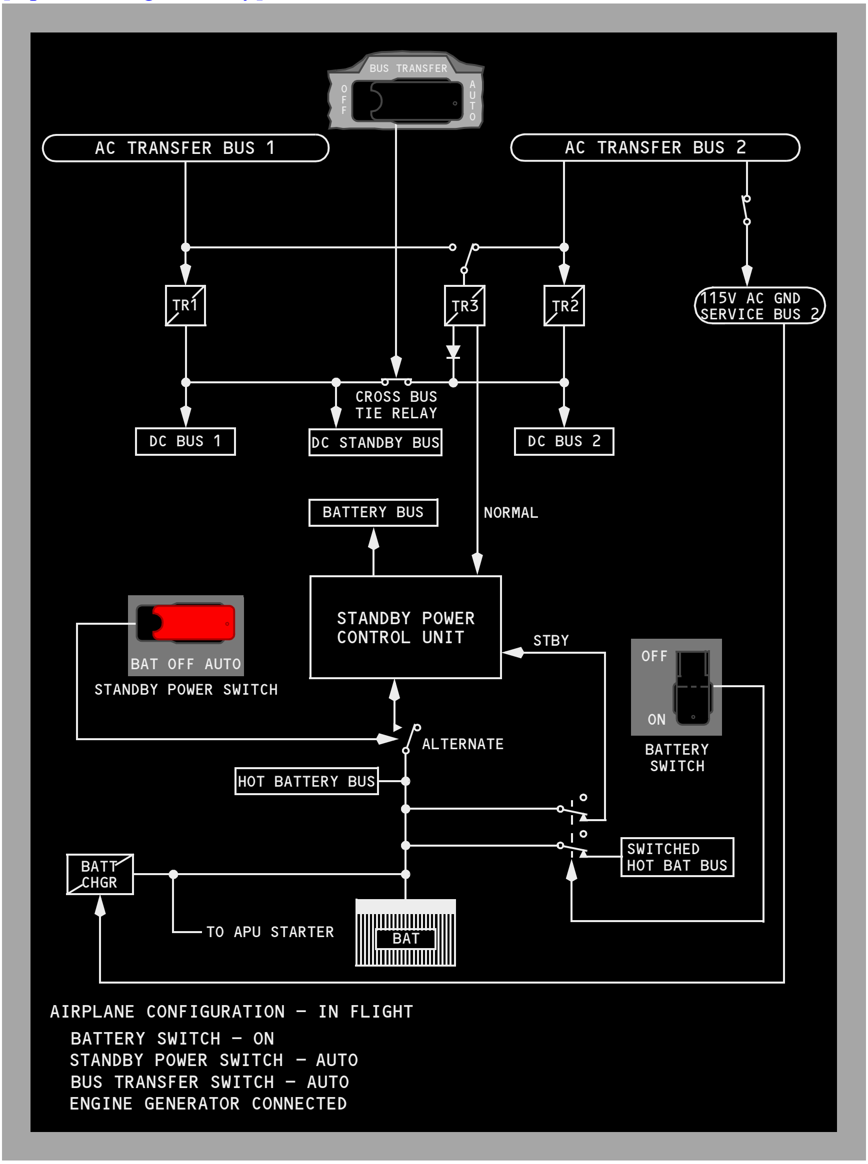
[Option]
The purpose of the battery chargers is to restore and maintain the batteries at full electrical power. The main battery charger is powered through AC ground service bus 2. The auxiliary battery charger is powered through AC ground service bus 1.

The battery chargers provide a voltage output tailored to maximize the battery charge. Following completion of the primary charge cycle, the main battery charger reverts to a constant voltage TR mode. In the TR mode, it powers loads connected to the hot battery bus and the switched hot battery bus. The main battery charger TR also powers the battery bus if TR3 fails. With loss of AC transfer bus 1 or the source of power to DC bus 1, the AC and DC standby busses are powered by the main and auxiliary battery/battery chargers.

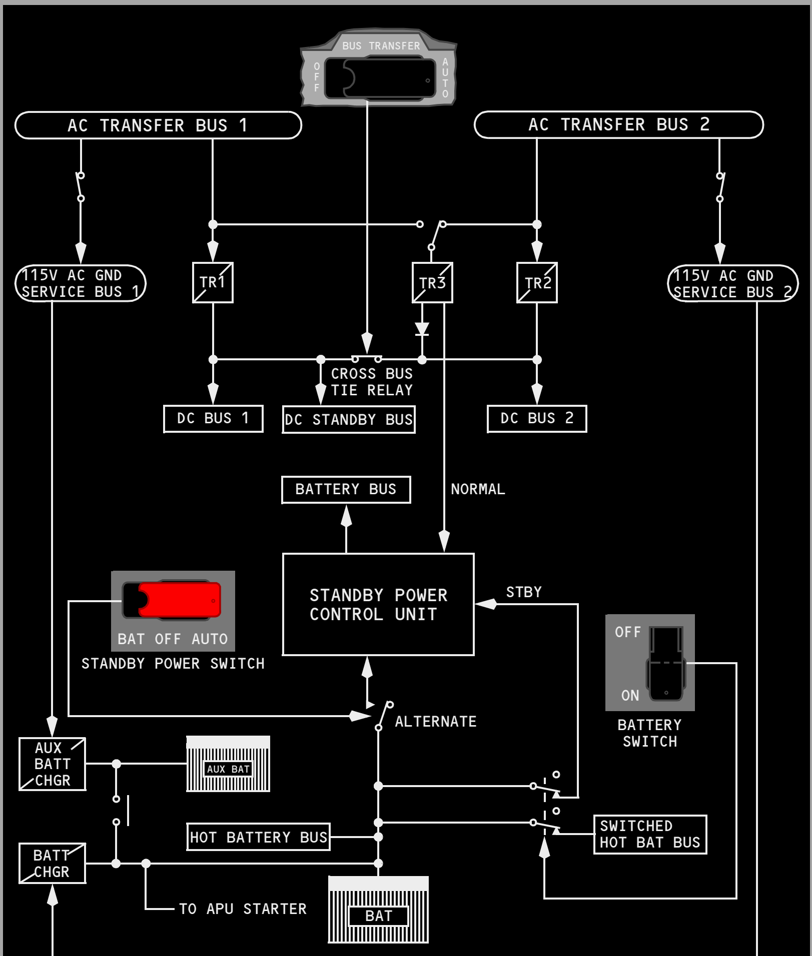
The auxiliary battery charger and battery are isolated from the power distribution system under normal operation. When the main battery is powering the standby system, the auxiliary battery is connected to operate in parallel with the main battery.

DC Power System Schematic

[Option - Single battery]



[Option – Dual battery]



AIRPLANE CONFIGURATION – IN FLIGHT

BATTERY SWITCH – ON
STANDBY POWER SWITCH – AUTO
BUS TRANSFER SWITCH – AUTO
ENGINE GENERATOR CONNECTED TO RELATED BUS

Standby Power System

Normal Operation

The standby system provides 115V AC and 24V DC power to essential systems in the event of loss of all engine or APU–driven AC power. The standby power system consists of:

- static inverter
- AC standby bus
- DC standby bus
- battery bus
- hot battery bus
- switched hot battery bus
- main battery

[Option - Dual battery]
- auxiliary battery

During normal operation the guarded standby power switch is in AUTO and the battery switch is ON. This configuration provides alternate power sources in case of partial power loss as well as complete transfer to battery power if all normal power is lost. Under normal conditions the AC standby bus is powered from AC transfer bus 1. The DC standby bus is powered by TR1, TR2, and TR3; the battery bus is powered by TR3; the hot battery bus and switched hot battery bus are powered by the battery/battery charger.

Alternate Operation

Single Battery

[Option]
The alternate power source for standby power is the battery. With the standby power switch in the AUTO position, the loss of all engine or APU electrical power causes the battery to power the standby loads, both in the air and on the ground. The AC standby bus is powered from the battery via the static inverter. The DC standby bus, battery bus, hot battery bus, and switched hot battery bus are powered directly from the battery.

The standby power switch provides for automatic or manual control of power to the standby buses.

In the AUTO position, automatic switching from normal to alternate power occurs if power from either AC transfer bus 1 or DC bus 1 is lost.

Positioning the switch to BAT overrides automatic switching and places the AC standby bus, DC standby bus, and battery bus on battery power. The battery switch may be ON or OFF. If the battery switch is OFF, the switched hot battery bus is not powered.

Positioning the standby power switch to OFF de–energizes both the AC standby bus and the DC standby bus and illuminates the STANDBY PWR OFF light.

Dual Battery

[Option]

The alternate power sources for standby power are the main battery and auxiliary battery. With the standby power switch in the AUTO position, the loss of all engine or APU electrical power causes the batteries to power the standby loads, both in the air and on the ground. The AC standby bus is powered from the batteries via the static inverter. The DC standby bus, battery bus, hot battery bus, and switched hot battery bus are powered directly from the batteries.

The standby power switch provides for automatic or manual control of power to the standby buses.

In the AUTO position, automatic switching from normal to alternate power occurs if power from either AC transfer bus 1 or DC bus 1 is lost.

Positioning the switch to BAT overrides automatic switching and places the AC standby bus, DC standby bus, and battery bus on battery power. The battery switch may be ON or OFF. If the battery switch is OFF, the switched hot battery bus is not powered.

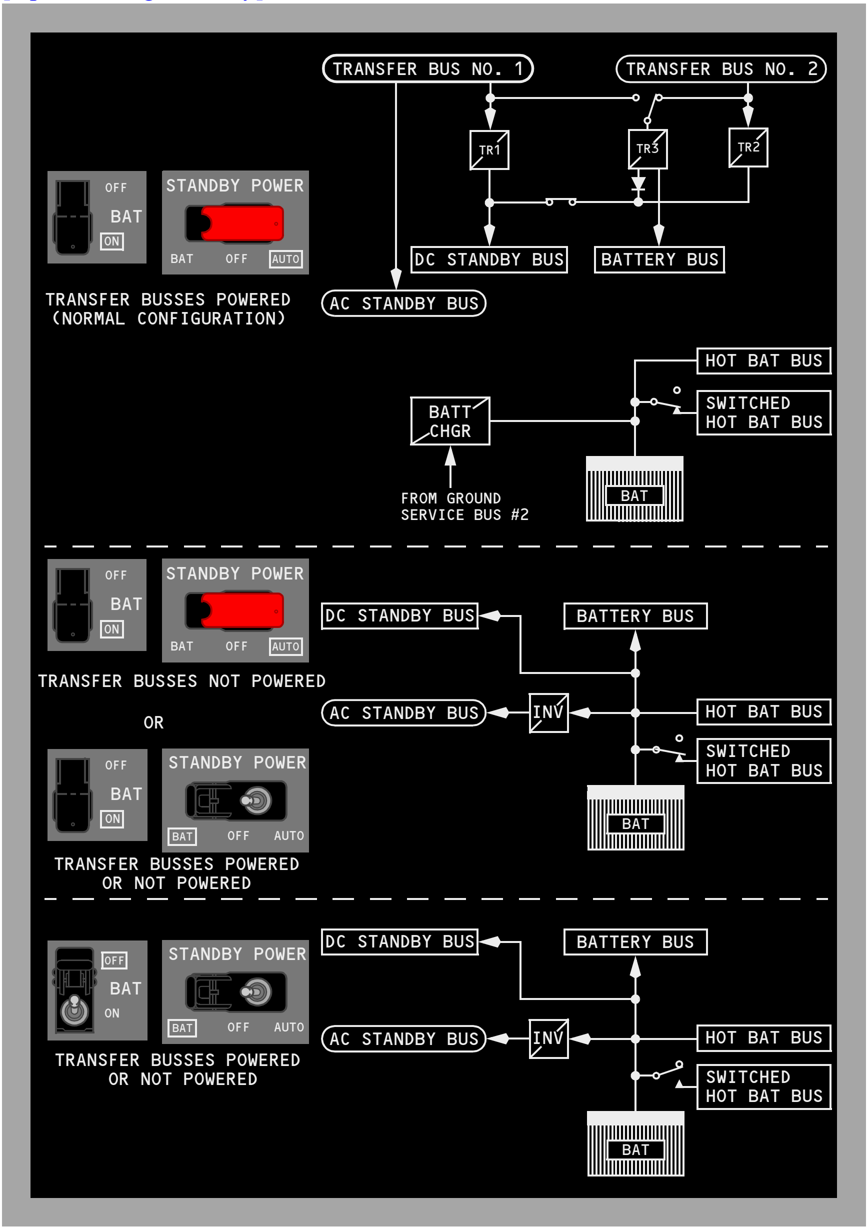
Positioning the standby power switch to OFF de–energizes both the AC standby bus and the DC standby bus and illuminates the STANDBY PWR OFF light.

Static Inverter

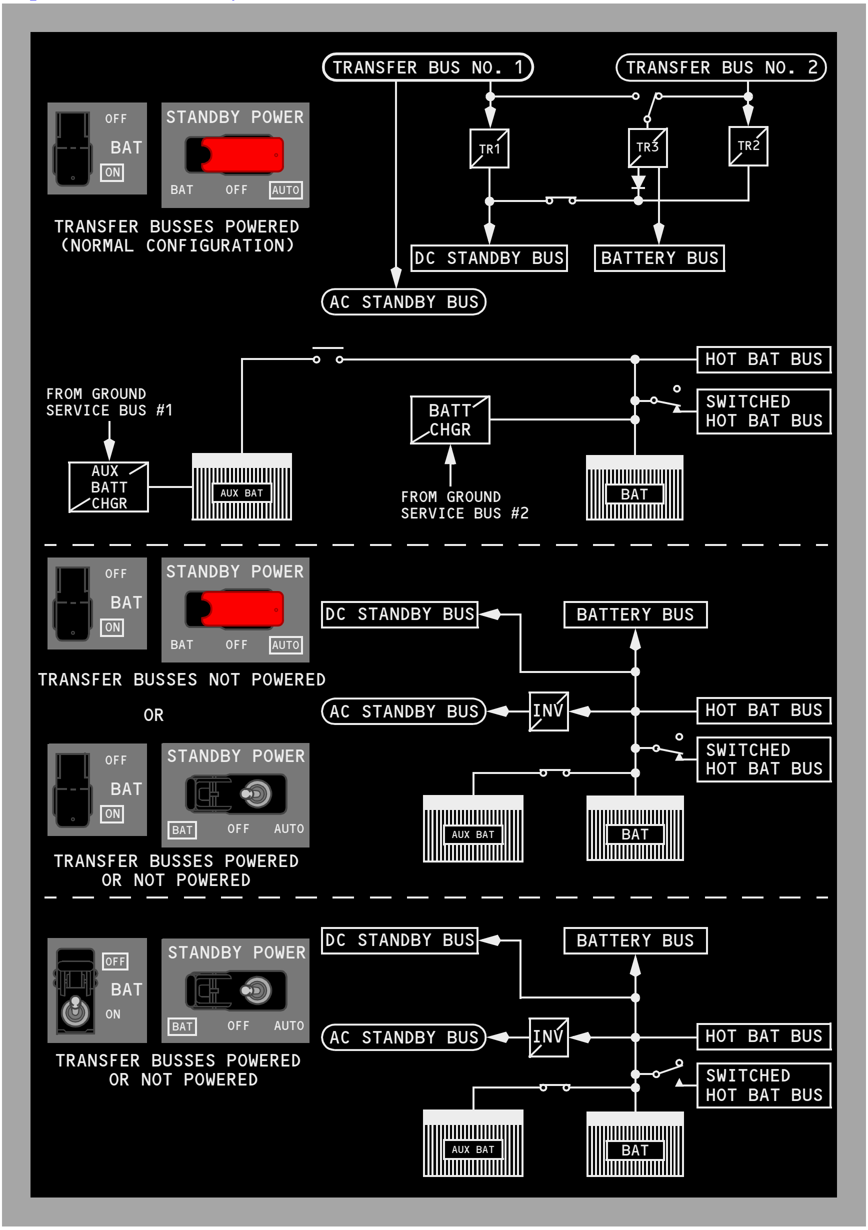
The static inverter converts 24 volt DC power from the battery to 115V AC power to supply the AC standby bus during the loss of normal electrical power. The power supply to the inverter is controlled by the standby power switch and the battery switch on the overhead panel.

Standby Power System Schematic

[Option - Single battery]



[Option – Dual battery]



All Generators Inoperative

The following list identifies the significant equipment that operates when the main battery and the auxiliary battery are the only source of electrical power.

Airplane General

- standby compass light
- white dome lights
- emergency instrument flood lights
- flight crew oxygen
- passenger oxygen

[Option]
- standby forward airstair interior/exterior operation

Air Systems

- A/C pack valves
- BLEED TRIP OFF lights
- manual pressurization control
- altitude warning horn
- CABIN ALTITUDE lights

[737-600/700]
- PACK TRIP OFF lights

[737-800/900]
- PACK lights

Anti-Ice

[Option]
- Captain’s pitot probe heat

Communications

- flight interphone system
- service interphone system
- passenger address system
- VHF No. 1

Electrical

- STANDBY POWER OFF light

Engines, APU

[Over/Under Engine Display]
- upper display unit

N1, N2, fuel flow, EGT, fuel quantity, oil pressure, oil temperature, oil quantity

[Side-by-Side Engine Display]
- upper display unit

N1, N2, fuel flow, EGT, fuel quantity, oil pressure, oil temperature, oil quantity, hydraulic pressure, hydraulic quantity

- thrust reversers
- starter valves
- right igniters
- APU operation (start attempts not recommended above 25,000 feet)

Fire Protection

- APU and engine fire extinguisher bottles
- APU and engine fire detection system
- Cargo fire extinguisher bottle

Flight Instruments

- Captain's outboard display unit (compact EFIS or PFD format)

[Option]
- Captain's outboard and inboard display units (EFIS/MAP or PFD/ND format)
- clocks
- left EFIS control panel
- Standby instruments

radio magnetic indicator (RMI), standby airspeed/altimeter, standby attitude indicator, standby magnetic compass

Flight Management, Navigation

- FMC
- left CDU
- heading/track indications
- VHF NAV No. 1
- ILS No. 1
- GLS No.1
- left IRS
- left GPS
- marker beacon

[Option]
- ADF No. 1

[Option]
- IFF No. 1

[Option]
- transponder No. 1

[Option]
- DME No. 1

Fuel

- crossfeed valve
- engine fuel shutoff valves
- ENG VALVE CLOSED lights
- spar fuel shutoff valve
- SPAR VALVE CLOSED lights
- fuel quantity indicators

Hydraulic Power

- engine hydraulic shutoff valves
- standby rudder shutoff valves

Landing Gear

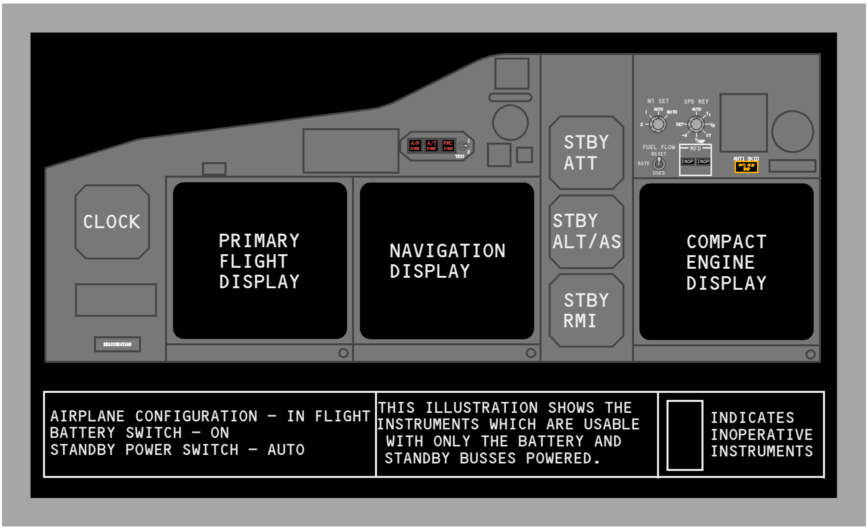
- inboard antiskid system
- ANTISKID INOP light
- parking brake
- air/ground system
- landing gear indicator lights

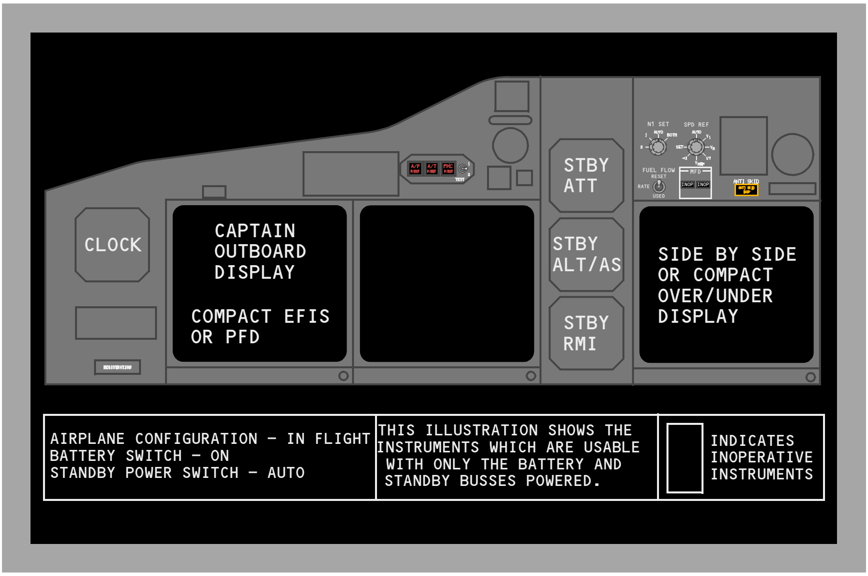
Warnings

- stall warning system
- aural warnings
- master caution light recall

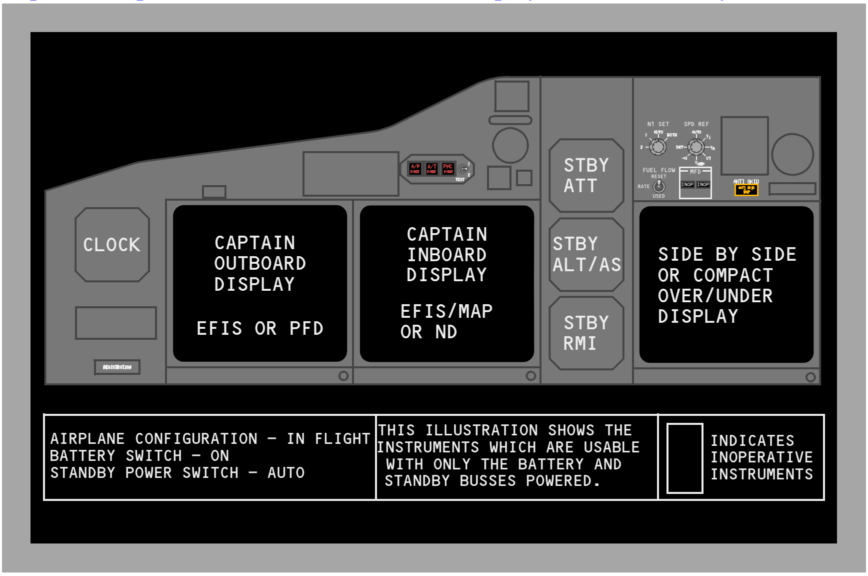
Basic Equipment Operating – Captain Instrument Panel

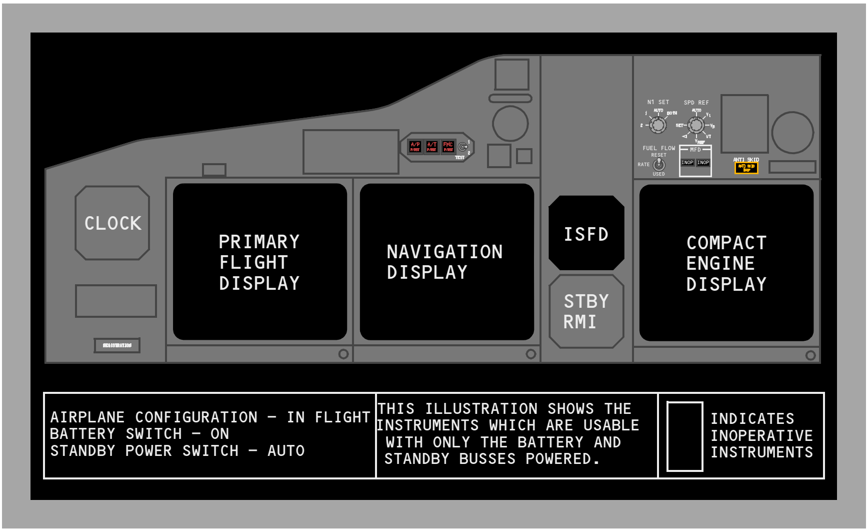
The standby power system utilizes the battery as a source of power to supply the below depicted flight instruments. All of the Captain's instruments that are powered by standby power are integrally lighted on standby power.



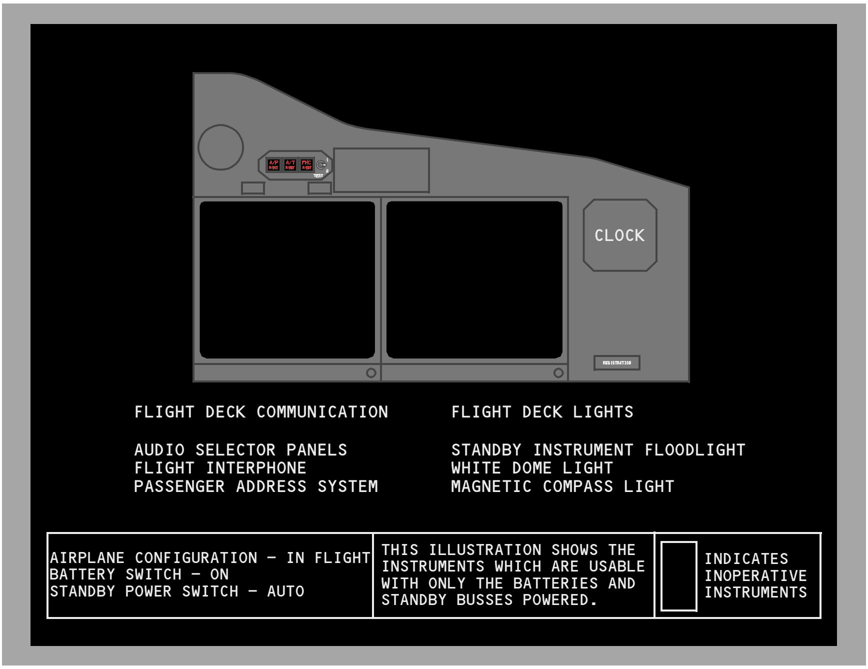


[Option - Captain's Outboard and Inboard Display Units on Standby Power]





Basic Equipment Operating – First Officer Instrument Panel



Intentionally
Blank

Engines, APU — Chapter 7
Table of Contents — Section TOC

Intentionally
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Primary and Secondary Engine Indications

[Option - Side by side display, lbs]

1 **Primary Engine Indications**

2 **Fuel Quantity Indications**

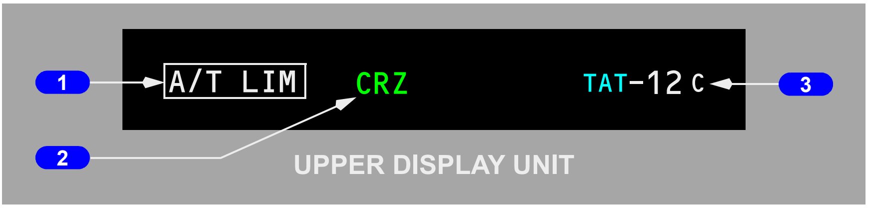
Refer to Chapter 12, Fuel.

3 **Secondary Engine Indications**

4 **Hydraulic Indications**

Refer to Chapter 13, Hydraulics.

Autothrottle Limit, Thrust Mode Display and Total Air Temperature



1 Autothrottle Limit (A/T LIM) Indication

Illuminated (white) – The FMC is not providing the A/T system with N1 limit values. The A/T is using a degraded N1 thrust limit from the related EEC.

2 Thrust Mode Display

Displayed (green) – the active N1 limit reference mode.

With N1 Set Outer Knob (on engine display control panel) in AUTO, active N1 limit is displayed by reference N1 bugs.

With N1 Set Outer Knob (on engine display control panel) in either 1, 2 or BOTH (other than AUTO), the thrust mode display annunciation is MAN.

Active N1 limit is normally calculated by FMC.

[Option - with Double Derate]
Thrust mode display annunciations are:

- TO – takeoff
- TO 1 – derated takeoff one
- TO 2 – derated takeoff two
- D-TO – assumed temperature reduced thrust takeoff
- D-TO 1 – derate one and assumed temperature reduced thrust takeoff
- D-TO 2 – derate two and assumed temperature reduced thrust takeoff

[Option]
- TO B – takeoff bump thrust
- CLB – climb
- CLB 1 – derated climb one
- CLB 2 – derated climb two
- CRZ – cruise
- G/A – go–around
- CON – continuous

[Option]
- Q-CLB – quiet climb
- —— – FMC not computing thrust limit.

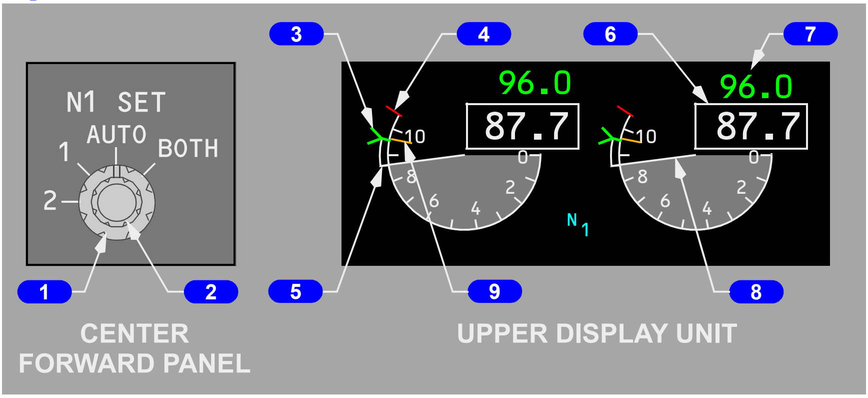
Note: In the “bump” configuration, the highest takeoff thrust level is an FMC selectable thrust bump and the use of assumed temperature method (ATM) thrust reduction is not allowed in combination with the bump rating..

3 Total Air Temperature (TAT) Indication

Displayed (label –cyan, temp – white) – total air temperature (degrees C).

N1 Indications

[Option - with Double Derate]



1 N1 SET Outer Knob

AUTO –
- both reference N1 bugs set by FMC based on N1 limit page and takeoff reference page
- displays reference N1 bugs at active N1 limit for A/T.

BOTH –
- both reference N1 bugs and readouts manually set by turning N1 SET inner knob
- has no effect on A/T operation.

1 or 2 –
- respective N1 reference bug and readout manually set by turning N1 SET inner knob
- has no effect on A/T operation.

2 **N1 SET Inner Knob (spring-loaded to center)**

Rotate – positions reference N1 bug(s) and readouts when N1 SET outer knob is set to BOTH, 1, or 2.

3 **Reference N1 Bugs**

Displayed (green) – with N1 SET outer knob in AUTO, 1, 2 or BOTH position.

4 **N1 Redlines**

Displayed (red) – N1% RPM operating limit

5 **N1 Command Sectors**

Displayed (white) – momentary difference between actual N1 and value commanded by thrust lever position.

6 **N1 RPM Readouts (digital)**

Displayed (white) – normal operating range.

Displayed (red) –

- operating limit exceeded
- on ground after engine shutdown, red box indicates an inflight exceedance has occurred.

7 **Reference N1 Readouts**

Displayed (green) –

- manually set N1% RPM when N1 SET outer knob is in BOTH, 1, or 2 position
- – – – – when N1 SET outer knob is in AUTO position and FMC source invalid.

[Option - with Double Derate]
- when N1 SET outer knob is in AUTO position, may indicate fixed derate, assumed temperature derate, or a combination of fixed and assumed temperature derate

Not Displayed when Reverse Thrust is selected.

8 **N1 RPM Indications**

Displays N1% RPM:

- displayed (white) – normal operating range
- displayed (red) – operating limit exceeded.

[Option - Double Derate]

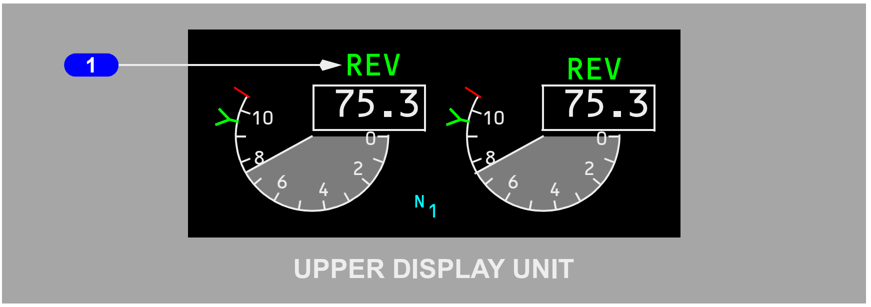
9 **N1 Maximum Bug**

Displayed (amber) –

- N1 value for full rated thrust
- computed by the EEC through all phases of flight.

Not Displayed when Reverse Thrust is selected.

Thrust Reverser Indications

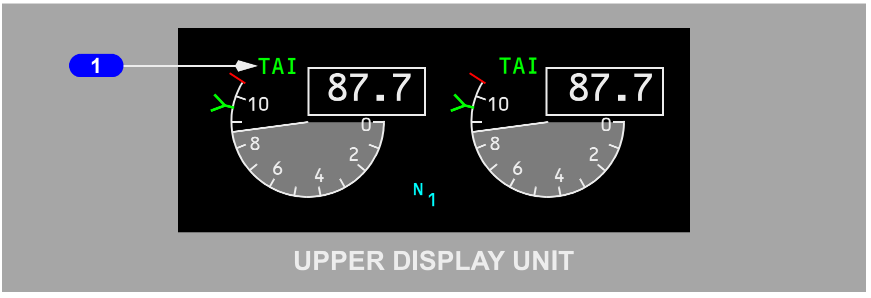


1 **Thrust Reverser (REV) Indications**

Displayed (amber) – thrust reverser is moved from stowed position.

Displayed (green) – thrust reverser is deployed.

Thermal Anti–Ice Indication

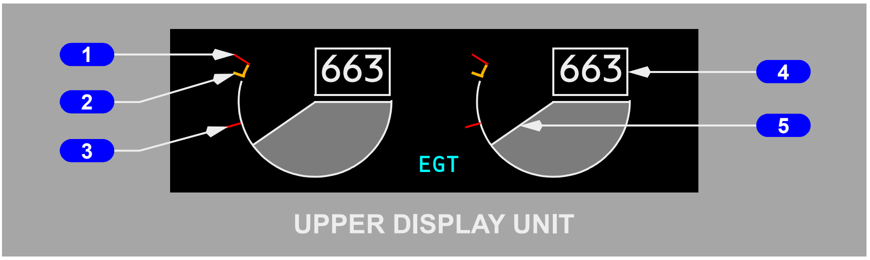


1 **Thermal Anti–Ice (TAI) Indications**

Displayed (green) – cowl anti–ice valve(s) open.

Displayed (amber) – cowl anti–ice valve is not in position indicated by related engine anti–ice switch.

EGT Indications



1 Exhaust Gas Temperature (EGT) Redlines

Displayed (red) –

- maximum takeoff EGT limit.
- maximum in-flight start EGT limit when the start linit redline is not shown.

2 Exhaust Gas Temperature (EGT) Amber Bands

Displayed (amber) – lower end of band displays maximum continuous EGT limit.

3 Exhaust Gas Temperature (EGT) Start Limit Redlines

Displayed (red) –

- until the engine achieves stabilized idle (approximately 59% N2).
- for ground starts and some-in-flight starts as determined by the EEC.

4 Exhaust Gas Temperature (EGT) Readouts (digital)

Displayed (white) – normal operating range (degrees C)

[Option - Color change inhibit 10 minutes]
Displayed (amber) – maximum continuous limit exceeded

- color change inhibited for up to 5 minutes during takeoff or go-around (normal operation)
- color change inhibited for up to 10 minutes during takeoff or go-around (when an engine out condition occurs within the first 5 minutes of the inhibit)

Displayed (red) – maximum takeoff limit or start limit exceeded

On ground, after both engines are shut down, red box indicates an exceedance has occurred

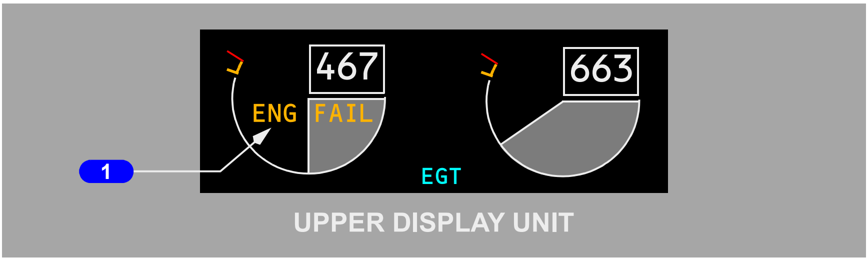
EEC senses conditions that may lead to hot start during ground starts (blinking white box).

5 **Exhaust Gas Temperature (EGT) Indications**

Displayed (white) – normal operating range.

Displayed (red) – maximum takeoff limit or start limit exceeded.

Engine Fail Alert



1 **Engine Fail (ENG FAIL) Alert**

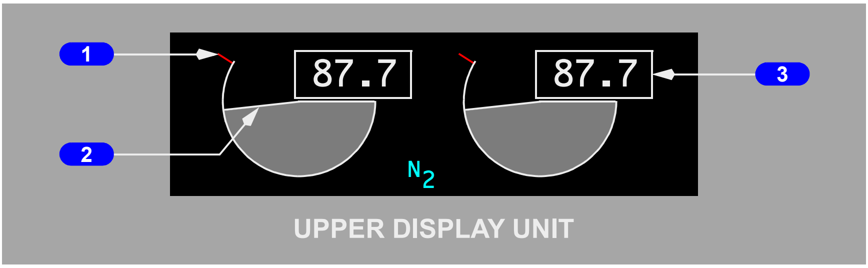
Displayed (amber) –

- engine N2 below sustainable idle (less than 50%); and
- engine start lever in IDLE position.

Alert remains until –

- engine N2 above sustainable idle (50% or greater); or
- start lever moved to CUTOFF; or
- engine fire switch pulled.

N2 Indications



1 **N2 Redlines**

Displayed (red) – N2 % RPM operating limit.

2 N2 RPM Indications

Displays N2 % RPM

- displayed (white) – normal operating range
- displayed (red) – operating limit exceeded.

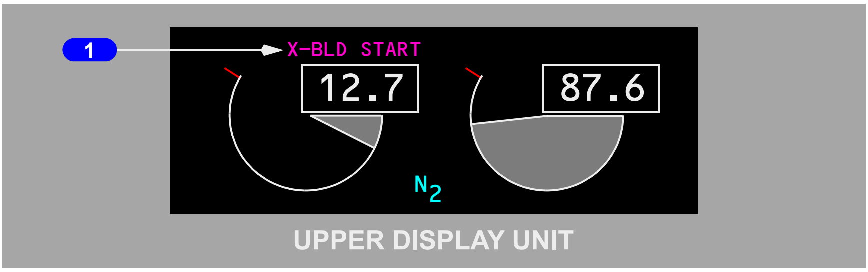
3 N2 Readouts (digital)

Displayed (white) – normal operating range.

Displayed (red) –

- operating limit exceeded
- on ground, after engine shutdown, red box indicates an inflight exceedance has occurred.

Crossbleed Start Indication



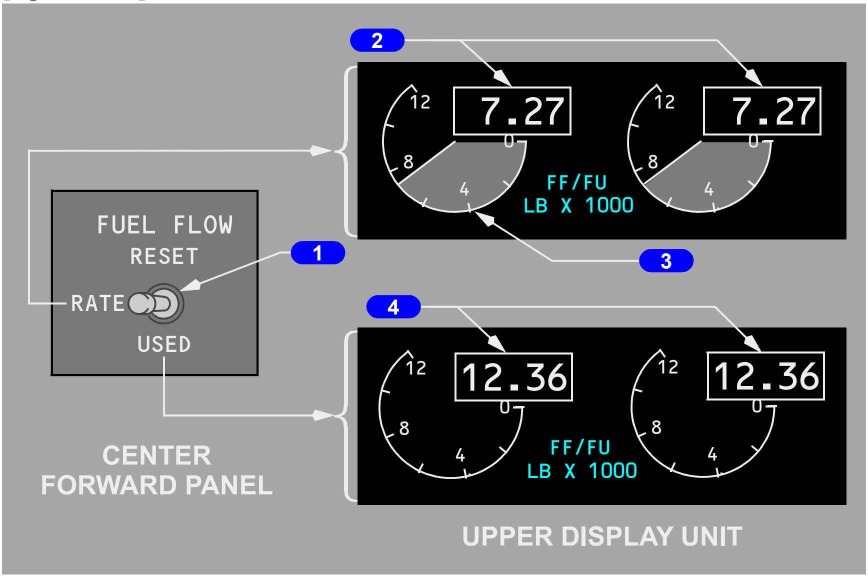
1 Crossbleed (X–BLD) START Indication

Displayed (magenta) – crossbleed air recommended for inflight start.

Displayed when airspeed is less than required for a windmilling start.

Fuel Flow/Fuel Used Indications

[Option - lbs]



1 FUEL FLOW Switch (spring-loaded to RATE)

RATE – displays fuel flow to engine.

USED –

- pointer and shading are removed
- displays fuel used since last reset
- after 10 seconds, display automatically reverts to fuel flow.

RESET –

- pointer and shading are removed
- resets fuel used to zero
- displays fuel used momentarily, decreases to zero, then displays fuel flow.

2 Fuel Flow (FF) Readout (digital)

[Option - lbs]
Displayed (white) – fuel flow to engine with FUEL FLOW switch in RATE position (pounds per hour x 1000).

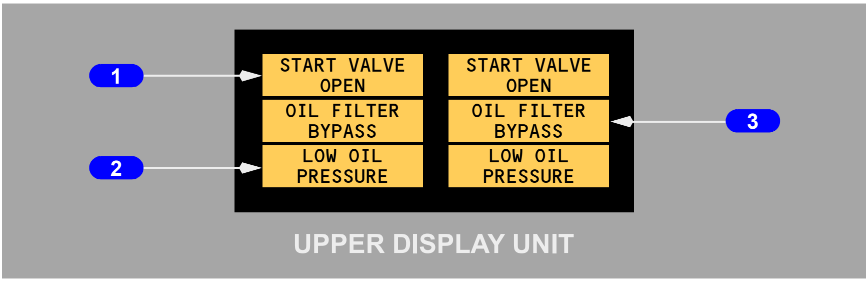
3 Fuel Flow (FF) Dial/ Index Markers & Digits (white)

[Option - lbs]
Displayed (white) – fuel flow to engine with FUEL FLOW switch in RATE position (pounds per hour x 1000).

4 Fuel Used (FU) Readout (digital)

Displayed (white) – when FUEL FLOW switch moved to USED or RESET.

Crew Alerts



1 START VALVE OPEN Alert

Illuminated (amber) –

- steady – respective engine start valve open and air is supplied to starter
- blinking – uncommanded opening of start valve. Alert is displayed and solid amber boxes are displayed in unannunciated positions for that engine. All three boxes blink for ten seconds, then alert remains on steady and solid amber boxes are removed (see Note).

2 LOW OIL PRESSURE Alert

Illuminated (amber) –

- steady – oil pressure at or below red line
- blinking – with a condition of low oil pressure. Alert is displayed and solid amber boxes are displayed in unannunciated positions for that engine. All three boxes blink for ten seconds, then alert remains on steady and solid amber boxes are removed (see Note).

3 OIL FILTER BYPASS Alert

Illuminated (amber) –

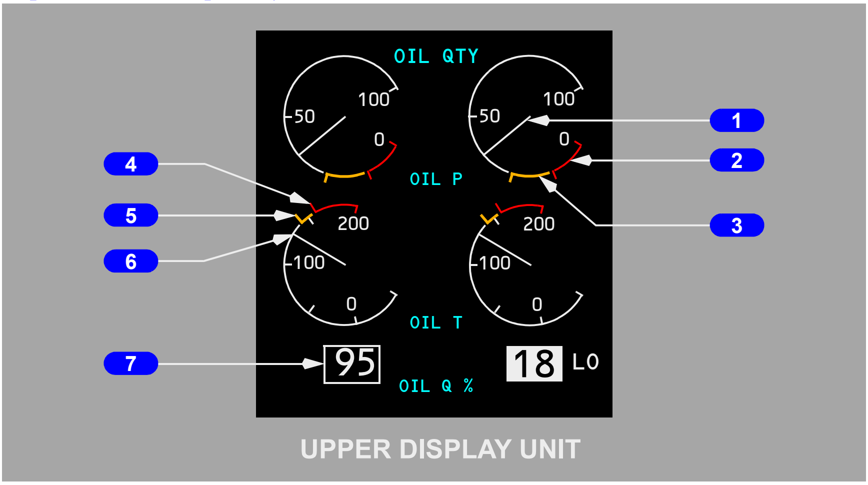
- steady – indicates an impending bypass of scavenge oil filter
- blinking – with an impending bypass. Alert is displayed and solid amber boxes are displayed in unannunciated positions for that engine. All three boxes blink for ten seconds, then alert remains on steady and solid amber boxes are removed (see Note).

Note: Blinking is inhibited:

- during takeoff from 80 knots to 400 feet RA, or 30 seconds after reaching 80 knots, whichever occurs first
- during landing below 200 feet RA until 30 seconds after touchdown
- during periods when blinking is inhibited, alerts illuminate steady.

Engine Oil Indications

[Option - Low oil quantity reverse video]



1 Oil Pressure (OIL P) Indication

Displays engine oil pressure (psi)

- displayed (white) – normal operating range
- displayed (amber) – caution range
- displayed (red) – operating limit reached.

2 Low Oil Pressure (OIL P) Redline

Displayed (red) – oil pressure operating limit.

3 Low Oil Pressure (OIL P) Amber Band

Displayed (amber) – low oil pressure caution range beginning at red line:

- variable depending on N2% RPM above 65% N2
- amber band not displayed below 65% N2.

4 High Oil Temperature (OIL T) Redline

Displayed (red) – oil temperature operating limit.

5 High Oil Temperature (OIL T) Amber Band

Displayed (amber) – oil temperature caution range.

6 Oil Temperature (OIL T) Indication

Displays oil temperature (degrees C):

- displayed (white) – normal operating range
- displayed (amber) – caution range reached
- displayed (red) – operating limit reached.

7 Oil Quantity (OIL Q)% Readout

Displays usable oil quantity as a percentage of full quantity.

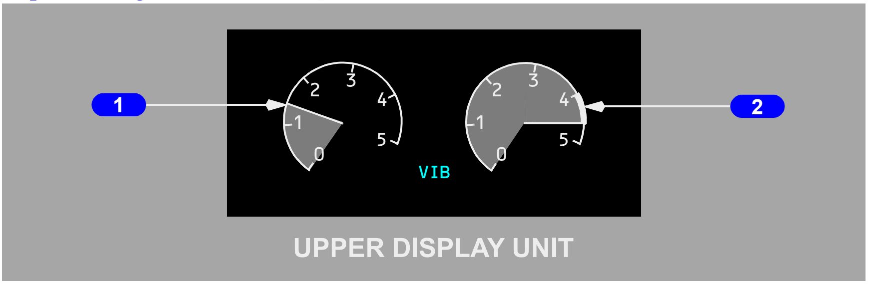
[Option - Low oil quantity reverse video]
Video is reversed and LO (white) displayed for low oil quantity.

Note: Indicated oil quantity may decrease significantly during engine start, takeoff and climb out. If this occurs, engine operation is not impacted and the correct oil quantity should be indicated during level flight.

Note: An oil quantity indication as low as zero is normal if windmilling N2 RPM is below approximately 8%.

Engine Vibration Indications

[Option - High vibration alert]



1 Vibration (VIB) Pointer

Displayed (white) – engine vibration level.

[Option - High vibration alert]

2 High Engine Vibration Indication

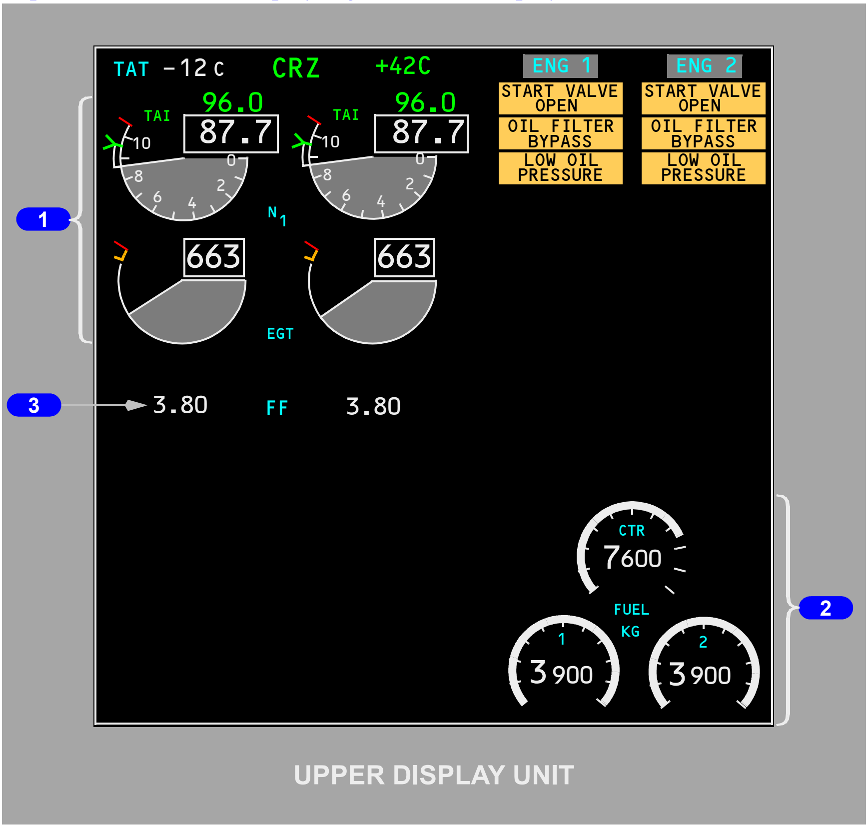
Displayed (white)

When engine vibration level is greater than four units, the portion of the dial arc between 4 units and the pointer, becomes bold.

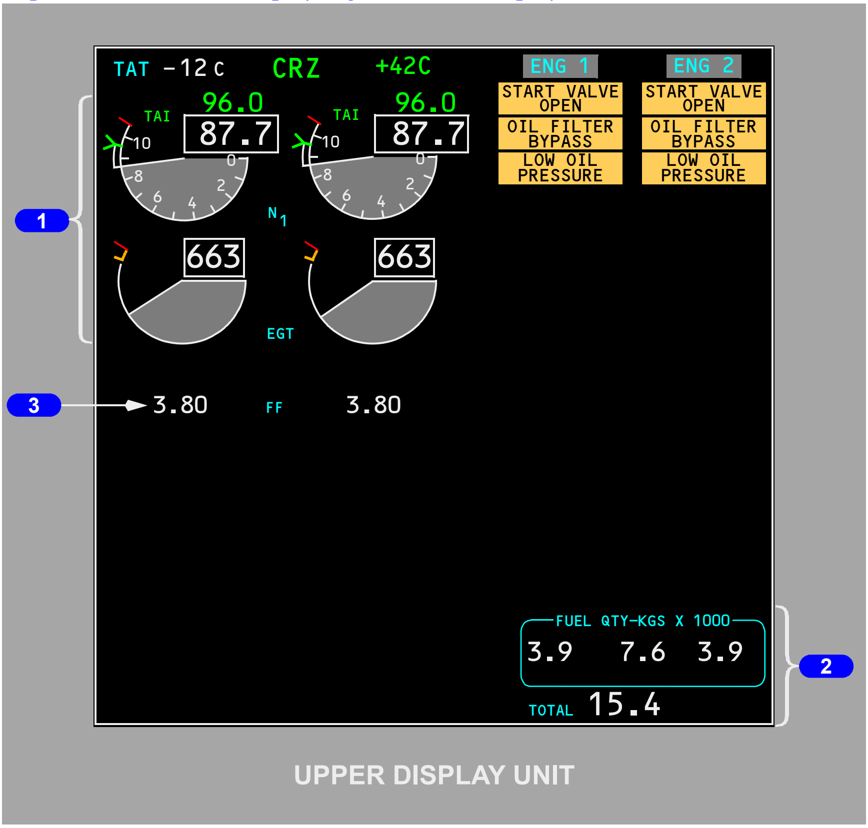
Intentionally
Blank

Primary Engine Indications

[Option - Over/Under display, kgs, fuel flow displayed full time]



[Option - Over/Under display, kgs, fuel flow displayed full time]



1 **Primary Engine Indications**

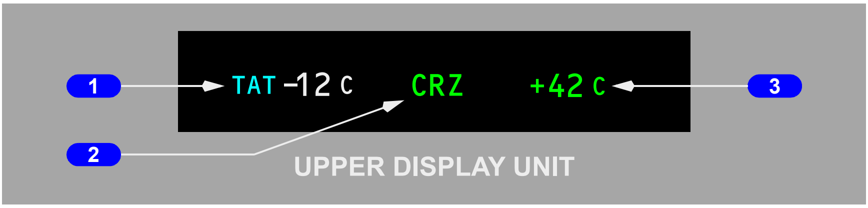
2 **Fuel Quantity Indications**

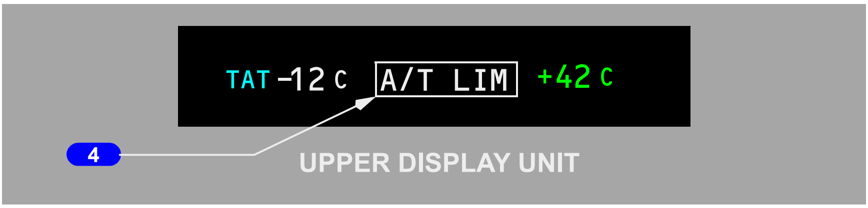
Refer to Chapter 12, Fuel

[Option - Fuel flow displayed full time]

3 **Fuel Flow Indications**

Total Air Temperature, Thrust Mode Display, Selected Temperature and Autothrottle Limit





1 Total Air Temperature (TAT) Indication

Displayed (label – cyan, temp – white) – total air temperature (degrees C).

Note: TAT indication should not be used in lieu of ambient OAT to calculate takeoff performance.

2 Thrust Mode Display

Displayed (green) – the active N1 limit reference mode.

With N1 Set Outer Knob (on engine display control panel) in AUTO, active N1 limit is displayed by reference N1 bugs.

With N1 Set Outer Knob (on engine display control panel) in either 1, 2 or BOTH (other than AUTO), the thrust mode display annunciation is MAN.

Active N1 limit is normally calculated by FMC.

[Option - without double derate]
Thrust mode display annunciations are:

- R-TO – reduced takeoff
- R-CLB – reduced climb
- TO – takeoff

[Option]
- TO B – takeoff bump thrust
- CLB – climb
- CRZ – cruise
- G/A – go–around

- CON – continuous
- – – – – FMC not computing thrust limit

Note: R-TO does not indicate the type of reduced takeoff. The N1 limit may be reduced due to the entry of an assumed temperature, a takeoff thrust derate or a combination of both assumed temperature and takeoff thrust derate.

3 Selected Temperature

Displayed (green) – selected assumed temperature (degrees C) for reduced thrust takeoff N1.

Repeats data selected on TAKEOFF REF page.

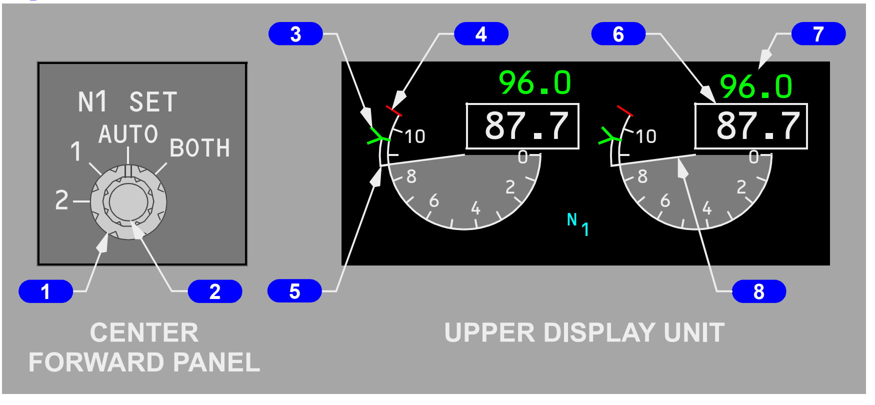
4 Autothrottle Limit (A/T LIM) Indication

Illuminated (white) – The FMC is not providing the A/T system with N1 limit values. The A/T is using a degraded N1 thrust limit from the related EEC.

Replaces thrust mode display annunciation when illuminated.

N1 Indications

[Option - without Double Derate]



1 N1 SET Outer Knob

AUTO –

- both reference N1 bugs set by FMC based on N1 limit page and takeoff reference page
- displays reference N1 bugs at active N1 limit for A/T

BOTH –

- both reference N1 bugs and readouts manually set by turning N1 SET inner knob
- has no effect on A/T operation

1 or 2 –

- respective N1 reference bug and readout manually set by turning N1 SET inner knob
- has no effect on A/T operation

2 N1 SET Inner Knob (spring-loaded to center)

Rotate – positions reference N1 bug(s) and readouts when N1 SET outer knob is set to BOTH, 1, or 2.

3 Reference N1 Bugs

Displayed (green) – with N1 SET outer knob in AUTO, 1, 2 or BOTH position.

Position corresponds to digital value on the Reference N1 Readout.

4 N1 Redlines

Displayed (red) – N1% RPM operating limit

5 N1 Command Sectors

Displayed (white) – momentary difference between actual N1 and value commanded by thrust lever position.

6 N1 RPM Readouts (digital)

Displayed (white) – normal operating range.

Displayed (red) –

- operating limit exceeded
- on ground after engine shutdown, red box indicates an inflight exceedance has occurred

7 Reference N1 Readouts

Displayed (green) –

- manually set N1% RPM when N1 SET outer knob is in BOTH, 1, or 2 position
- – – – – when N1 SET outer knob is in AUTO position and FMC source invalid

[Option - without Double Derate]
- blank when N1 SET outer knob is in AUTO position

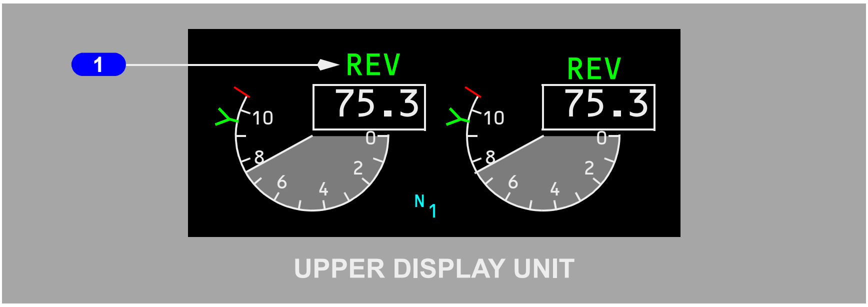
Not Displayed when Reverse Thrust is selected.

8 N1 RPM Indications

Displays N1% RPM:

- displayed (white) – normal operating range
- displayed (red) – operating limit exceeded

Thrust Reverser Indications

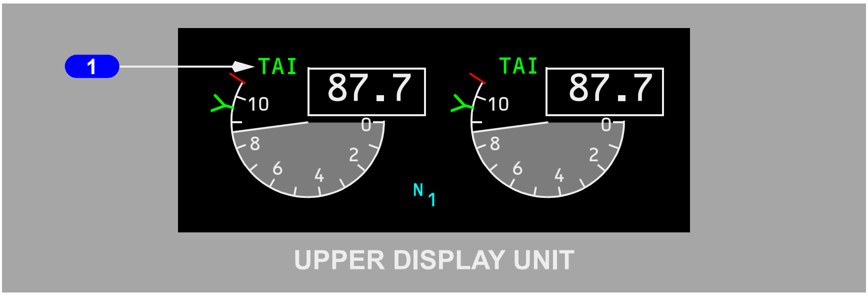


1 Thrust Reverser (REV) Indications

Displayed (amber) – thrust reverser is moved from stowed position.

Displayed (green) – thrust reverser is deployed.

Thermal Anti–Ice Indication

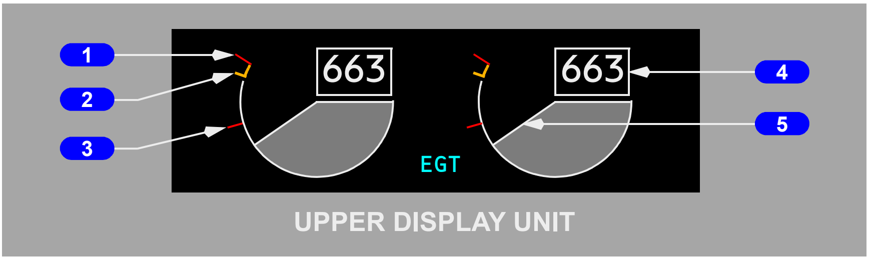


1 Thermal Anti–Ice (TAI) Indications

Displayed (green) – cowl anti–ice valve(s) open.

Displayed (amber) – cowl anti–ice valve is not in position indicated by related engine anti–ice switch.

EGT Indications



1 Exhaust Gas Temperature (EGT) Redlines

Displayed (red) –

- maximum takeoff EGT limit
- maximum in-flight start EGT limit when the start limit redline is not shown

2 Exhaust Gas Temperature (EGT) Amber Bands

Displayed (amber) – lower end of band displays maximum continuous EGT limit.

3 Exhaust Gas Temperature (EGT) Start Limit Redlines

Displayed (red) –

- until the engine achieves stabilized idle (approximately 59% N2)
- for ground starts and some in-flight starts as determined by the EEC

4 Exhaust Gas Temperature (EGT) Readouts (digital)

Displayed (white) – normal operating range (degrees C)

[Option - Color change inhibit 5 minutes]
Displayed (amber) – maximum continuous limit exceeded; color change inhibited for up to 5 minutes during takeoff or go-around

Displayed (red) – maximum takeoff limit or start limit exceeded

On ground, after both engines are shut down, red box indicates an exceedance has occurred

Displayed (white-blinking) EEC senses conditions that may lead to hot start or stall during ground starting. Current versions of EEC software will automatically cut fuel for an impending hot start or stall during ground starting.

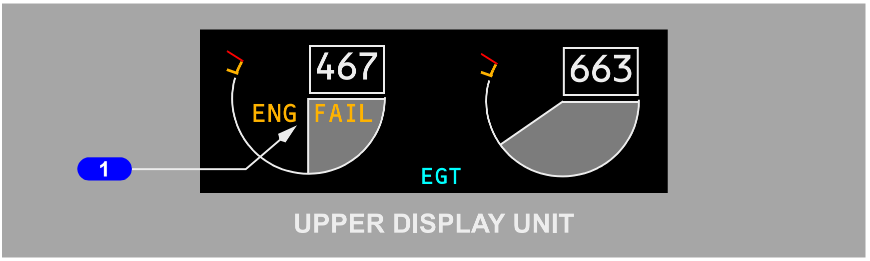
5 Exhaust Gas Temperature (EGT) Indications

Displayed (white) – normal operating range.

[Option - Color change inhibit 5 minutes]
Displayed (amber) – maximum continuous limit exceeded; color change inhibited for up to 5 minutes during takeoff or go–around

Displayed (red) – maximum takeoff limit or start limit exceeded.

Engine Fail Alert



1 Engine Fail (ENG FAIL) Alert

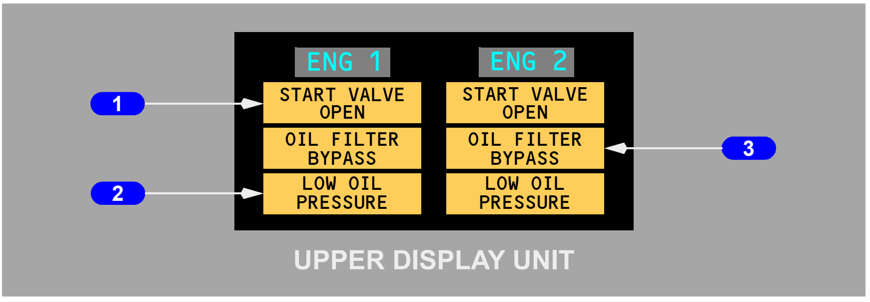
Displayed (amber) –

- engine operating below sustainable idle (less than 50% N2); and
- engine start lever in IDLE position

Alert remains until –

- engine recovers; or
- start lever moved to CUTOFF; or
- engine fire switch pulled

Crew Alerts



1 START VALVE OPEN Alert

Illuminated (amber) –

- steady – respective engine start valve open and air is supplied to starter
- blinking – uncommanded opening of start valve. Alert is displayed and solid amber boxes are displayed in unannunciated positions for that engine. All three boxes blink for ten seconds, then alert remains on steady and solid amber boxes are removed (see Note)

2 LOW OIL PRESSURE Alert

Illuminated (amber) –

- steady – oil pressure at or below red line
- blinking – with a condition of low oil pressure. Alert is displayed and solid amber boxes are displayed in unannunciated positions for that engine. All three boxes blink for ten seconds, then alert remains on steady and solid amber boxes are removed (see Note)

3 OIL FILTER BYPASS Alert

Illuminated (amber) –

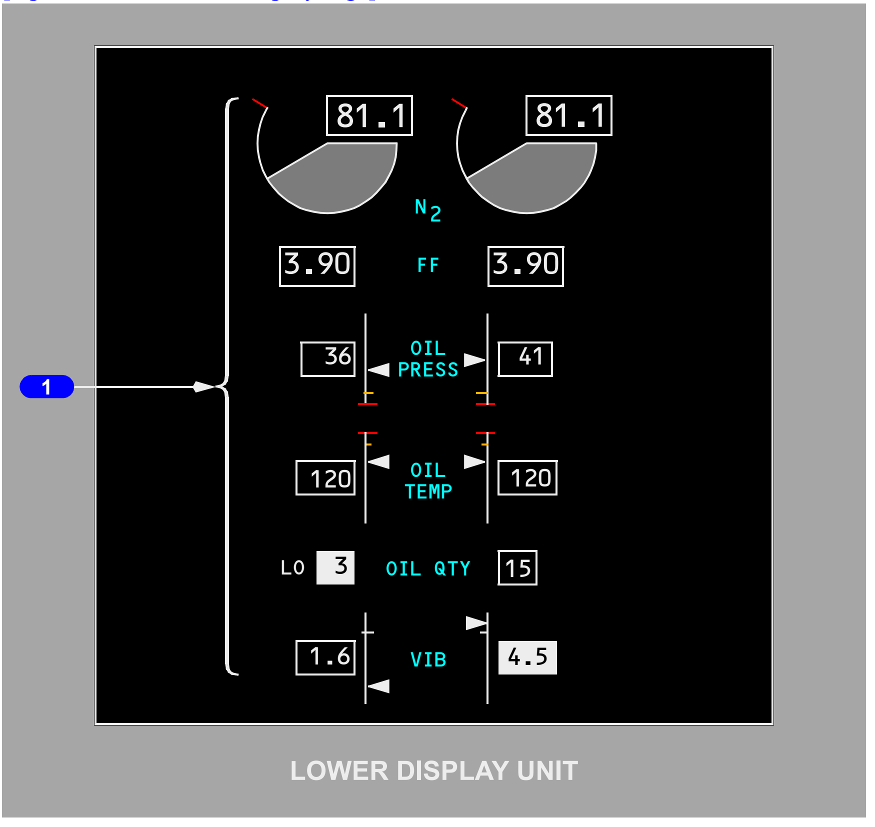
- steady – indicates an impending bypass of scavenge oil filter
- blinking – with an impending bypass. Alert is displayed and solid amber boxes are displayed in unannunciated positions for that engine. All three boxes blink for ten seconds, then alert remains on steady and solid amber boxes are removed (see Note)

Note: Blinking is inhibited:

- during takeoff from 80 knots to 400 feet RA, or 30 seconds after reaching 80 knots, whichever occurs first
- during landing below 200 feet RA until 30 seconds after touchdown
- during periods when blinking is inhibited, alerts illuminate steady

Secondary Engine Indications

[Option - Over/Under display, kgs]

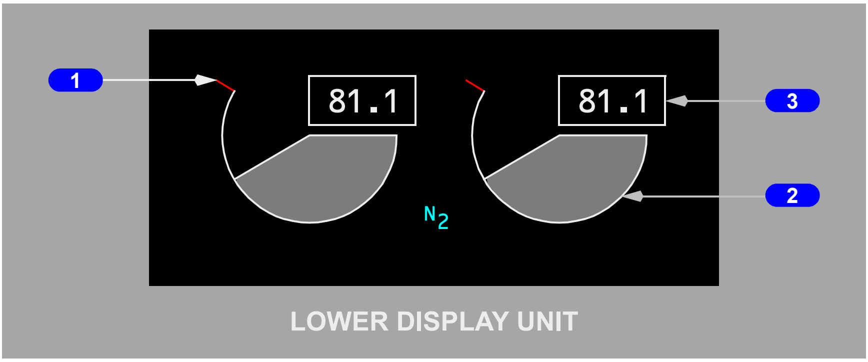


1 Secondary Engine Indications

Secondary engine indications are displayed:

- when CDS initially receives power
- when selected by the Multi-Function Display (MFD)
- in flight when an engine start lever moved to CUTOFF
- in flight when an engine fails
- when a secondary engine parameter exceeds normal operating range

N2 Indications



1 N2 Redlines

Displayed (red) – N2% RPM operating limit.

2 N2 RPM Indications

Displays N2% RPM

- displayed (white) – normal operating range
- displayed (red) – operating limit exceeded

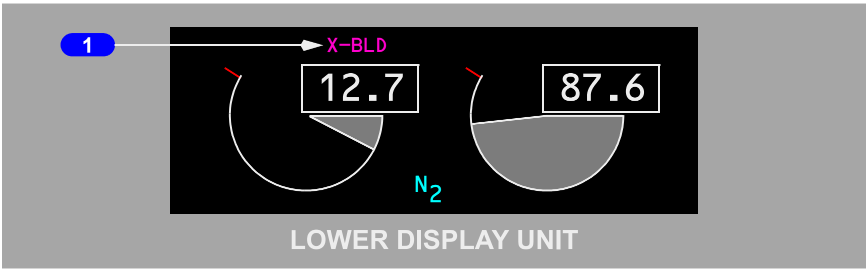
3 N2 Readouts (digital)

Displayed (white) – normal operating range.

Displayed (red) –

- operating limit exceeded
- on ground, after engine shutdown, red box indicates an inflight exceedance has occurred

Crossbleed Start Indication



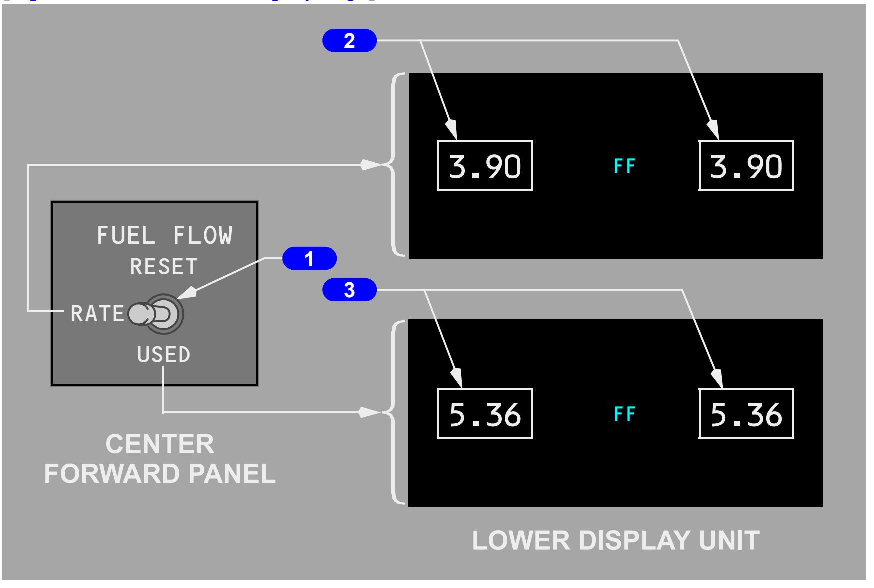
1 **Crossbleed Start (X–BLD) Indication**

Displayed (magenta) – crossbleed air recommended for inflight start.

Displayed when airspeed is less than required for a windmilling start.

Fuel Flow/Fuel Used Indications

[Option - Over/Under display, kgs]



1 **FUEL FLOW Switch (spring-loaded to RATE)**

RATE – displays fuel flow to engine.

USED –

- displays fuel used since last reset
- after 10 seconds, display automatically reverts to fuel flow

RESET –

- resets fuel used to zero
- displays fuel used for 1 second, decreases to zero, then displays fuel flow

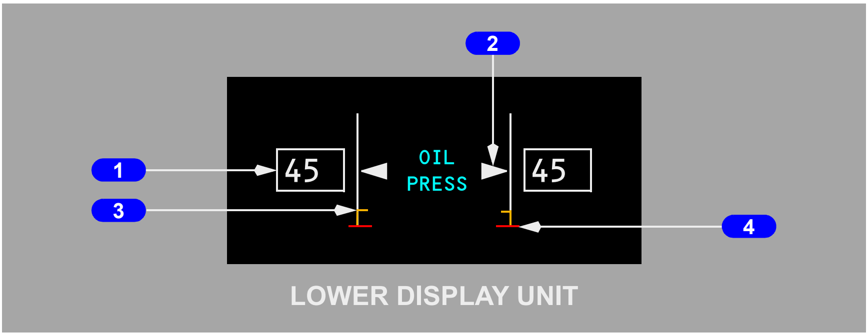
2 **Fuel Flow (FF) Readout (digital)**

[Option - kgs]
Displayed (white) – fuel flow to engine with FUEL FLOW switch in RATE position (kilograms per hour x 1000).

3 Fuel Used Readout (digital)

Displayed (white) – when FUEL FLOW switch moved to USED or RESET.

Oil Pressure Indications



1 Oil Pressure (OIL PRESS) Readout

Displays engine oil pressure (psi)

- displayed (white) – normal operating range
- displayed (amber) – caution range
- displayed (red) – operating limit reached

2 Oil Pressure (OIL PRESS) Pointer

Displays engine oil pressure:

- displayed (white) – normal operating range
- displayed (amber) – caution range reached
- displayed (red) – operating limit reached

3 Low Oil Pressure (OIL PRESS) Amber Band

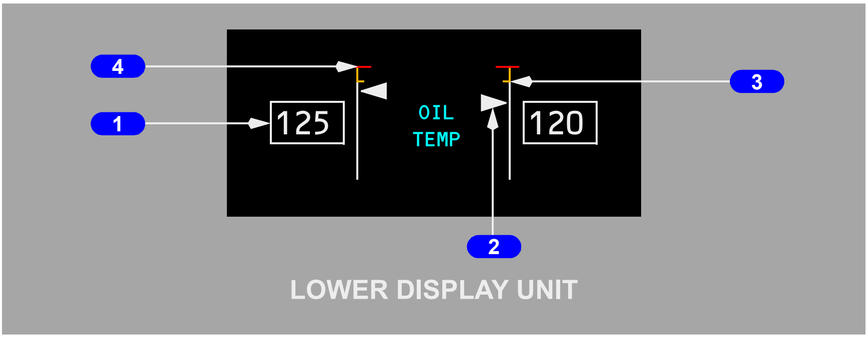
Displayed (amber) – low oil pressure caution range beginning at red line:

- variable depending on N2% RPM above 65% N2
- amber band not displayed below 65% N2

4 Low Oil Pressure (OIL PRESS) Redline

Displayed (red) – oil pressure operating limit.

Oil Temperature Indications



1 Oil Temperature (OIL TEMP) Readout

Displays oil temperature (degrees C):

- displayed (white) – normal operating range
- displayed (amber) – caution range reached
- displayed (red) – operating limit reached

2 Oil Temperature (OIL TEMP) Pointer

Displays oil temperature (degrees C):

- displayed (white) – normal operating range
- displayed (amber) – caution range reached
- displayed (red) – operating limit reached

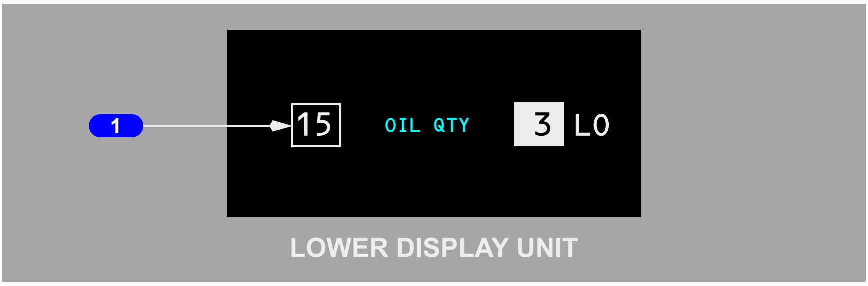
3 High Oil Temperature (OIL TEMP) Amber Band

Displayed (amber) – oil temperature caution range.

4 High Oil Temperature (OIL TEMP) Redline

Displayed (red) – oil temperature operating limit.

Oil Quantity Indications



1 Oil Quantity (OIL QTY) Readout

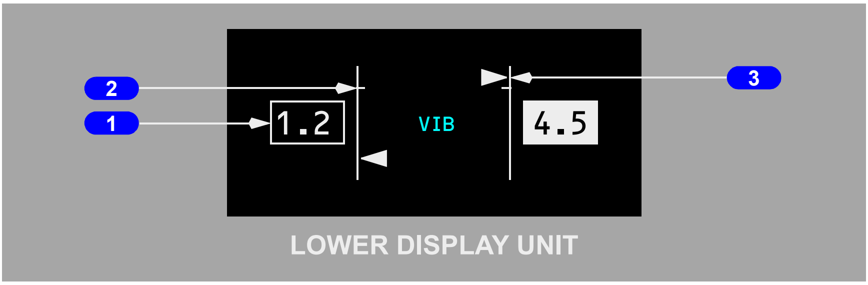
[Option - liters]
Displays usable oil quantity in liters.

Video is reversed and LO (white) displayed for low oil quantity.

Note: Indicated oil quantity may decrease significantly during engine start, takeoff and climb out. If this occurs, engine operation is not impacted and the correct oil quantity should be indicated during level flight.

Note: An oil quantity indication as low as zero is normal if windmilling N2 RPM is below approximately 8%.

Engine Vibration Indications



1 Vibration (VIB) Readout

Displayed (white) – engine vibration level.

Video is reversed for high vibration.

2 High Limit

Displays tick mark and thick line.

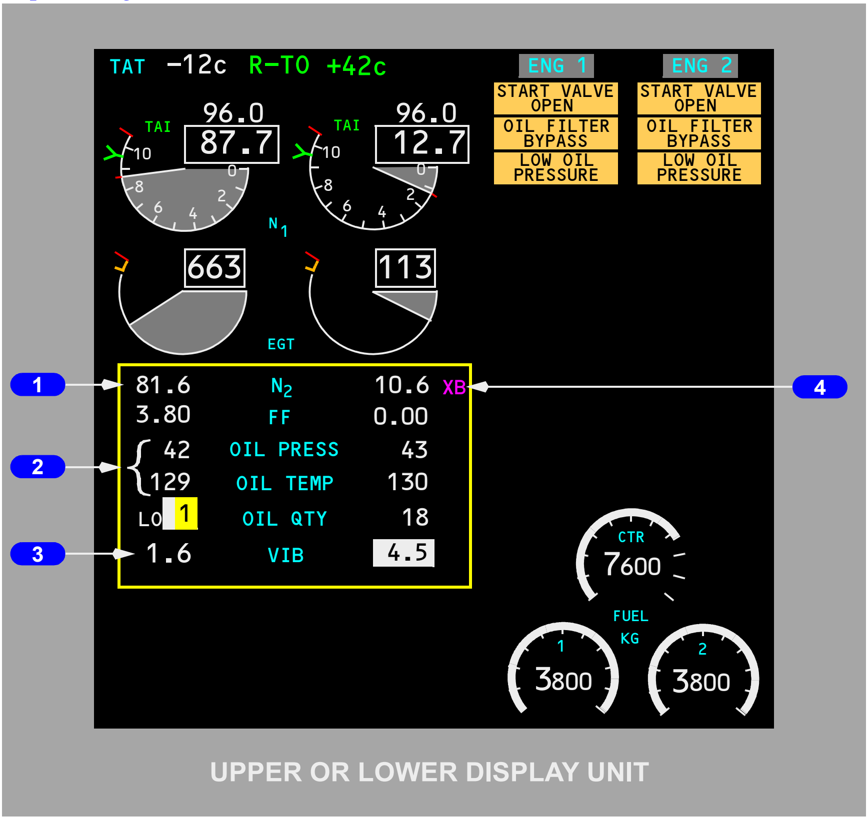
3 Vibration (VIB) Pointer

Displayed (white) – engine vibration level.

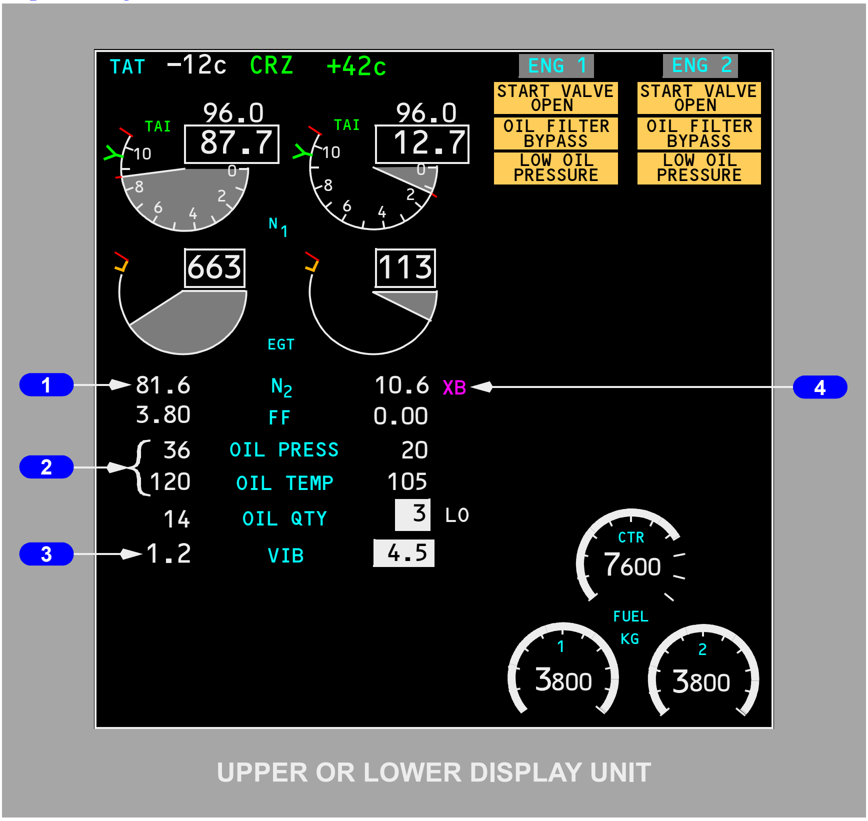
Compact Engine Displays

The following changes occur to the secondary engine display in the compact engine displays.

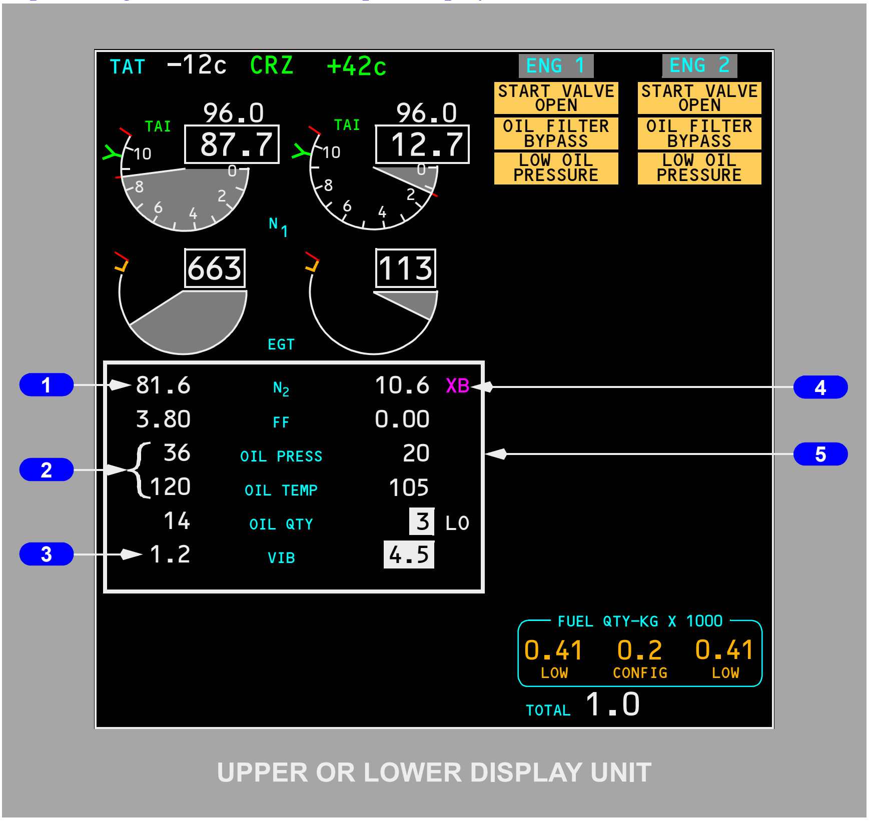
[Option - kgs]



[Option - kgs]


TAT -12c CRZ +42c
ENG 1
ENG 2
START VALVE OPEN
OIL FILTER BYPASS
LOW OIL PRESSURE
START VALVE OPEN
OIL FILTER BYPASS
LOW OIL PRESSURE
TAI
96.0
87.7
96.0
12.7
N1
663
113
EGT
1
81.6
N2
10.6
XB
4
3.80
FF
0.00
2
36
OIL PRESS
20
120
OIL TEMP
105
14
OIL QTY
3
LO
3
1.2
VIB
4.5
CTR
7600
FUEL
KG
1
3800
2
3800
UPPER OR LOWER DISPLAY UNIT

[Option - kgs with selectable compact display and total fuel]



1 **N2 RPM Indications**

N2 changes from round dial display to a digital display.

The digital display is framed by a red box after engine shutdown on the ground if an inflight exceedance occurred.

2 **OIL PRESS, OIL TEMP Indications**

Displayed as digital readouts only

The digital readouts display amber or red if limits are exceeded.

3 **Vibration (VIB) Indications**

Displayed as digital readout only.

4 Crossbleed Start (XB) Indications

Displayed on the side of N2

[Option - Selectable Compact Display]

5 Exceedance Indication

Displayed as rectangular box outline around secondary engine parameters if limits are exceeded when compact display is selected.

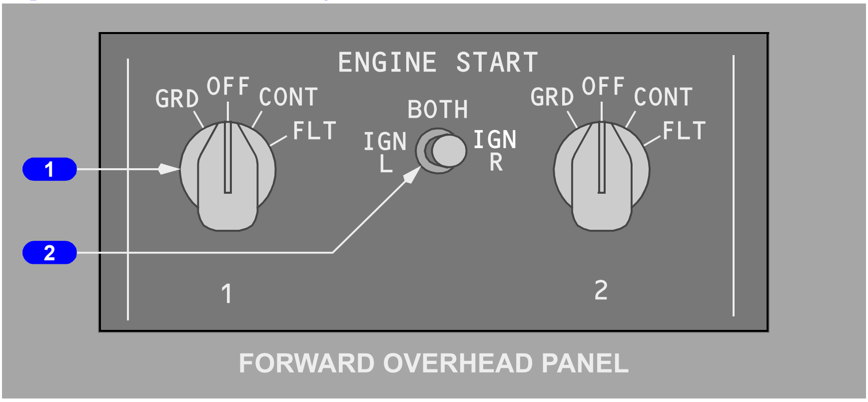
The outline has thick lines and blinks for 10 seconds. After 10 seconds, the lines are thinner and do not blink.

The color of the outline matches the color of the exceedance - amber, red or white.

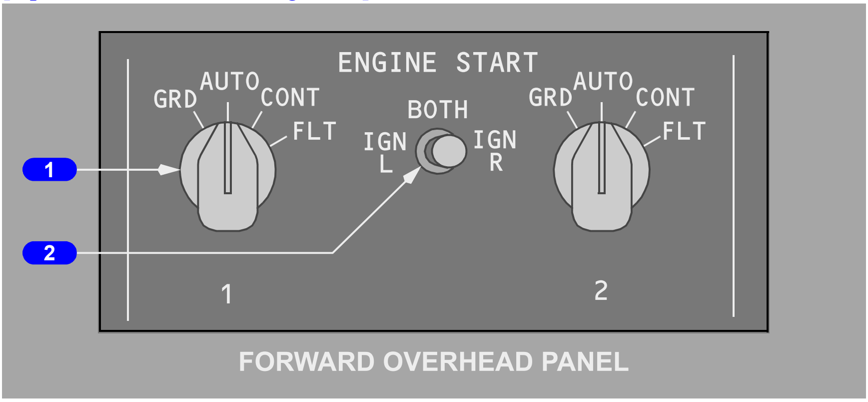
Intentionally
Blank

Engine Start Switches

[Option - Without automatic ignition]



[Option - With automatic ignition]



1 ENGINE START Switches

GRD –

- opens start valve
- closes engine bleed valve
- for ground starts, arms selected igniter(s) to provide ignition when engine start lever is moved to IDLE
- for inflight starts, arms both igniters to provide ignition when engine start lever is moved to IDLE

[Option - Without automatic ignition]
- releases to OFF at start valve cutout.

[Option - With automatic ignition]
- releases to AUTO at start valve cutout.

[Option - Without automatic ignition]
OFF –
- ignition normally off
- both igniters are activated when engine start lever is in IDLE and:
  - an uncommanded rapid decrease in N2 occurs or,
  - N2 is between 57% and 50% or,
  - in flight - N2 is between idle and 5%

[Option - With automatic ignition]
AUTO –
- ignition normally off
- both igniters are activated when engine start lever is in IDLE and:
  - an uncommanded rapid decrease in N2 occurs or,
  - N2 is between 57% and 50% or,
  - in flight - N2 is between idle and 5%.
- provides automatic ignition to selected igniters when:
  - engine is running and,
  - flaps are not up below 18000 feet altitude or,
  - engine anti-ice is selected to ON

CONT –
- provides ignition to selected igniters when engine is operating and engine start lever is in IDLE
- in flight - provides ignition to both igniters when N2 is below idle and engine start lever is in IDLE

FLT – provides ignition to both igniters when engine start lever is in IDLE.

2 Ignition Select Switch

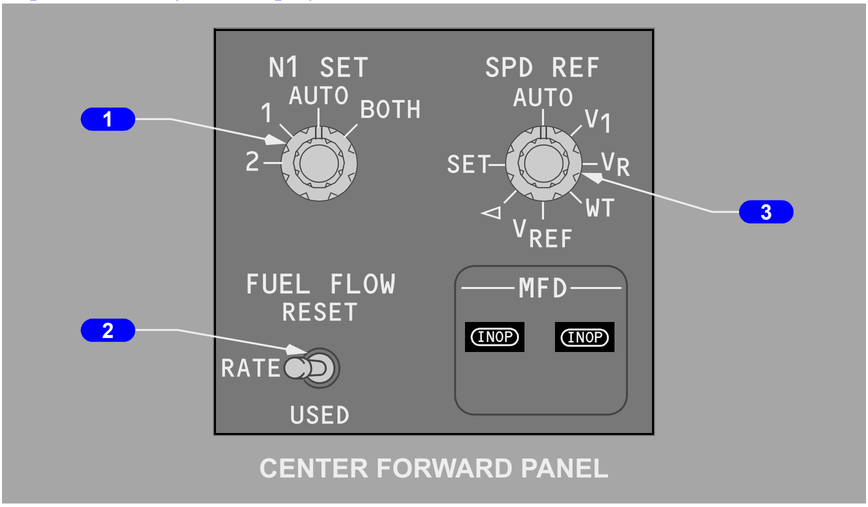
IGN L – selects the left igniter for use on both engines.

BOTH – selects both igniters for use on both engines.

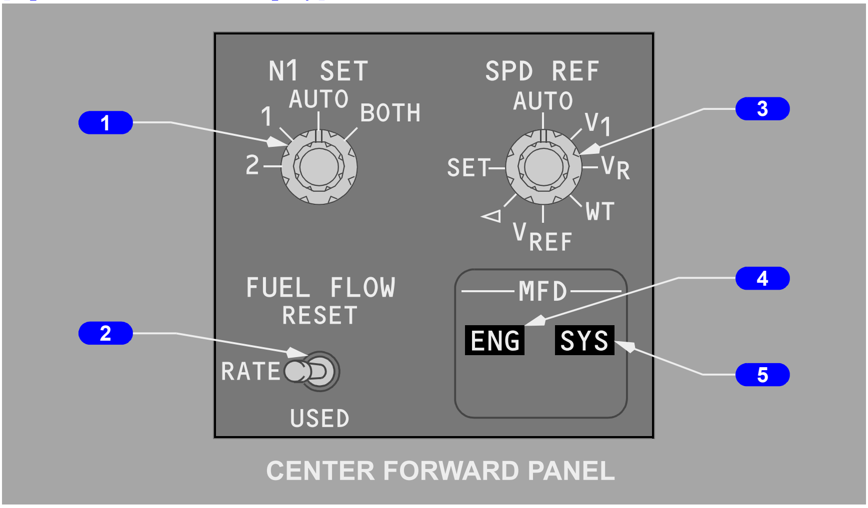
IGN R – selects the right igniter for use on both engines.

Engine Display Control Panel

[Option - Side by side display]



[Option - Over/Under display]



1 N1 SET Knob

[Option - Side by side display]
Refer to section 10, Side by Side - Displays

[Option - Over/Under display]
Refer to section 11, Over/Under - Displays

2 FUEL FLOW Switch

[Option - Side by side display]
Refer to section 10, Side by Side - Displays

[Option - Over/Under display]
Refer to section 11, Over/Under - Displays

3 Speed Reference Selector

Refer to Chapter 10, Flight Instruments, Displays.

[Option - Over/Under display]
4 MFD Engine (ENG) Switch

Push – ENG

- displays secondary engine indications on lower DU; or if the lower DU is unavailable, on upper or inboard DU based on the position of the display select panel selector
- second push blanks lower DU

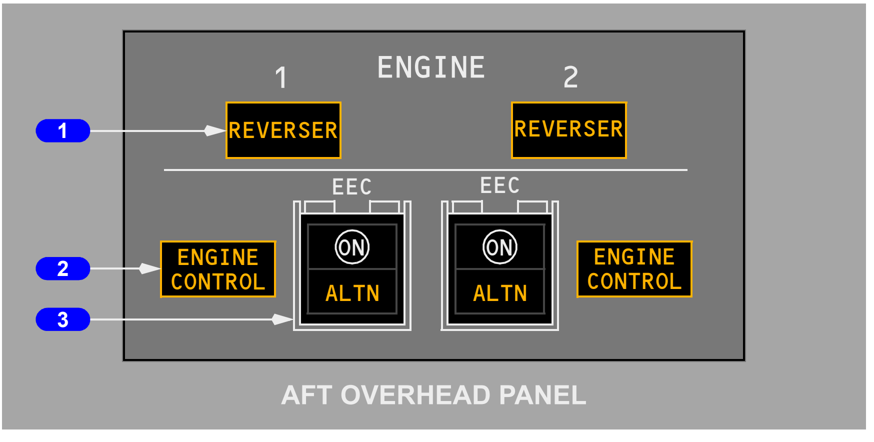
5 MFD System (SYS) Switch

Refer to:

- Chapter 13, Hydraulics

[Option - Over/Under display with flight control surface position indicator]
- Chapter 9, Flight Controls

Engine Panel



1 REVERSER Lights

Illuminated (amber) – one or more of following has occurred:

- isolation valve or thrust reverser control valve is not in commanded position
- one or more thrust reverser sleeves are not in commanded state
- auto–restow circuit has been activated
- a failure has been detected in synchronization shaft lock circuitry

2 ENGINE CONTROL Lights

Illuminated (amber) – engine control system is not dispatchable due to faults in system.

Light operates when:

- engine is operating and,
- airplane on ground and:
  - below 80 kts prior to takeoff or,
  - approximately 30 seconds after touchdown

3 Electronic Engine Control (EEC) Switches

ON – in view (white)

- indicates normal control mode is selected
- engine ratings calculated by EEC from sensed atmospheric conditions and bleed air demand
- when ON is not in view, the EEC has been manually selected to the alternate mode

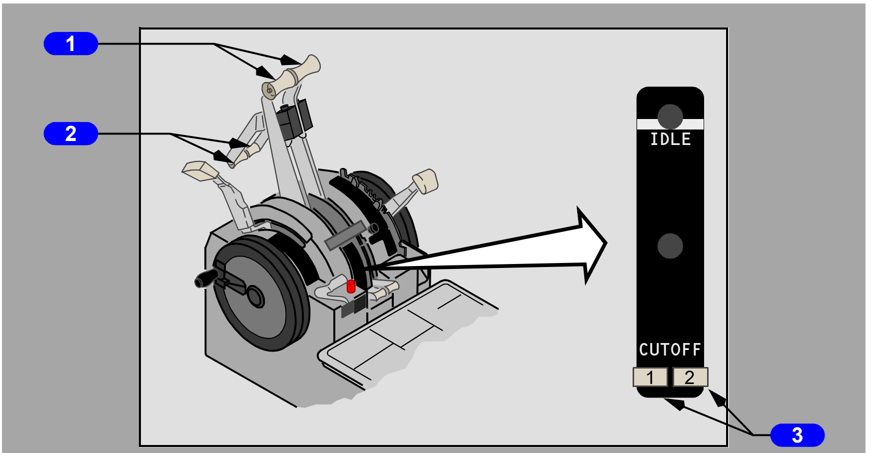
ALTN – in view (amber)

- indicated EEC has automatically switched to alternate control mode or it has been selected manually
- EEC provides rated thrust or higher

Note: Both ON and ALTN may be in view if EEC has automatically switched to soft alternate mode.

Note: EGT limits must be observed in both normal and alternate control modes.

Engine Controls



CONTROL STAND

1 Forward Thrust Levers

- controls engine thrust
- cannot be advanced if the reverse thrust lever is in the deployed position

2 Reverse Thrust Levers

- controls engine reverse thrust
- cannot select reverse thrust unless related forward thrust lever is at IDLE.

Note: Reverse thrust lever is blocked at reverse idle position until related thrust reverser is more than 60% deployed.

Note: Movement of reverse thrust lever into reverse thrust engages locking pawl preventing forward thrust lever from moving. Terminating reverse thrust removes locking pawl and restores forward thrust lever movement ability.

3 Engine Start Levers

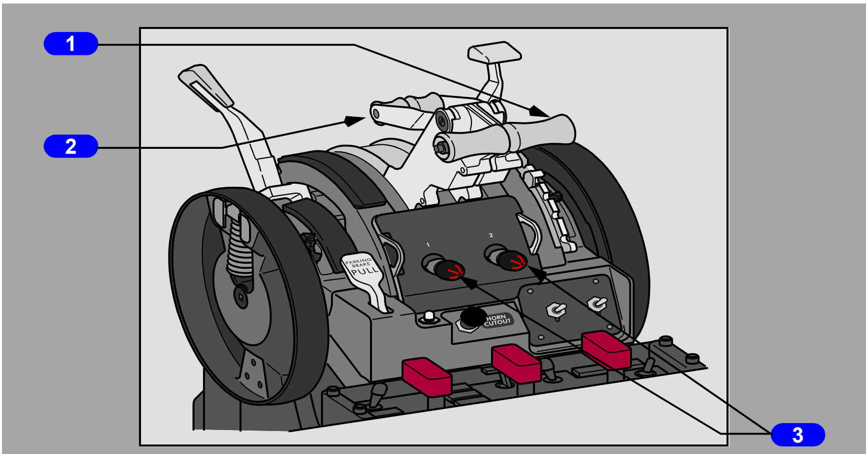
IDLE –

- energizes ignition system through EEC
- electrically opens spar fuel shutoff valve in the wing leading edge outboard of the pylon
- electrically opens engine–mounted fuel shutoff valve via the EEC

CUTOFF –

- closes both spar and engine fuel shutoff valves
- de–energizes ignition system

[Option - New Engine Start Levers - Prior to L/N 5605]



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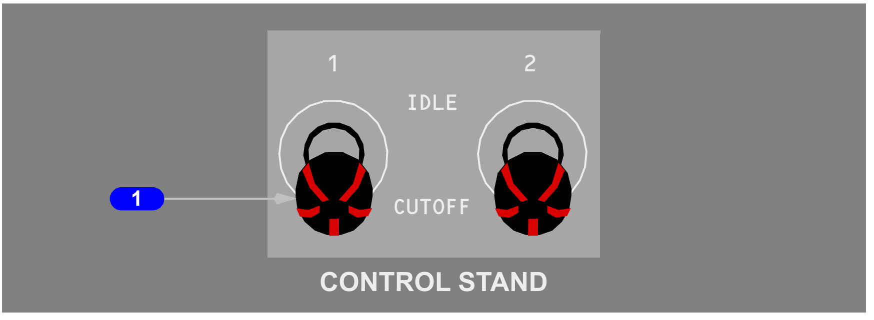
Engine Start Levers

[Option - New Engine Start Levers]



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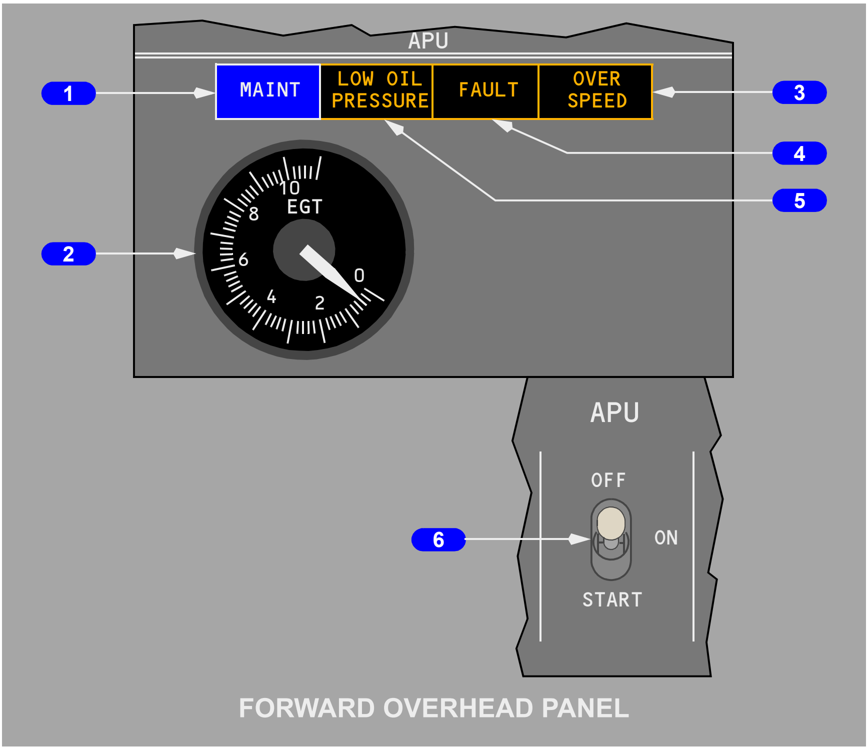
CUTOFF –

- closes both spar and engine fuel shutoff valves
- de–energizes ignition system

Note: Illuminate (red) in the event of engine fire or during an engine fire test.

CAUTION: Do not apply rotational force when moving the engine start lever.

APU



1 APU Maintenance (MAINT) Light

Illuminated (blue) – APU maintenance problem exists:

- APU may be operated
- light is disarmed when APU switch is in OFF

2 APU Exhaust Gas Temperature (EGT) Indicator

Displays APU EGT

EGT indicator remains powered for 5 minutes after shutdown.

3 APU OVERSPEED Light

Illuminated (amber) –

- APU RPM limit has been exceeded resulting in an automatic shutdown
- overspeed shutdown protection feature has failed a self–test during a normal APU shutdown

- if light is illuminated when APU switch is placed to OFF, light extinguishes after 5 minutes
- light is disarmed when the APU switch is in OFF position

4 APU FAULT Light

Illuminated (amber) –

- a malfunction exists causing APU to initiate an automatic shutdown
- if light is illuminated when APU switch is placed to OFF, light extinguishes after 5 minutes
- light is disarmed when APU switch is in OFF position

5 APU LOW OIL PRESSURE Light

Illuminated (amber) –

- during start until the APU oil pressure is normal
- oil pressure is low causing an automatic shutdown (after start cycle is complete)
- if light is illuminated when APU switch is placed to OFF, light extinguishes after 5 minutes
- light is disarmed when APU switch is in OFF position

6 APU Switch

OFF – normal position when APU is not running

- positioning switch to OFF with APU running trips APU generator off the bus(es), if connected, and closes APU bleed air valve. APU continues to run for a 60 second cooling period
- APU air inlet door automatically closes after shutdown

ON – normal position when APU is running.

START (momentary) – positioning APU switch from OFF to START and releasing it to ON, initiates an automatic start sequence.

Introduction

The airplane is powered by two CFM56–7 engines. The engine is a dual–rotor, axial–flow turbofan. The N1 rotor consists of a fan, a low–pressure compressor and a low–pressure turbine. The N2 rotor consists of a high–pressure compressor and a high–pressure turbine. The N1 and N2 rotors are mechanically independent. The N2 rotor drives the engine gearboxes. A bleed–air–powered starter motor is connected to the N2 rotor.

A dual–channel electronic engine control (EEC) regulates each engine. The EEC monitors autothrottle and flight crew inputs to automatically set engine thrust.

Each engine has individual flight deck controls. Thrust is set by positioning the thrust levers. The thrust levers are positioned automatically by the autothrottle system or manually by the flight crew. The forward thrust levers control forward thrust from idle to maximum. The reverse thrust levers control thrust from reverse idle to maximum reverse

Engine Indications

[Option - Side by side display]

Engine indications are displayed on the center instrument panel upper display unit (DU). If a failure is detected on the upper DU, the engine indications automatically shift to the lower DU. The engine indications can also be manually selected to either the Captain's or First Officer's inboard DU, or the lower DU, using the respective display select panel.

N1, EGT, N2, and FF/FU are the primary indications and are displayed as both digital readouts and round dial/moving pointer indications. N1, EGT, and N2 have operating limits indicated by redlines. EGT also displays an amber caution limit. If one of these indications exceeds the red or amber line, the digital readout, box, pointer, and indicator change color to red or amber.

Oil pressure, oil temperature, oil quantity, and engine vibration are the secondary engine indications. Oil pressure and oil temperature indications are displayed with a round dial/moving pointer. Operating and caution ranges are displayed with red and amber lines. If the red or amber line is reached, the pointer changes color to red or amber for that indication. The oil quantity indicator displays a digital readout of quantity as a percent of full.

Engine vibration indications are displayed with a round dial/moving pointer.

The EEC must receive electrical power to supply engine operating data to the flight deck engine indications. When the EEC is not powered, N1, N2, oil quantity and engine vibration are displayed directly from the engine sensors. Positioning the engine start switch to GRD supplies electrical power to the EEC and displays pointers/digits for all engine parameters.

During battery start with no power on the airplane, only N1, N2, and oil quantity are available. The EEC is not powered until the engine accelerates to a speed greater than 15% N2. At 15% N2, the EEC becomes energized and pointers/digits for all engine parameters are displayed.

An engine failure alert indication (ENG FAIL) is displayed in amber on the EGT indicator when the respective engine is operating at a condition below sustainable idle (50% N2) and the engine start lever is in the IDLE position. The alert remains until the engine recovers, the engine start lever is moved to CUTOFF, or the engine fire switch is pulled.

Engine Indications

[Option - Over/Under display]
Primary and secondary engine indications are provided. Engine indications are displayed on the center forward panel upper display unit (DU), lower DU or the Captain's or First Officer's inboard DU.

Primary Engine Indications

N1 and EGT are the primary engine indications. The primary engine indications are normally displayed on the center forward panel upper DU. If that unit fails, the display automatically moves to the lower DU. The primary engine indications can also be manually selected to either the Captain's or First Officer's inboard DU, or the lower DU, using the respective display select panel.

Secondary Engine Indications

[Option - Fuel flow displayed full time]
N2, fuel flow, oil pressure, oil temperature, oil quantity, and engine vibration are the secondary engine indications. The secondary engine indications, except for fuel flow, are manually selected to either the Captain's or First Officer's inboard DU, or the lower DU, using the respective display select panel and the ENG switch on the engine display control panel. Fuel flow is displayed full time on the upper display unit below the primary engine indications.

The secondary engine indications are automatically displayed when:

- the displays initially receive electrical power
- in flight when an engine start lever is moved to CUTOFF
- in flight when an engine N2 RPM is below idle
- a secondary engine parameter is exceeded

When the secondary engine indications are automatically displayed, they cannot be cleared until the condition is no longer present.

Normal Display Format

N1, EGT, and N2 are displayed as both digital readouts and round dial/moving pointer indications. The digital readouts display numerical values while the moving pointers indicate relative value.

Oil pressure, oil temperature, and engine vibration indications are both digital readouts and vertical indication/moving pointers. Fuel flow and oil quantity are digital readouts only. All digital readouts are enclosed by boxes.

The dials and vertical indications display the normal operating range, caution range, and operating limits.

Normal operating range is displayed on a dial or vertical indication in white.

N1, EGT, and N2 have operating limits indicated by redlines. EGT also displays an amber caution limit. If one of these indications exceeds the red or amber line, the digital readout, box, pointer, and indicator change color to red or amber.

The oil temperature and oil pressure vertical indications have a caution range and an operating limit redline. If the oil temperature or pressure reaches the caution range, the digital readout, digital readout box, and pointer all change color to amber. If one of these indications reach the operating limit, the digital readout, digital readout box, and pointer all change color to red.

The EEC must receive electrical power to supply engine operating data to the flight deck engine indications. When the EEC is not powered, N1, N2, oil quantity and engine vibration are displayed directly from the engine sensors. Positioning the engine start switch to GRD supplies electrical power to the EEC and displays pointers/digits for all engine parameters.

During battery start with no power on the airplane, only N1, N2, and oil quantity are available. The EEC is not powered until the engine accelerates to a speed greater than 15% N2. At 15% N2, the EEC becomes energized and pointers/digits for all engine parameters are displayed.

An engine failure alert indication (ENG FAIL) is displayed in amber on the EGT indicator when the respective engine is operating at a condition below sustainable idle (50% N2) and the engine start lever is in the IDLE position. The alert remains until the engine recovers, the engine start lever is moved to CUTOFF, or the engine fire switch is pulled.

Compact Display

In compact format, the primary and secondary engine indications are combined on the same display. The N1 and EGT indications are displayed as they are normally. All other indications change to digital readouts only. N2, oil temperature, and oil pressure digital readouts turn red or amber if an exceedance occurs. The N2 digital display is framed with a red box after engine shutdown on the ground if an inflight exceedance occurred.

Primary and secondary engine indications are displayed in compact format on the upper DU when the secondary engine indications are selected for display (manually or automatically) and the lower DU is unavailable. Alternatively, the compacted indications are displayed on the lower DU if the upper DU is unavailable.

Electronic Engine Control (EEC)

Each engine has a full authority digital EEC. Each EEC has two independent control channels, with automatic channel transfer if the operating channel fails. With each engine start or start attempt, the EEC alternates between control channels. The EEC uses thrust lever inputs to automatically control forward and reverse thrust. N1 is used by the EEC to set thrust in two control modes: normal and alternate. Manual selection of the control mode can be made with the EEC switches on engine panel.

EEC Normal Mode

In the normal mode, the EEC uses sensed flight conditions and bleed air demand to calculate N1 thrust ratings. The EEC compares commanded N1 to actual N1 and adjusts fuel flow to achieve the commanded N1.

The full rated takeoff thrust for the installed engine is available at a thrust lever position less than the forward stop. Fixed or assumed temperature derated takeoff thrust ratings are set at thrust lever positions less than full rated takeoff. The maximum rated thrust is available at the forward stop. The EEC limits the maximum thrust according to the airplane model as follows:

Note: Typical engine ratings based on model/series airplane. For actual engine ratings refer to Performance Dispatch chapter.

- 737-600 – CFM56-7B22 rating
- 737-700 – CFM56-7B24 rating
- 737-800 – CFM56-7B27 rating
- 737-900 – CFM56-7B27 rating

Takeoff Bump Thrust

[Option - Takeoff Bump thrust]

Takeoff bump thrust is available when increased thrust is needed for takeoff, above the normal maximum takeoff thrust setting. When selected using the FMC N1 LIMIT page, takeoff thrust is increased by either the flight crew or the autothrottle positioning the thrust levers to set N1 to the reference N1 bug. Bump thrust applies only to the takeoff rating; maximum climb, maximum continuous and go-around thrust ratings are not affected.

Airplanes equipped with a takeoff thrust bump have a reserve thrust capability which is greater than the standard values listed under the EEC Normal Mode listed above. Use of this reserve thrust capability is intended for emergency use only in the event of wind shear or impending ground contact.

FMC selection of takeoff bump thrust can be configured as either “Bump Option” or a “Full-Rate Option.” When configured as a FMC “Bump Option”, the default takeoff rating is lower than takeoff bump, and the takeoff bump must be activated via the FMC-CDU. With this “Bump Option” configuration, assumed temperature engine derates are not available from the bump. When configured as a FMC “Full-Rate Option”, the default takeoff rating is the takeoff bump. With this full-rate option, the assumed temperature engine derate method may always be used. With this “Full-Rate Option” configuration, the ability to select the lowest normally offered takeoff fixed derate is lost.

EEC Alternate Mode

The EEC can operate in either of two alternate modes, soft or hard. If required signals are not available to operate in the normal mode, the EEC automatically changes to the soft alternate mode. When this occurs, the ALTN switch illuminates and the ON indication remains visible. In the soft alternate mode, the EEC uses the last valid flight conditions to define engine parameters which allows the mode change to occur with no immediate change in engine thrust.

Note: While the EECs are in the soft alternate mode, thrust rating shortfalls or exceedances may occur as ambient conditions change.

The soft alternate mode remains until the hard alternate mode is entered by either retarding the thrust lever to idle or manually selecting ALTN with the EEC switch on the aft overhead panel.

Note: Loss of either DEU results in a loss of signal to both EECs. The EEC ALTN lights illuminate and each EEC reverts to the alternate mode to prevent the engines from operating on a single source of data.

When the hard alternate mode is entered, the EEC reverts to the alternate mode thrust schedule. Hard alternate mode thrust is always equal to or greater than normal mode thrust for the same lever position. EEC limiting is not provided in the hard alternate mode and maximum rated thrust may be reached at a thrust lever position less than full forward.

CAUTION: To avoid inducing an overboost condition when the EECs are in the hard alternate mode, it is recommended that the thrust levers be advanced to or near the full forward position only in emergency situations where terrain contact is imminent.

If the hard alternate mode is entered by reducing the thrust lever to idle while in the soft alternate mode, the ALTN switch remains illuminated and the ON indication remains visible. When ALTN is selected manually, the ON indication is blanked.

Structural Limit Protection

The EEC provides N1 and N2 redline overspeed protection in both normal and alternate modes. The EGT limit must be observed by the crew because the EEC does not provide EGT redline exceedance protection.

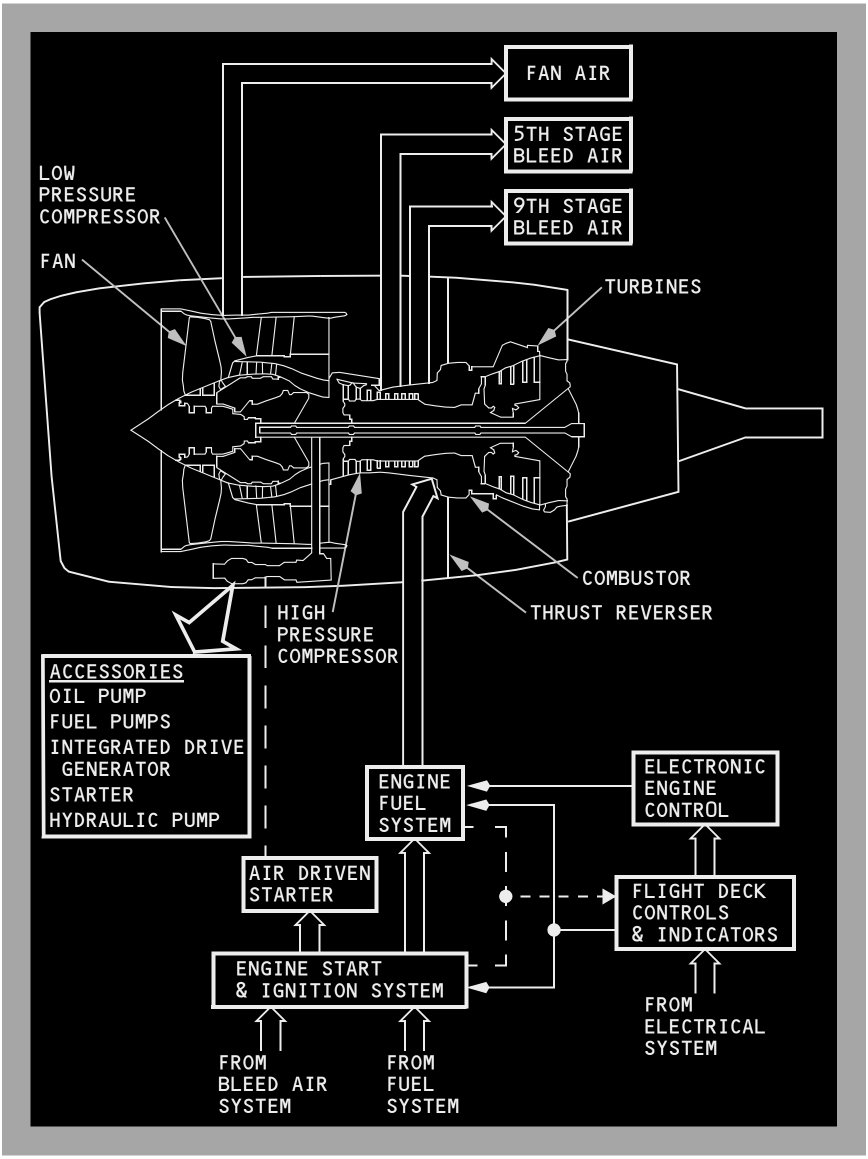
Idle Operation

The EEC automatically selects ground minimum idle, flight minimum idle, and approach idle. Ground minimum idle is selected for ground operations and flight minimum idle is selected for most phases of flight. Approach idle is selected in flight if any of the following conditions are met:

- Cowl thermal anti-ice switch is ON for either engine 1 or engine 2
- Altitude is below 19,000 feet MSL AND left or right main landing gear is down and locked
- Altitude is below 19,000 feet MSL AND left or right flaps are in the approach configuration (flaps ≥ 15)

At the same airspeed and altitude, N1 and N2% RPM will be higher for approach idle than for flight minimum idle. This higher% RPM improves engine acceleration time in the event of a go–around. Approach idle is maintained until after touchdown, when ground minimum idle is selected. In flight, if a fault prevents the EEC from receiving flap, or main landing gear position signals, approach idle schedule begins below 19,000 feet MSL.

Power Plant Schematic



Engine Fuel System

Fuel is delivered under pressure from fuel pumps located in the fuel tanks. The fuel flows through a fuel spar shutoff valve located at the engine mounting wing stations. The fuel passes through the first stage engine fuel pump where pressure is increased. It then passes through two fuel/oil heat exchangers where IDG oil and main engine oil heat the fuel. A fuel filter then removes contaminants. Fuel automatically bypasses the filter if the filter becomes saturated. Before the fuel bypass occurs, the fuel FILTER BYPASS alert illuminates on the fuel control panel. The second stage engine fuel pump adds more pressure before the fuel reaches the hydro mechanical unit (HMU). To meet thrust requirements, the EEC meters fuel through the HMU.

The spar fuel shutoff valve and engine fuel shutoff valve allow fuel flow to the engine when both valves are open. The valves are open when the engine fire switch is in and the start lever is in IDLE. Both valves close when either the start lever is in CUTOFF or the engine fire switch is out. SPAR VALVE CLOSED and ENG VALVE CLOSED lights located on the overhead panel indicate valve position.

Fuel flow is measured after passing through the engine fuel shutoff valve and is displayed on the display unit. Fuel flow information is also provided to the FMS.

Engine Oil System

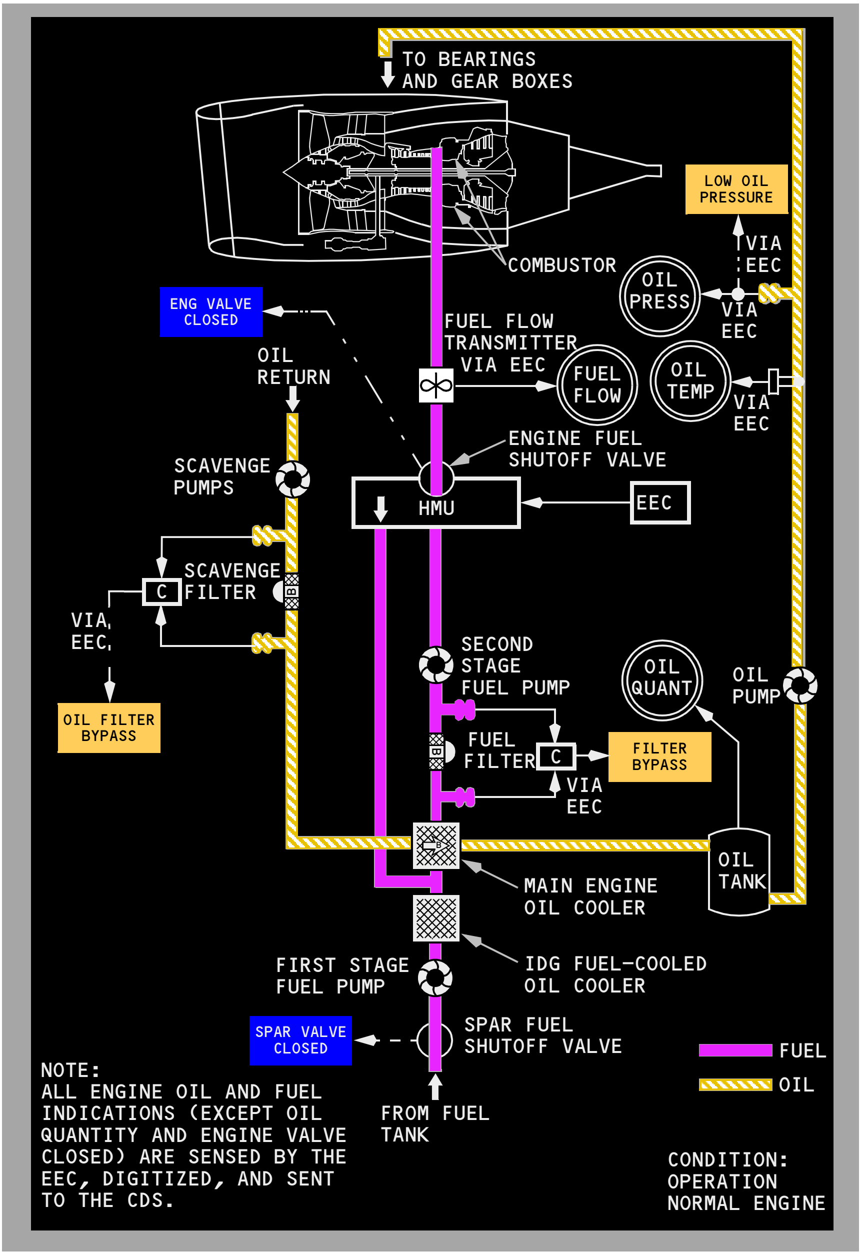
Oil from the individual engine tank is circulated under pressure, through the engine to lubricate the engine bearings and accessory gearbox. The oil quantity indicator, oil temperature indicator, oil pressure indicator and LOW OIL PRESSURE alert are all located on the display unit.

The oil system is pressurized by the engine driven oil pump. Oil from the pump, goes to the engine bearings and gearbox. Sensors for the oil temperature indicator, oil pressure indicator and LOW OIL PRESSURE alert are located downstream of the oil pump prior to engine lubrication.

Oil is returned to the oil tank by engine driven scavenge pumps. From the scavenge pumps oil passes through a scavenge filter. If the filter becomes saturated with contaminants, oil automatically bypasses the filter. Prior to the oil bypassing the scavenge filter, the OIL FILTER BYPASS alert illuminates on the upper display unit.

Prior to returning to the oil tank, the oil passes through the main engine oil cooler where it is cooled by engine fuel to maintain proper oil temperature.

Engine Fuel and Oil System Schematic



Engine Start System

Starter operation requires pressurized air and electrical power. Air from the bleed air system powers the starter motor. The APU, an external ground cart, or the other operating engine provides the bleed air source.

In the GRD position, the engine start switch uses battery power to close the engine bleed air valve and open the start valve to allow pressure to rotate the starter. When the start valve opens, an amber START VALVE OPEN alert is provided on the upper display unit. The starter rotates the N2 compressor through the accessory drive gear system. When the engine accelerates to the recommended value (25% N2 or max motoring), moving the engine start lever to the IDLE position opens the fuel valves on the wing spar and engine, and causes the EEC to supply fuel and ignition to the combustor where the fuel ignites. Initial fuel flow indications lag actual fuel flow by approximately two seconds, therefore, during engine start, an EGT rise may occur before fuel flow indication.

[Option - Without automatic ignition]
At starter cutout speed (approximately 56% N2), power is removed from the start switch holding solenoid. The engine start switch returns to OFF, the engine bleed air valve returns to the selected position, and the start valve closes.

[Option - With automatic ignition]
At starter cutout speed (approximately 56% N2), power is removed from the start switch holding solenoid. The engine start switch returns to AUTO, the engine bleed air valve returns to the selected position, and the start valve closes.

Abnormal Start Protection (Ground Starts Only)

During ground starts, the EEC monitors engine parameters to detect impending hot starts, engine stalls, EGT start limit exceedances, and wet starts. These protection features do not function during inflight starts.

If an impending hot start is detected by a rapid rise in EGT or EGT approaching the start limit, or a compressor stall occurs, the white box surrounding the EGT digital readout flashes white. The flashing white box resets when the start lever is moved to CUTOFF or the engine reaches idle N2. Current versions of EEC software (7.B.Q and later) automatically turn off the ignition and shuts off fuel to the engine for an impending hot start or stall.

If the EGT exceeds the starting limit, the EGT display, both box and dial, turn red. The EEC automatically turns off the ignition and shuts off fuel to the engine. The alert terminates and the display returns to white when EGT drops below the start limit. Following shutdown of both engines, the EGT box turns red to remind the crew of the exceedance.

A wet start occurs if the EGT does not rise after the start lever is moved to IDLE. If a wet start is detected, the EEC turns off the ignition and shuts off fuel to the engine 15 seconds after the start lever is moved to IDLE.

Engine Ignition System

Each engine has two igniter plugs. The EEC arms the igniter plug(s) selected by the ignition select switch. The left igniter plug receives power from the associated AC transfer bus. The right igniter plug receives power from the AC standby bus.

Auto-Relight

An auto-relight capability is provided for flameout protection. Whenever the EEC detects an engine flameout, both igniters are activated. A flameout is detected when an uncommanded rapid decrease in N2 occurs, or N2 is below idle RPM.

Inflight Starting

Two methods of starting an engine inflight are available, windmill and crossbleed. None of the ground start protection features are functional during inflight start.

Note: At low N2 values, the oil scavenge pump may not provide enough pressure to return oil to the tank, causing a low oil quantity indication. Normal oil quantity should be indicated after start.

[Option - Side by side display]
If crossbleed starting is required, the X–BLD START indication is displayed above the N2 dial. This indication is based on airplane altitude, airspeed and N2.

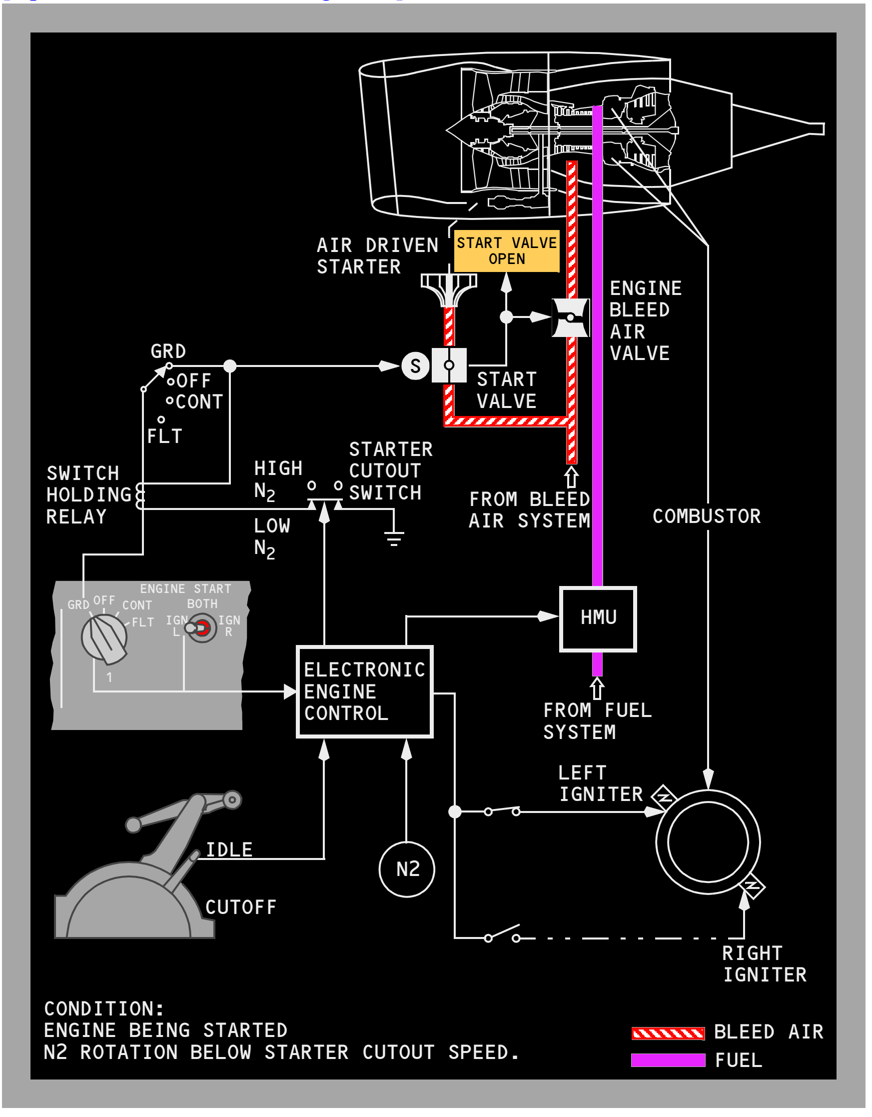
[Option - Over/Under display]
If crossbleed starting is required, the X–BLD indication (XB for the compact engine display) is displayed above the N2 dial. This indication is based on airplane altitude, airspeed and N2.

During engine inflight starts the EGT start limit redline can be shown depending on the start logic as determined by the EEC.

If only the EGT redline is shown, this is the inflight start EGT limit. If both the EGT redline and the EGT start limit redline are shown, the start limit redline is the inflight start EGT limit for all engine starts.

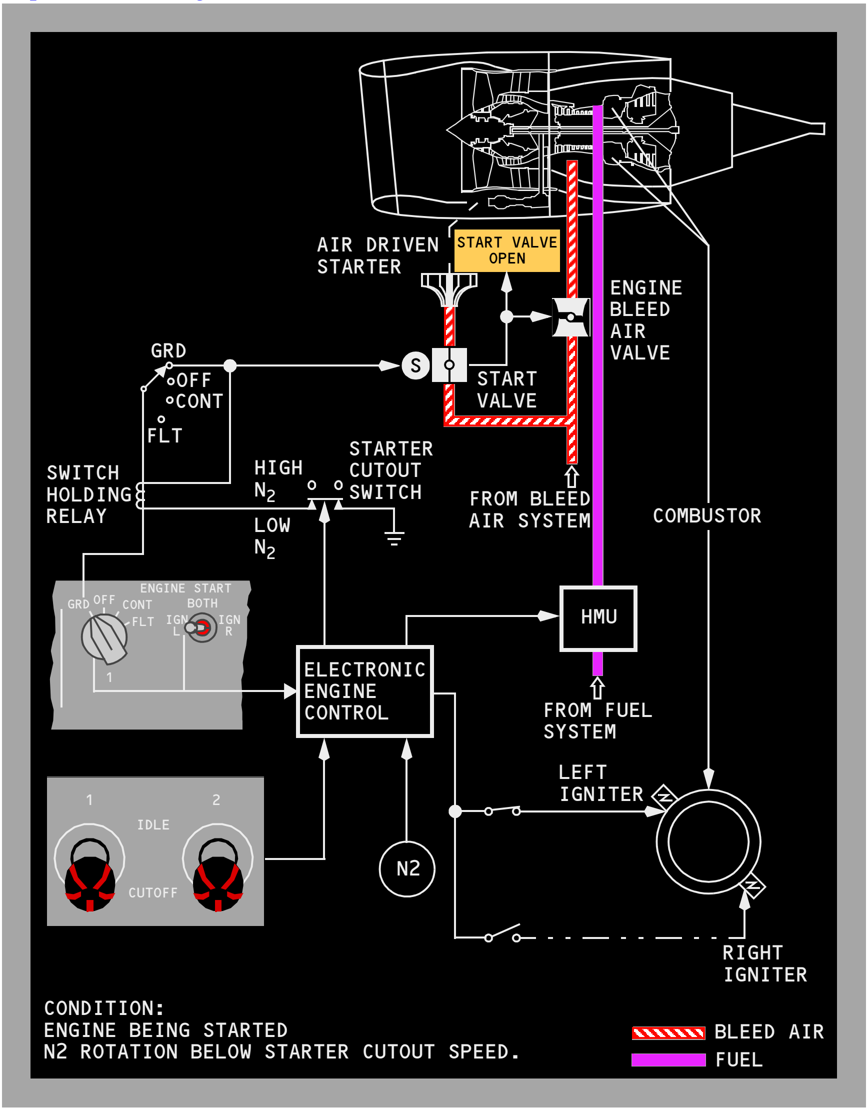
Engine Start and Ignition System Schematic

[Option - Without automatic ignition]



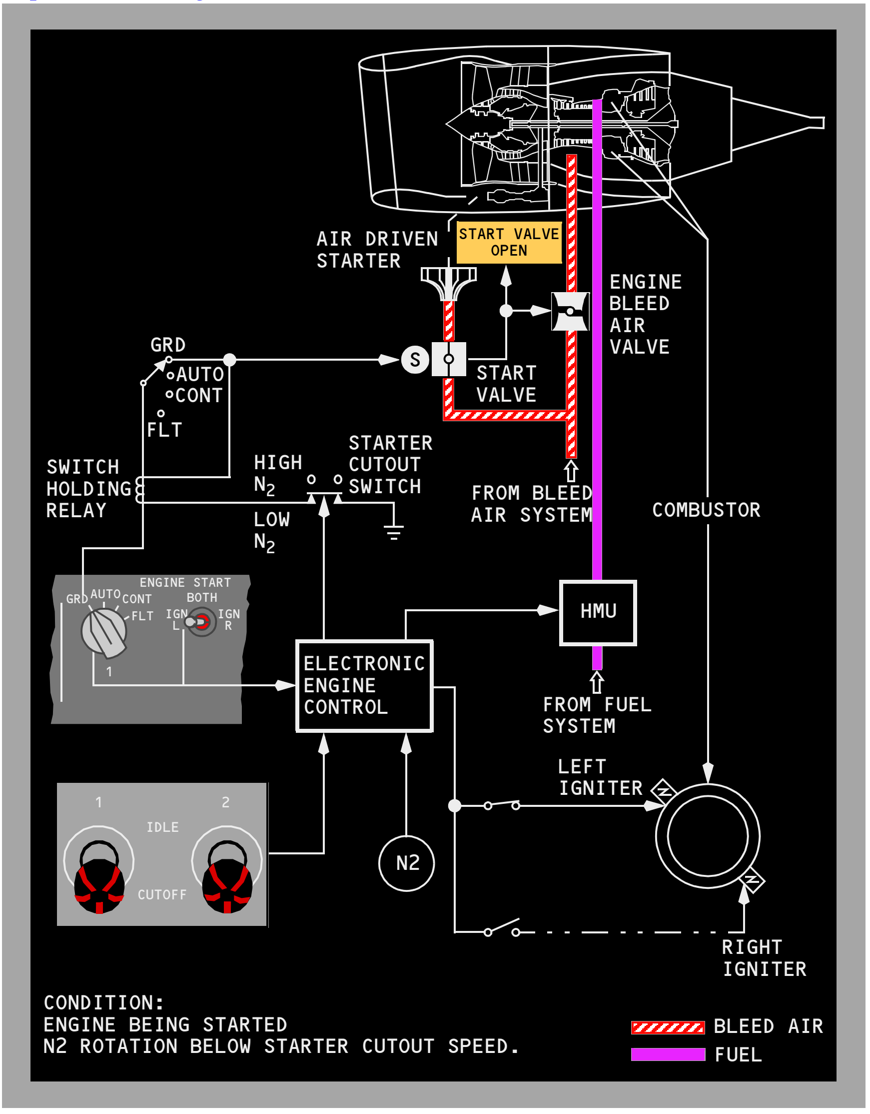
[Option - Without automatic ignition]

[Option - New Engine Start Levers - Prior to L/N 5605]



[Option - With automatic ignition]

[Option - New Engine Start Levers - Prior to L/N 5605]



Thrust Reverser

Each engine is equipped with a hydraulically operated thrust reverser, consisting of left and right translating sleeves. Aft movement of the reverser sleeves causes blocker doors to deflect fan discharge air forward, through fixed cascade vanes, producing reverse thrust. The thrust reverser is for ground operations only and is used after touchdown to slow the airplane, reducing stopping distance and brake wear.

Hydraulic pressure for the operation of engine No. 1 and engine No. 2 thrust reversers comes from hydraulic systems A and B, respectively. If hydraulic system A and/or B fails, alternate operation for the affected thrust reverser is available through the standby hydraulic system. When the standby system is used, the affected thrust reverser deploys and retracts at a slower rate and some thrust asymmetry can be anticipated.

The thrust reverser can be deployed when either radio altimeter senses less than 10 feet altitude, or when the air/ground safety sensor is in the ground mode. Movement of the reverse thrust levers is mechanically restricted until the forward thrust levers are in the idle position.

When reverse thrust is selected, an electro–mechanical lock releases, the isolation valve opens and the thrust reverser control valve moves to the deploy position, allowing hydraulic pressure to unlock and deploy the reverser system. An interlock mechanism restricts movement of the reverse thrust lever until the reverser sleeves have approached the deployed position. When either reverser sleeve moves from the stowed position, the amber REV indication, located on the upper display unit, illuminates. As the thrust reverser reaches the deployed position, the REV indication illuminates green and the reverse thrust lever can be raised to detent No. 2. This position provides adequate reverse thrust for normal operations. When necessary, the reverse thrust lever can be pulled beyond detent No. 2, providing maximum reverse thrust.

Downward motion of the reverse thrust lever past detent No. 1 (reverse idle thrust) initiates the command to stow the reverser. When the lever reaches the full down position, the control valve moves to the stow position allowing hydraulic pressure to stow and lock the reverser sleeves. After the thrust reverser is stowed, the isolation valve closes and the electro–mechanical lock engages.

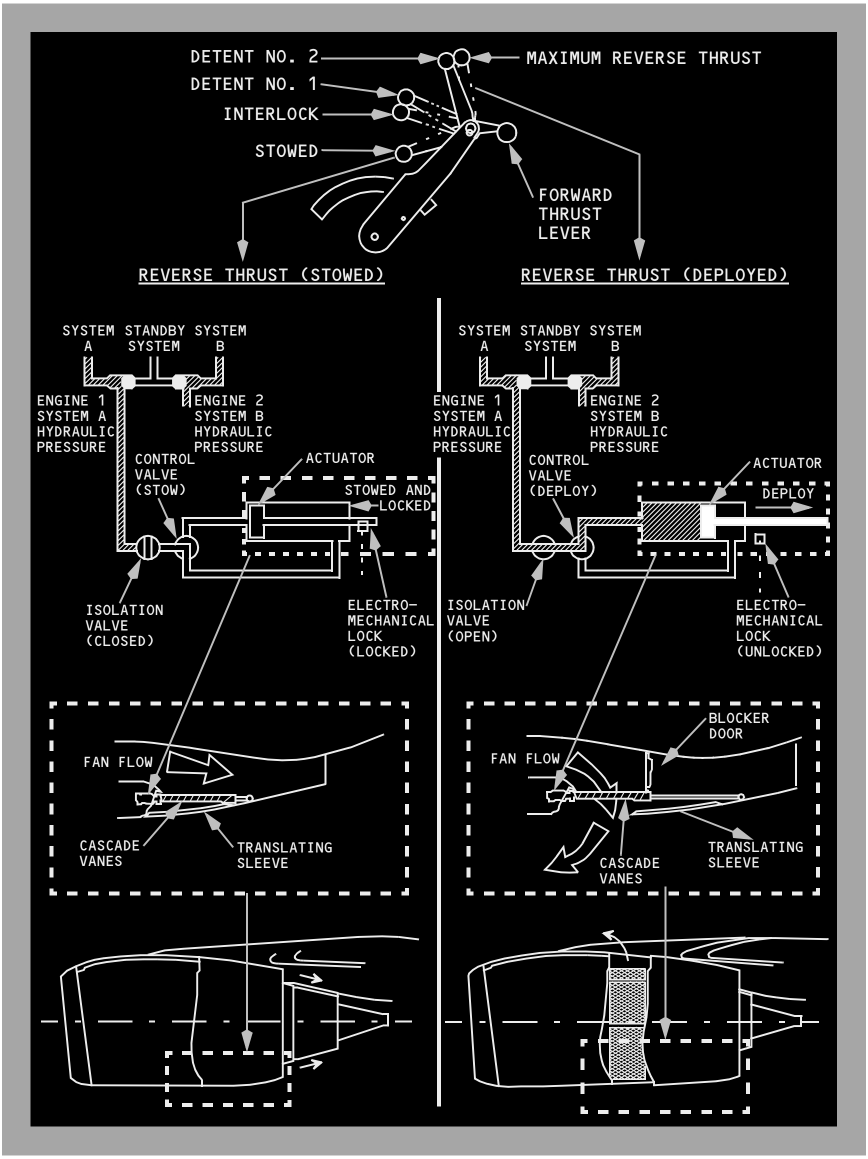
The REVERSER light, located on the aft overhead panel, illuminates when the thrust reverser is commanded to stow and extinguishes 10 seconds later when the isolation valve closes. Any time the REVERSER light illuminates for more than approximately 12 seconds, a malfunction has occurred and the MASTER CAUTION and ENG system annunciator lights illuminate.

Note: A pause in movement of the reverse thrust levers past detent No. 1 toward the stow position may cause MASTER CAUTION and ENG system annunciator lights to illuminate. A pause of approximately 16 seconds engages the electro-mechanical lock and prevents the thrust reverser sleeves from further movement. Cycling the thrust reversers may clear the fault and restore normal operation.

When the reverser sleeves are in the stow position, an electro–mechanical lock and a hydraulically operated locking actuator inhibit motion to each reverser sleeve until reverser extension is selected. Additionally, an auto–restow circuit compares the actual reverser sleeve position and the commanded reverser position. In the event of incomplete stowage or uncommanded movement of the reverser sleeves toward the deployed position, the auto–restow circuit opens the isolation valve and commands the control valve to the stow position directing hydraulic pressure to stow the reverser sleeves. Once the auto–restow circuit is activated, the isolation valve remains open and the control valve is held in the stowed position until the thrust reverser is commanded to deploy or until corrective maintenance action is taken.

WARNING: Actuation of the thrust reversers on the ground without suitable precautions is dangerous to ground personnel.

Thrust Reverser Schematic



Airborne Vibration Monitoring System

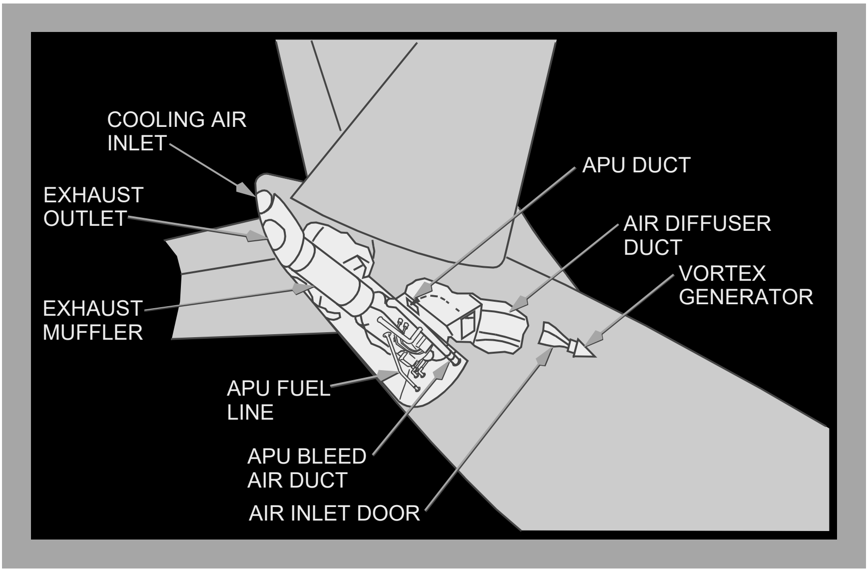
The airborne vibration monitoring (AVM) system monitors engine vibration levels. Its primary function is the display of low and high pressure rotor synchronous vibration on the secondary engine display. The AVM is also used to balance the low pressure rotor. Balancing reduces high vibration indication or audible noise and tactile vibration.

Introduction

The auxiliary power unit (APU) is a self–contained gas turbine engine installed within a fireproof compartment located in the tail of the airplane.

The APU supplies bleed air for engine starting or air conditioning. An AC electrical generator on the APU provides an auxiliary AC power source.

APU Location



APU Operation

The APU starts and operates up to the airplane maximum certified altitude.

The APU supplies bleed air for both air conditioning packs on the ground or one pack in flight. Both transfer busses can be powered on the ground or in flight.

APU Fuel Supply

[Option - APU DC fuel boost pump]
Fuel to start and operate the APU comes from the left side of the fuel manifold when the AC fuel pumps are operating. A DC operated APU fuel boost pump is installed to ensure positive fuel pressure to the APU fuel control unit. During APU start and operation, the pump operates automatically when the APU fuel control unit senses low fuel pressure. The pump shuts off automatically when an AC fuel pump pressurizes the fuel manifold. If the AC and DC fuel pumps are not operating, fuel is suction fed from the No. 1 tank. During APU operation, fuel is automatically heated to prevent icing.

APU Engine and Cooling Air

APU engine air routes to the APU through an automatically operated air inlet door located on the right side of the fuselage. APU exhaust gases discharge overboard through an exhaust muffler.

Air for APU cooling enters through a cooling air inlet above the APU exhaust outlet. This air circulates through the APU compartment, passes through the oil cooler and vents through the exhaust outlet.

Electrical Requirements for APU Operation

APU operation requires the following:

- APU fire switch on the overheat/fire panel must be IN
- APU fire control handle on the APU ground control panel must be IN
- battery switch must be ON

Electrical power to start the APU comes from No. 1 transfer bus or the airplane battery(ies). With AC power available, the starter generator uses AC power to start the APU. With no AC power, the starter generator uses battery power to start the APU.

Moving the battery switch to OFF on the ground or in the air automatically shuts down the APU because of power loss to the electronic control unit.

APU Start

The automatic start sequence begins by moving the APU switch momentarily to START. This initiates opening of the air inlet door. When the APU inlet door reaches the full open position the start sequence begins. After the APU reaches the proper speed, ignition and fuel are provided. When the APU is ready to accept a bleed air or electrical load the APU GEN OFF BUS light illuminates.

Note: While the APU is starting using battery power only, the CPS FREQ indication will be blank and the AC VOLTS indication will be 0 when the AC Meters Selector is set to APU GEN. After the APU completes the start sequence and the blue APU GEN OFF BUS light illuminates, the CPS FREQ will show actual APU frequency and AC VOLTS will show actual APU voltage.

Note: During the APU start cycle, the APU EGT indication may fluctuate from 0º to 1100º C prior to normal EGT rise and the LOW OIL PRESSURE light may cycle on and off several times. These indications have no adverse effect on starting the APU. It is not necessary to monitor EGT during start.

If the APU does not reach the proper speed with the proper acceleration rate within the time limit of the starter, the start cycle automatically terminates. The start cycle may take as long as 120 seconds. Automatic shutdown occurs in the event of EGT exceedance.

If the start fails or the APU GEN OFF BUS light fails to illuminate by the end of the start cycle, a system failure has occurred and the FAULT light illuminates.

Operate the APU for two full minutes before using it as a bleed air source. This two minutes stabilization is recommended to extend the service life of the APU.

APU Shutdown

Moving the APU switch to OFF trips the APU generator, closes the APU bleed air valve and extinguishes the APU GEN OFF BUS light. Shutdown occurs automatically after 60 seconds. When the APU speed decreases sufficiently during shutdown, the fuel valve and inlet door close. If the fuel valve does not close, the FAULT light will illuminate after approximately 30 seconds. An immediate shutdown can be accomplished by pulling the APU fire switch.

Note: Operate the APU for one full minute with no bleed air load prior to shutdown. This cooling period is recommended to extend the service life of the APU. When the APU switch is moved to OFF, this time delay is met automatically.

Electronic Control Unit (ECU)

An electronic control unit (ECU) monitors and controls the APU. If the ECU detects a fault that may cause damage to the APU or the aircraft, it will automatically execute a protective shutdown. One of three different indications on the APU Indicator Panel will appear when a protective shutdown is initiated:

- Fault Light, or
- Overspeed Light, or
- Low Oil Pressure Light

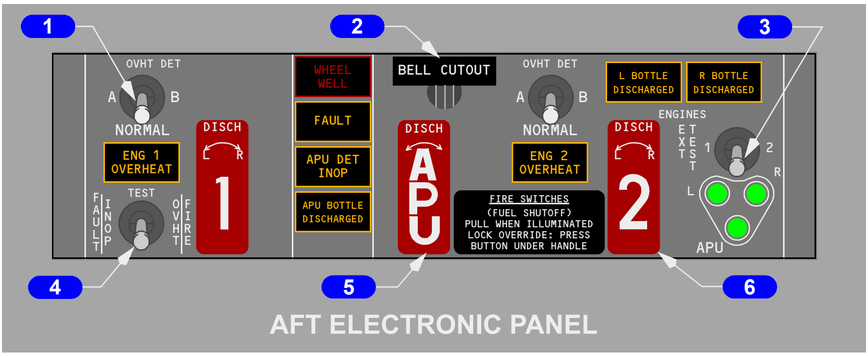
The ECU automatically controls APU speed through the electronic fuel control. If speed or EGT exceed acceptable levels with the APU providing electrical load only, some electrical load is shed. When electrical load and air extraction raise the EGT above acceptable levels during engine starting, electrical load shedding occurs prior to reducing bleed air. When electrical load and air extraction raise the EGT above acceptable levels other than during engine starting, the inlet guide vanes move toward a closed position, reducing bleed air extraction while maintaining electrical load.

APU Automatic Load Shedding

[Option - CAB/UTIL Power Switch]
In flight, if the APU is the only source of electrical power, all galley busses and main buses are automatically shed. If electrical load still exceeds design limits, both IFE busses are also automatically shed. On the ground, the APU attempts to carry a full electrical load. If an overload condition is sensed, the APU sheds galley busses and main busses until the load is within limits. Manual restoration of galley and main bus power can be attempted by moving the CAB/UTIL Power Switch to OFF, then back ON.

Fire Protection — Chapter 8
Table of Contents — Section TOC

Overheat/Fire Protection Panel Switches



1 Overheat Detector (OVHT DET) Switch

NORMAL – detection loop A and loop B are active.

A – detection loop A is active.

B – detection loop B is active.

2 Fire Warning BELL CUTOUT Switch

Push –

- extinguishes both master FIRE WARN lights
- silences the fire warning bell
- silences the remote APU fire warning horn (on the ground only)
- resets the system for additional warnings.

3 Extinguisher (EXT) TEST Switch

(spring–loaded to center)

1 or 2 – tests bottle discharge circuit continuity for all three extinguisher bottles.

4 Fault/Inoperative (FAULT/INOP) and Overheat/Fire (OVHT/FIRE) TEST Switch

(spring–loaded to center)

FAULT/INOP – tests fault detection circuits for both engines and the APU.

OVHT/FIRE – tests overheat and fire detection loops on both engines and APU, and wheel well fire detector

Note: See Fire and Overheat Detection System Fault Test in Section 20.

5 APU Fire Switch

Illuminated (red) –

- indicates fire in APU
- unlocks APU fire switch..

Note: Master FIRE WARN lights illuminate, fire warning bell sounds, and in the main wheel well the APU fire warning horn sounds (on ground only), and APU fire warning light flashes.

In – normal position, mechanically locked if no fire signal.

Up –

- arms APU extinguisher circuit
- closes fuel shutoff valve, APU bleed air valve, and APU inlet door
- trips generator control relay and breaker
- allows APU fire switch to rotate.

Rotate (left or right) –

- discharges APU fire bottle.

6 Engine Fire Switch

Illuminated (red) –

- indicates fire in related engine
- unlocks related engine fire switch.

Note: Master FIRE WARN lights illuminate and fire warning bell sounds.

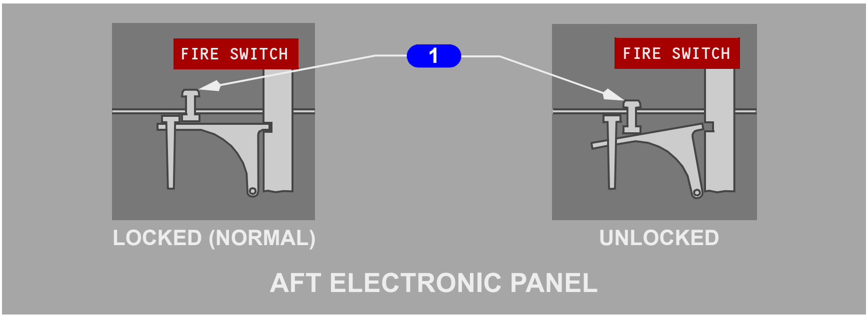
In – normal position, mechanically locked if no fire signal.

Up –

- arms one discharge squib on each engine fire extinguisher
- closes fuel, hydraulic shutoff and engine bleed air valves
- disables thrust reverser
- trips generator control relay and breaker
- deactivates engine driven hydraulic pump LOW PRESSURE light
- allows engine fire switch to rotate.

Rotate (left or right) – discharges related fire bottle.

Fire Switch Override

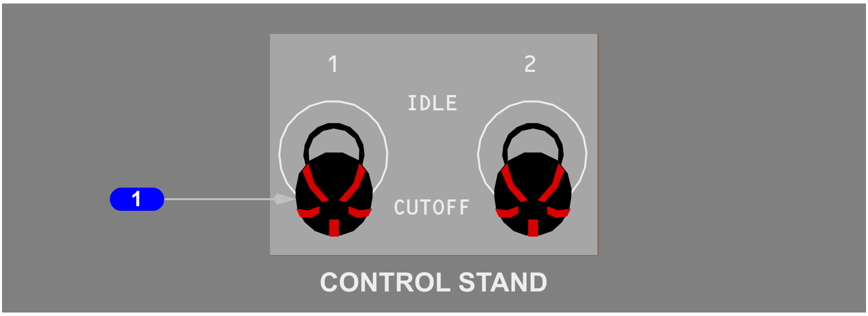


1 Fire Switch Override

Push – unlocks fire switch.

Engine Start Levers

[Option - New Engine Start Levers]



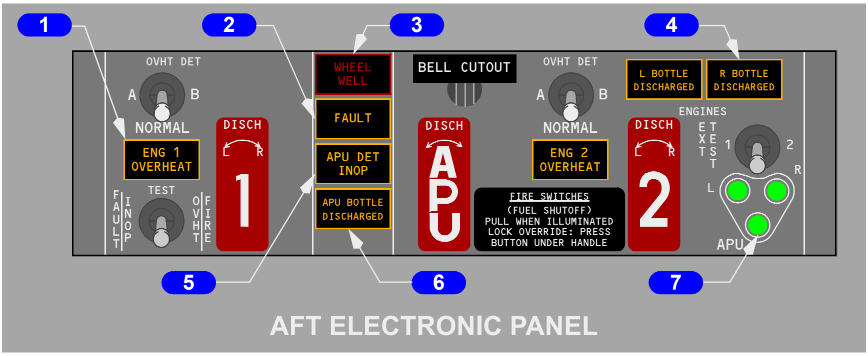
1 Engine Start Levers

Illuminated (red) –

- an associated engine fire is detected, or
- the fire TEST switch is held to the OVHT/FIRE position.

CAUTION: Do not apply rotational force when moving the engine start lever.

Overheat/Fire Protection Panel Lights



1 Engine (ENG) OVERHEAT Light

Illuminated (amber) – indicates overheat in related engine.

Note: MASTER CAUTION and OVHT/DET system annunciator lights illuminate.

2 FAULT Light

Illuminated (amber) – with the overheat detector switch in NORMAL - indicates both detector loops for an engine have failed.

Illuminated (amber) – with the overheat detector switch in A or B – indicates the selected loop for an engine has failed.

Note: MASTER CAUTION and OVHT/DET system annunciator lights do not illuminate.

3 WHEEL WELL Fire Warning Light

Illuminated (red) – indicates fire in main gear wheel well.

Note: Master FIRE WARN lights illuminate and fire warning bell sounds.

4 Engine BOTTLE DISCHARGED Light

Illuminated (amber) – indicates related fire extinguisher bottle has discharged or pressure is low.

5 APU Detector Inoperative (DET INOP) Light

Illuminated (amber) – indicates APU detector loop has failed.

Note: MASTER CAUTION and OVHT/DET system annunciator lights illuminate.

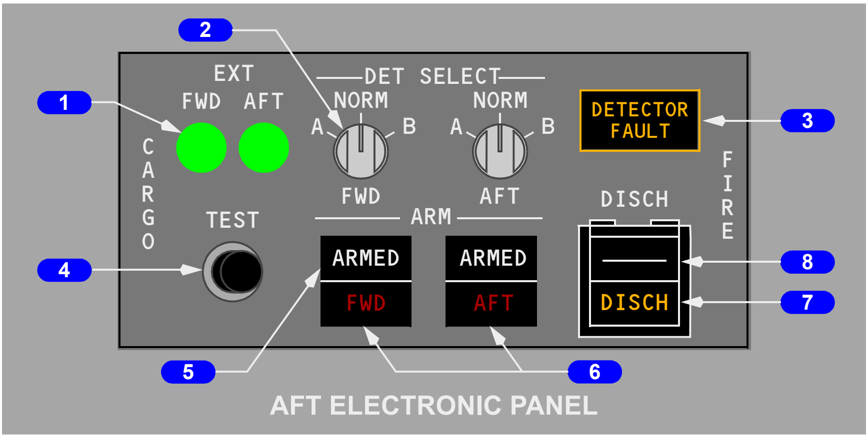
6 **APU BOTTLE DISCHARGED Light**

Illuminated (amber) – indicates APU extinguisher bottle has discharged or pressure is low.

7 **Extinguisher Test (EXT TEST) Lights**

Illuminated (green) – EXT TEST switch is positioned to 1 or 2 and circuit continuity is normal.

Cargo Fire Panel



1 **Extinguisher (EXT) Test Lights**

Illuminated (green) - Cargo Fire TEST switch is pushed and fire bottle discharge squib circuit continuity is normal.

2 **Detector Select (DET SELECT) Switches**

NORM - detection loop A and B are active.

A - detection loop A is active.

B - detection loop B is active.

3 **DETECTOR FAULT Light**

Illuminated (amber) -

- One or more of the selected detector loop(s) in either cargo compartment has failed.

PUSH - illuminates the DETECTOR FAULT light for a test.

4 **Cargo Fire TEST Switch**

PUSH - tests circuits for both forward and aft cargo fire detector loops and suppression system.

Note: See Cargo Fire System Tests in Section 20.

[Option - Single Cargo Fire Extinguisher bottle]

5 **Cargo Fire ARM Switches**

PUSH -

- FWD ARMED - extinguisher armed for the forward cargo compartment
- AFT ARMED - extinguisher armed for the aft cargo compartment.

[Option - Dual Cargo Fire Extinguisher bottles]

5 **Cargo Fire ARM Switches**

PUSH -

- FWD ARMED - extinguisher armed for the forward cargo compartment
- AFT ARMED - extinguisher armed for the aft cargo compartment.

Note: If the first bottle has discharged and the system remains armed, the second bottle discharge is inhibited upon landing. The second bottle discharge timer is disabled when the system is disarmed.

6 **Cargo Fire (FWD/AFT) Warning Lights**

Illuminated (red) -

- at least one detector in each loop detects smoke
- with power failed in one loop, at least one detector on the remaining loop detects smoke.

Note: Master FIRE WARN lights illuminate and fire warning bell sounds.

[Option - Single Cargo Fire Extinguisher bottle]

7 **Cargo Fire Bottle Discharge (DISCH) Light**

Illuminated (amber) - indicates the extinguisher bottle has discharged or pressure is low.

[Option - Dual Cargo Fire Extinguisher bottles]

7 **Cargo Fire Bottle Discharge (DISCH) Light**

Illuminated (amber) - indicates that either extinguisher bottle has discharged or pressure is low.

[Option - Single Cargo Fire Extinguisher bottle]

8 **Cargo Fire Discharge (DISCH) Switch**

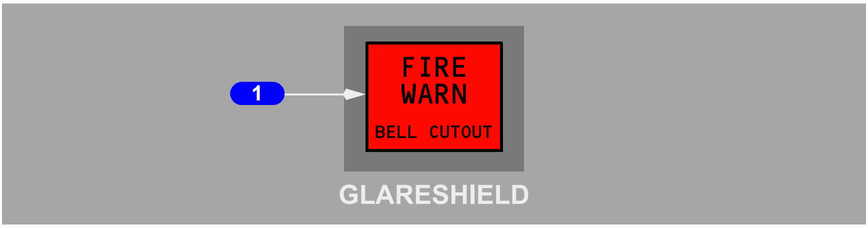
PUSH - if system is armed, discharges the extinguisher bottle.

[Option - Dual Cargo Fire Extinguisher bottles]

8 **Cargo Fire Discharge (DISCH) Switch**

PUSH - if system is armed, discharges the first extinguisher bottle. The timer is set for 60 minutes to discharge the second extinguisher bottle.

Master Fire Warning Light



1 **Master Fire Warning (FIRE WARN) Lights**

Illuminated (red) – indicates a fire warning (or system test) in engine, APU, main gear wheel well or cargo compartment

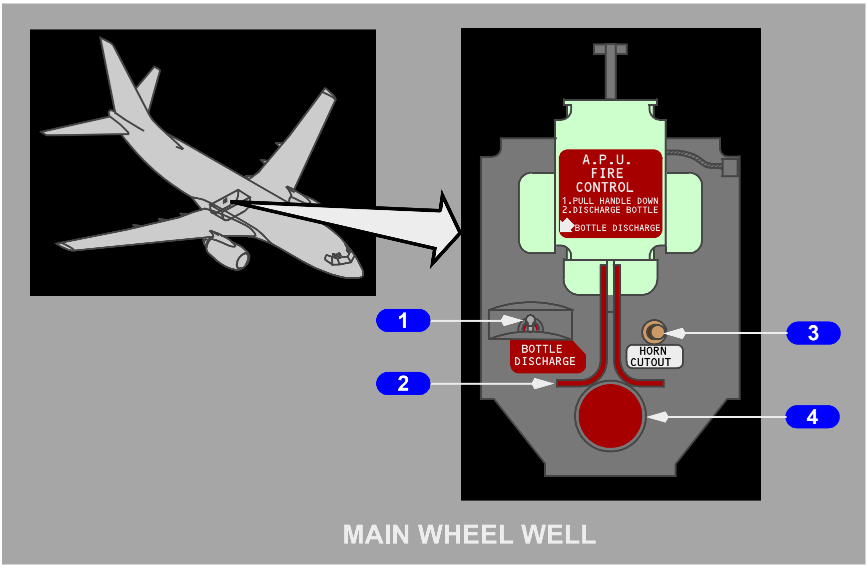
- fire warning bell sounds
- if on ground, remote APU fire warning horn sounds.

Push –

- extinguishes both master FIRE WARN lights
- silences fire warning bell
- silences remote APU fire warning horn
- resets system for additional warnings.

Note: Pushing fire warning bell cutout switch on overheat/fire protection panel results in same actions.

APU Ground Control Panel



1 APU BOTTLE DISCHARGE Switch

(spring–loaded to the right and safety wired.)

Left – discharges APU extinguisher.

Note: Armed only if APU fire control handle is pulled at this panel.

2 APU Fire Control Handle

Up – normal position.

Down –

- arms APU BOTTLE DISCHARGE switch (on this panel only)
- closes APU fuel shutoff, bleed air valve and APU inlet door
- trips generator control relay and breaker.

3 APU Fire Warning HORN CUTOUT Switch

Push –

- silences fire alarm bell
- silences APU fire warning horn
- causes APU fire warning light to stop flashing but remain illuminated.

4 **APU Fire Warning Light**

Illuminated (red flashing) – indicates fire in APU.

Note: Also, flight deck fire warning bell sounds and APU fire warning horn in main wheel well sounds.

Illuminated (red steady) – indicates APU fire warning HORN CUTOUT switch has been pushed following an APU fire indication.

Lavatory Fire

Lavatory Smoke Detector - Jamco

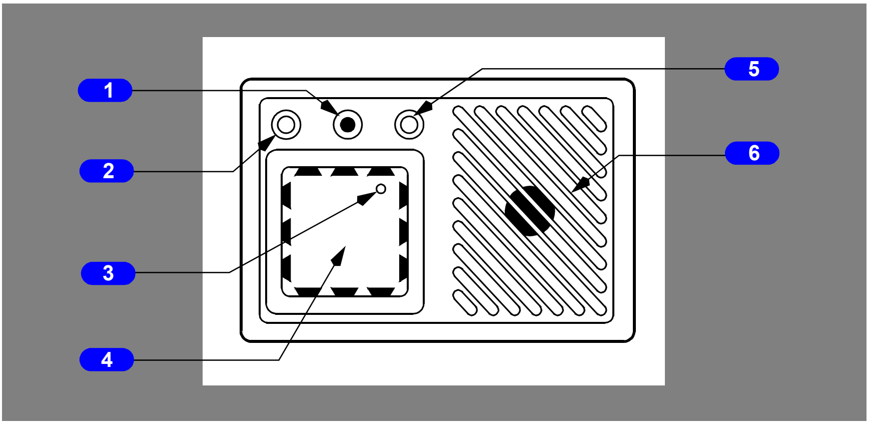
A smoke detector is mounted in each lavatory ceiling. When smoke activates the smoke detector, the alarm horn sounds and the red alarm indicator light illuminates on the smoke detector.

If the Interrupt/Reset Switch is pushed then the alarm indicator light extinguishes and the alarm horn is silenced.

If smoke is still present in the lavatory, then the smoke detector will re-activate until smoke is cleared.

Note: In addition to the self-contained (baseline) alert in which the smoke detector's integral horn is heard from within the lavatory, the following additional (customer selected) visual and aural alerts are available:

- Attendant chime/call light feature
- Flight compartment alert feature.



1 **Interrupt/Reset Switch (Recessed push button switch)**

Press & Hold - alarm indicator light extinguishes and the alarm horn is silenced.

Note: A tool (plastic or wooden probe or the like) is required to press recessed buttons.

2 **Power Indicator (Green)**

Illuminated - unit is powered and operating.

3 **Alarm Indicator (Red)**

Illuminated – Alarm state.

4 **Sensor**

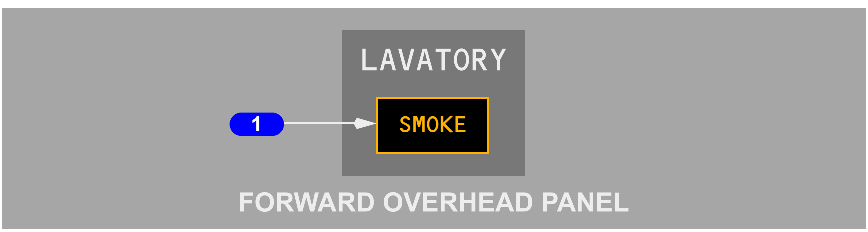
5 **Self-Test Switch**

INOP. [(Switch not present on PU90-499 Smoke Detector Model)]

6 **Alarm Horn**

Lavatory Smoke Detection

[Option - Lavatory Smoke Light]



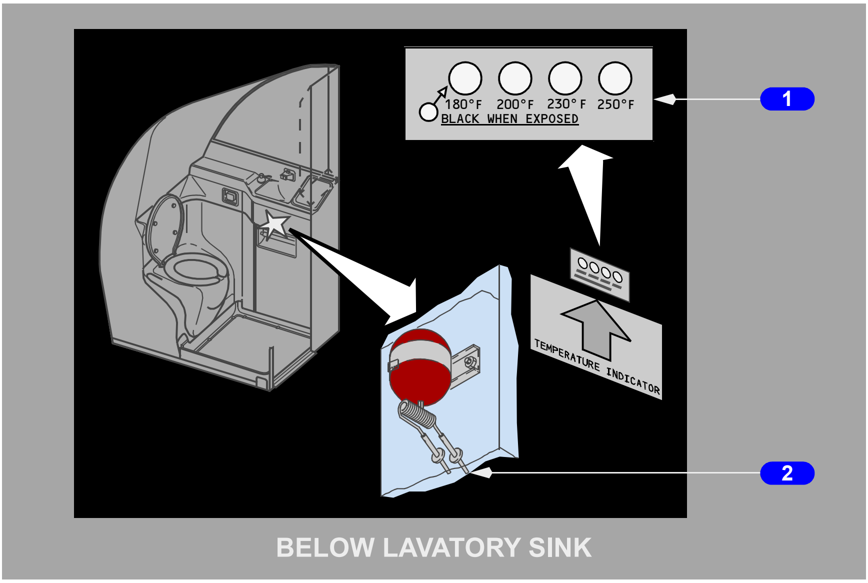
1 **LAVATORY SMOKE Light**

Illuminated (amber) –

- smoke has been detected in a lavatory
- a test is being conducted.

Note: MASTER CAUTION and OVERHEAD system annunciator lights illuminate.

Lavatory Fire Extinguisher



1 TEMPERATURE INDICATOR Placard

White – normal condition.

Black – exposed to high temperatures.

2 Heat Activated Nozzles

Flat black – normal condition.

Aluminum – indicates extinguisher has discharged.

Both nozzles discharge toward the towel disposal container.

Intentionally
Blank

Introduction

There are fire detection and extinguishing systems for:

- engines
- APU
- lavatories
- cargo compartment

The engines also have overheat detection systems.

The main gear wheel well has a fire detection system, but no fire extinguishing system.

The cargo compartment has smoke detection and fire suppression systems.

Engine Fire Protection

Engine fire protection consists of these systems:

- engine overheat and fire detection powered by the battery bus
- engine fire extinguishing powered by the hot battery bus.

Engine Overheat and Fire Detection

Each engine contains two overheat/fire detector loops. Each loop provides both fire and overheat detection. As the temperature of a detector increases to a predetermined limit, the detector senses an overheat condition. At higher temperatures, the detector senses a fire condition. Normally, both detector loops must sense a fire or overheat condition to cause an engine overheat or fire alert. The ENG OVERHEAT light or engine fire switch remains illuminated until the temperature drops below the onset temperature.

An OVHT DET switch for each engine, labeled A, B, and NORMAL, permits selection of either loop A or B, or both A and B, as the active detecting loops.

The system contains a fault monitoring circuit. If one loop fails with the OVHT DET switch in NORMAL, that loop is automatically deselected and the remaining loop functions as a single loop detector. There is no flight deck indication of single loop failure. If both loops fail on an engine, the FAULT light illuminates and the system is inoperative.

If the OVHT DET switch is positioned to A or B, the system operates as a single loop system. The non–selected loop is not monitored. If the selected loop fails, the FAULT light illuminates and the system is inoperative.

The indications of an engine overheat are:

- both MASTER CAUTION lights illuminate
- the OVHT/DET system annunciator light illuminates
- the related ENG OVERHEAT light illuminates.

The indications of an engine fire are:

- the fire warning bell sounds
- both master FIRE WARN lights illuminate
- the related engine fire switch illuminates.

[Option - New Engine Start Levers - Prior to L/N 5605]

- the related engine start lever illuminates
- all related engine overheat alert indications illuminate.

Engine Fire Extinguishing

The engine fire extinguisher system consists of two engine fire extinguisher bottles, two engine fire switches, two BOTTLE DISCHARGED lights, and an EXT TEST switch. Either or both bottles can be discharged into either engine.

The engine fire switches are normally locked down to prevent inadvertent shutdown of an engine. Illumination of an engine fire switch or ENG OVERHEAT light unlocks the engine fire switch. The switches may also be unlocked manually.

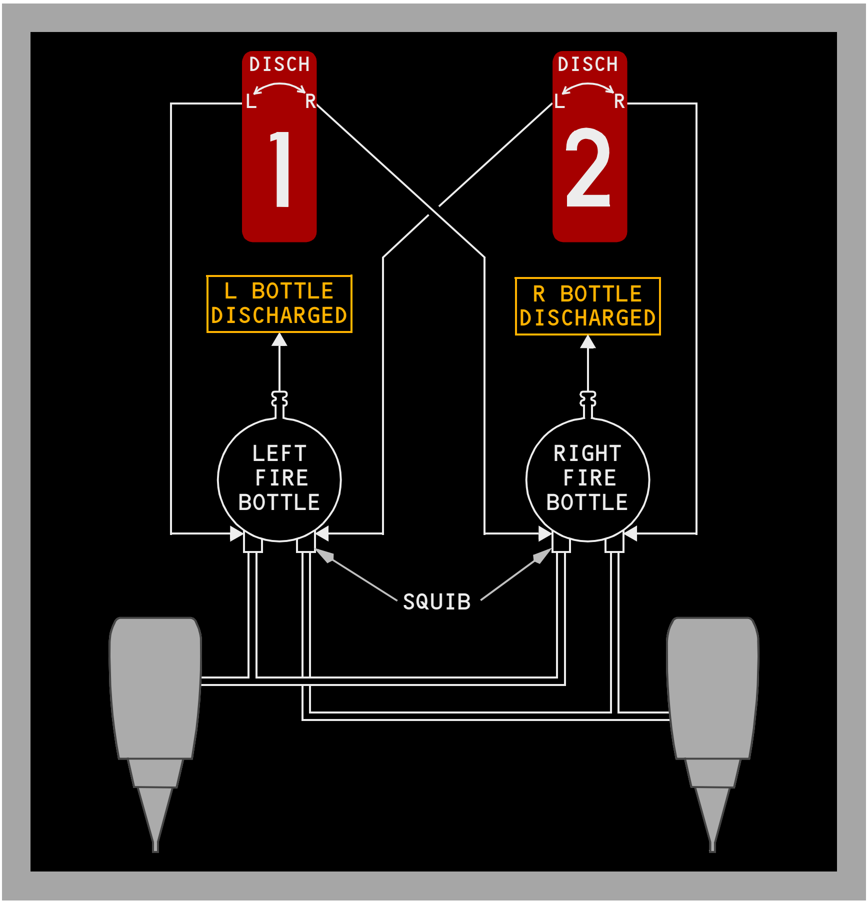
Pulling the engine fire switch up:

- closes both the engine fuel shutoff valve and the spar fuel shutoff valve
- closes the engine bleed air valve resulting in loss of wing anti–ice to the affected wing and closure of bleed air operated pack valve
- trips the generator control relay and breaker
- closes the hydraulic fluid shutoff valve. The engine driven hydraulic pump LOW PRESSURE light is deactivated
- disables thrust reverser for the related engine
- allows the engine fire switch to be rotated for discharge
- arms one discharge squib on each engine fire extinguisher bottle.

Rotating the engine fire switch electrically “fires” a squib, discharging the extinguishing agent into the related engine. Rotating the switch the other way discharges the remaining bottle.

The L or R BOTTLE DISCHARGED light illuminates a few seconds after the engine fire switch is rotated, indicating the bottle has discharged or pressure is low.

Engine Fire Extinguisher Schematic



APU Fire Protection

APU fire protection consists of these systems:

- APU fire detection powered by the battery bus.
- APU fire extinguishing powered by the hot battery bus.

APU Fire Detection

A single fire detection loop is installed on the APU. As the temperature of the detector increases to a predetermined limit, the detector senses a fire condition. The APU fire switch remains illuminated until the temperature of the detector has decreased below the onset temperature.

The system contains a fault monitoring circuit. If the loop fails, the APU DET INOP light illuminates indicating the APU fire detection system is inoperative.

The indications of an APU fire are:

- the fire warning bell sounds
- both master FIRE WARN lights illuminate
- the APU fire switch illuminates
- the APU automatically shuts down
- the wheel well APU fire warning horn sounds, (on the ground only), and the wheel well APU fire warning light flashes.

APU Fire Extinguishing

The APU fire extinguisher system consists of one APU fire extinguisher bottle, an APU fire switch, an APU BOTTLE DISCHARGED light, and an EXT TEST switch. The APU ground control panel located in the right main wheel well also contains an APU fire warning light, an APU BOTTLE DISCHARGED switch, an APU fire control handle and APU HORN CUTOUT switch.

The APU fire switch is normally locked down to prevent inadvertent shutdown of the APU. Illumination of the APU fire switch unlocks the switch. The switch may also be unlocked manually.

Pulling the APU Fire switch up:

- provides backup for the automatic shutdown feature
- deactivates the fuel solenoid and closes the APU fuel shutoff valve
- closes the APU bleed air valve
- closes the APU air inlet door
- trips the APU generator control relay and breaker
- allows the APU fire switch to be rotated for discharge
- arms the APU fire extinguisher bottle squib.

Rotating the APU fire switch in either direction electrically “fires” the squib discharging the extinguishing agent into the APU. The APU BOTTLE DISCHARGED light illuminates after a few seconds, indicating the bottle has discharged or pressure is low.

Main Wheel Well Fire Protection

Main wheel well fire protection consists of fire detection powered by AC transfer bus 2 and battery bus.

Note: The main wheel well has no fire extinguishing system. The nose wheel well does not have a fire detection system.

Main Wheel Well Fire Detection

A single fire detector loop is installed in the main wheel well. As the temperature of the detector increases to a predetermined limit, the detector senses a fire condition. The WHEEL WELL fire warning light remains illuminated until the temperature of the detector has decreased below the onset temperature.

The indications for a main wheel well fire are:

- the fire warning bell sounds
- both master FIRE WARN lights illuminate
- the WHEEL WELL fire warning light illuminates.

Cargo Compartment Fire Protection

Cargo fire protection consists of these systems:

- cargo compartment smoke detection powered by DC bus 1 and DC bus 2
- cargo compartment fire suppression powered by the hot battery bus.

Cargo Compartment Smoke Detection

The forward and aft cargo compartments each have smoke detectors in a dual loop configuration. Normally, both detection loops must sense smoke to cause an alert. In the event of a detector failure, the system can be manually converted to single-loop detection through the DETECT SELECT switch on the cargo fire control panel. In the event of a power failure in one loop the system automatically converts to single-loop detection.

Cargo Compartment Fire Warning

The indications of a cargo compartment fire are:

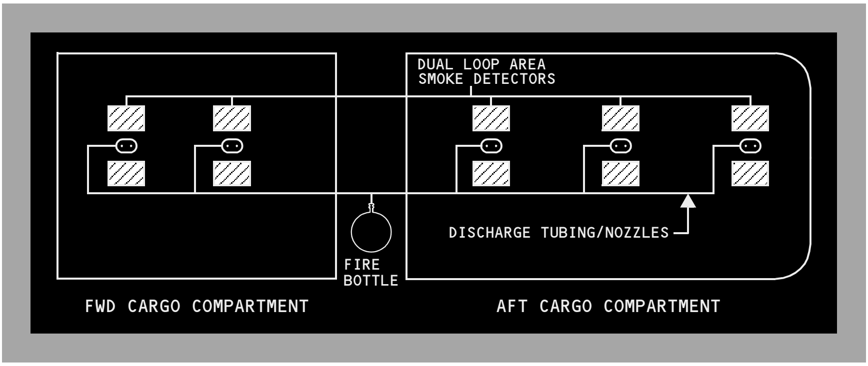
- the fire warning bell sounds
- both master FIRE WARN lights illuminate
- the FWD/AFT cargo fire warning light(s) illuminates.

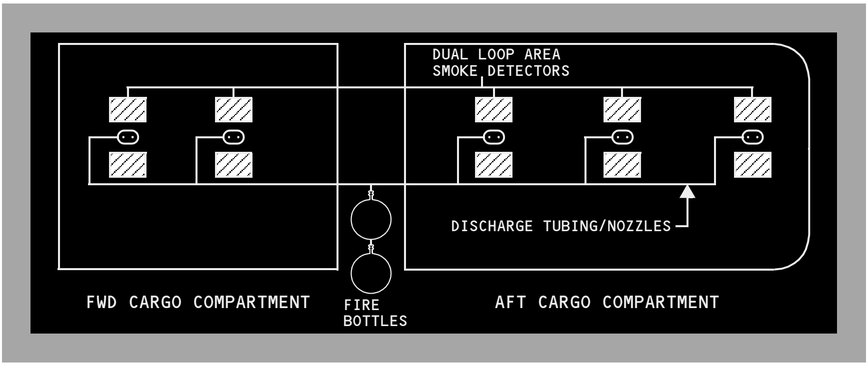
Cargo Compartment Fire Suppression

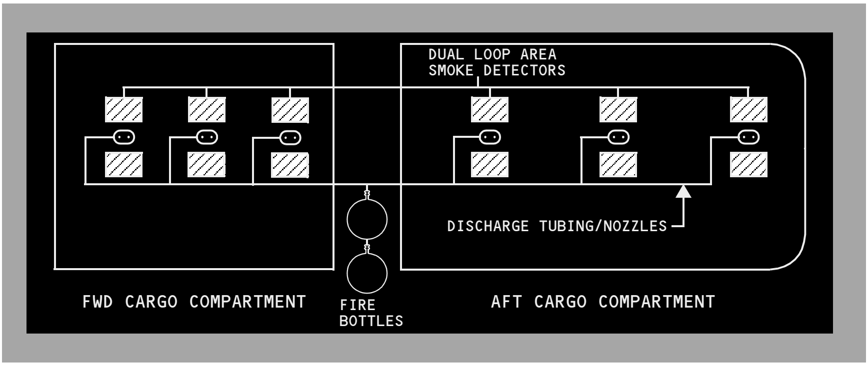
[Option - Single cargo fire extinguisher bottle]
A single fire extinguisher bottle is installed in the air conditioning mix bay on the forward wing spar. Detection of a fire in either the forward or aft compartment will cause the FWD or AFT cargo fire warning light to illuminate. The extinguisher is armed by pushing the appropriate cargo fire ARMED switch. Once armed, the system is discharged by pushing the cargo fire DISCH switch. This results in the total discharge of the bottle contents into the selected compartment, and provides fire suppression for a total time of 75 minutes, consisting of fire suppression for 60 mins of flight time to land at an airport plus an additional 15 minutes of fire suppression for a missed approach, go-around, landing and passenger unloading. The cargo fire DISCH light illuminates once the bottle is discharged indicating the fire suppression system has been fully activated. It may take up to 30 seconds for the light to illuminate.

[Option - Dual cargo fire extinguisher bottles]
Two fire extinguisher bottles are installed in the air conditioning mix bay on the forward wing spar. Detection of a fire in either the forward or aft compartment will cause the FWD or AFT cargo fire warning light to illuminate. The extinguishers are armed by pushing the appropriate cargo fire ARMED switch. Once armed, the first bottle is discharged by pushing the cargo fire DISCH switch. This results in the total discharge of the first bottle contents into the selected compartment. The second bottle discharge is metered to discharge at a reduced flow into the selected compartment. When the cargo fire DISCH switch is pushed, an aircraft has a total time of fire suppression of 195 minutes, consisting of 180 minutes to land at an airport plus an additional 15 minutes of fire suppression for a missed approach, go-around, landing and passenger unloading. Discharge of the second bottle may be disabled if the system is disarmed. The cargo fire DISCH light illuminates when a bottle is discharged indicating the fire suppression system has been fully activated. It may take up to 30 seconds for the light to illuminate. On landing, if the first bottle was discharged and the system remains armed, the second bottle discharge is inhibited.

Cargo Fire Suppression Schematic







Lavatory Fire Protection and Smoke Detection

Lavatory Fire Protection

FWD/AFT lavatory fire protection consists of these systems:

- lavatory smoke detection
- lavatory fire extinguishing (heat activated).

Lavatory Smoke Detection

The JAMCO lavatory smoke detection system monitors for the presence of smoke. When smoke is detected:

- an aural warning sounds
- the red alarm indicator light on the lavatory smoke detector panel illuminates.

There is no flight deck indication. When smoke is no longer present, ALARM MODE is reset by pressing the INTERRUPT switch.

The JAMCO lavatory smoke detection system monitors for the presence of smoke. When smoke is detected:

- an aural warning sounds
- the red alarm indicator light on the lavatory smoke detector panel illuminates and the appropriate amber lavatory call light will flash
- the amber lavatory SMOKE light on the forward overhead panel illuminates.

When smoke is no longer present, the system automatically resets.

Lavatory Fire Extinguisher System

A fire extinguisher system is located beneath the sink area in each lavatory. When a fire is detected:

- fire extinguisher operation is automatic
- flight deck has no indication of extinguisher discharge.

Fire and Overheat System Tests

The fire and overheat detection systems can be tested by pushing and holding the FAULT/INOP and OVHT/FIRE TEST switch. Extinguisher continuity can be tested by pushing and holding the EXT TEST switch. All test indications clear when switches are released.

FAULT/INOP Test Detection

The fault detection circuits for both the engines and the APU are tested by pushing and holding the FAULT/INOP and OVHT/FIRE TEST switch in the FAULT/INOP position.

The indications for the FAULT/INOP test are:

- both MASTER CAUTION lights illuminate
- the OVHT/DET system annunciator light illuminates
- the FAULT light illuminates
- the APU DET INOP light illuminates.

OVERHEAT/FIRE Test Detection

The overheat and fire detection loops on both engines, the APU, and the fire detector in the wheel well are tested by pushing and holding the FAULT/INOP and OVHT/FIRE TEST switch in the OVHT/FIRE position.

The indications for the OVHT/FIRE test are:

- the fire warning bell sounds
- both master FIRE WARN lights illuminate
- both MASTER CAUTION lights illuminate
- the OVHT/DET system annunciator light illuminates
- both engine fire switches illuminate

[Option - New Engine Start Levers - Prior to L/N 5605]

- both engine start levers illuminate
- the APU fire switch illuminates
- both ENG OVERHEAT lights illuminate
- the WHEEL WELL fire warning light illuminates if AC power is available
- on the ground, the wheel well APU fire warning horn sounds and the wheel well APU fire warning light flashes.

Extinguisher Test

When the EXT TEST switch is positioned to 1 or 2, the green EXT TEST lights illuminate, verifying circuit continuity from the squib to the engine and APU fire switch.

Cargo Fire System Tests

The cargo fire detection and suppression system can be tested by pushing and holding the cargo fire TEST switch. This sends a test signal to the forward and aft cargo fire detector loops and verifies continuity of the extinguisher bottle squib circuits. All test indications clear when the TEST switch is released.

Cargo Fire TEST

The indications for the Cargo Fire test are:

- the fire warning bell sounds
- both master FIRE WARN lights illuminate

- the extinguisher test lights illuminate
- the FWD and AFT cargo fire warning lights illuminate when all detectors in selected loop(s) respond to the fire test
- the cargo fire bottle DISCH light illuminates.

Note: The fire warning BELL CUTOUT switch on the Overheat/Fire Protection panel can silence the fire warning bell and extinguish the master FIRE WARN lights.

Note: During a Cargo Fire Test, the DETECTOR Fault light will illuminate if one or more detectors in the loop(s) has failed.

Note: Individual detector faults can only be detected by a manually initiated test. The MASTER CAUTION light does not illuminate.

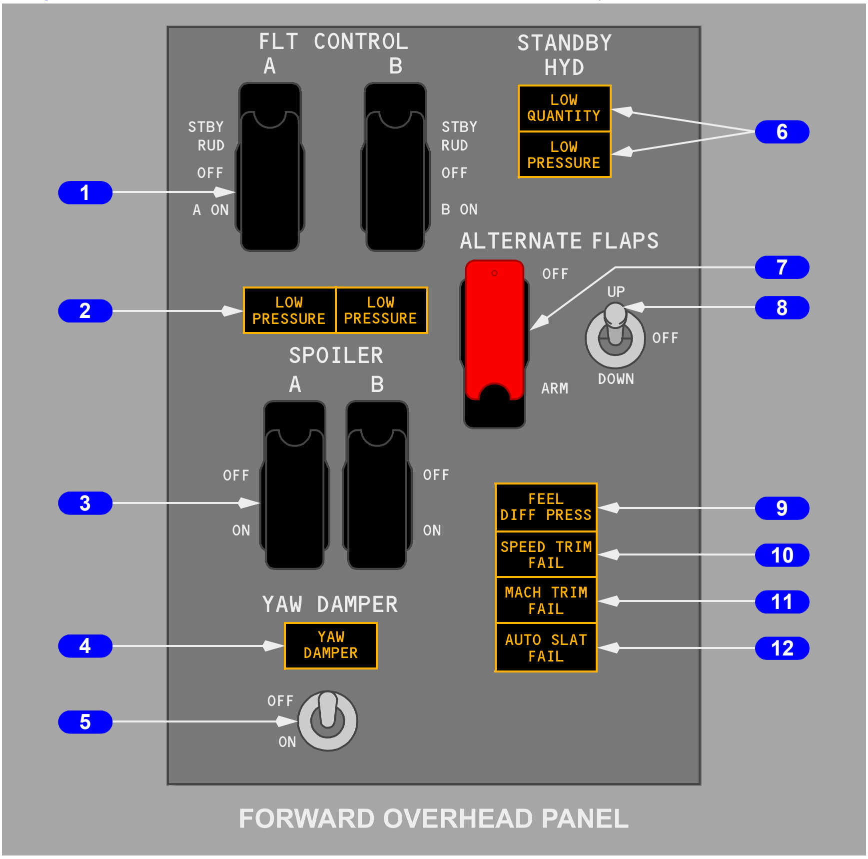
Note: At the end of cargo fire testing, up to a four second delay may occur to allow all applicable indications to extinguish at the same time.

Flight Controls — Chapter 9

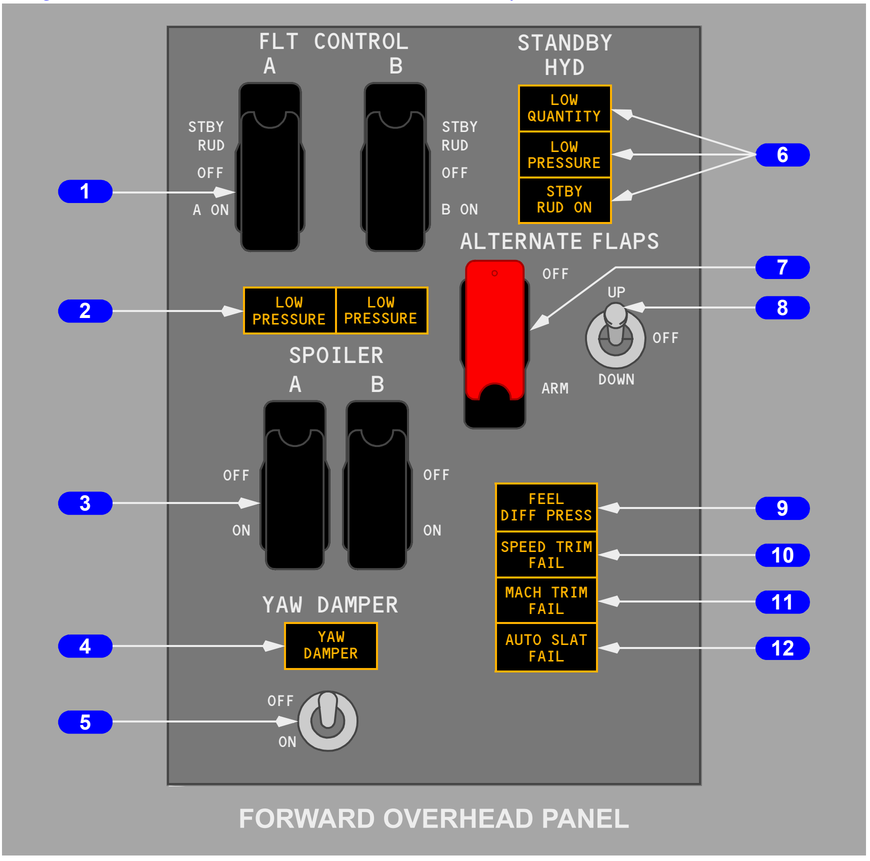
Table of Contents — Section TOC

Flight Control Panel

[Flight Control Panel for 737 without modified rudder system.]



[Flight Control Panel for 737 modified rudder system.]



1 FLIGHT CONTROL Switches

STBY RUD - activates standby hydraulic system pump and opens standby rudder shutoff valve to pressurize standby rudder power control unit.

OFF - closes flight control shutoff valve isolating ailerons, elevators and rudder from associated hydraulic system pressure.

ON (guarded position) - normal operating position.

2 Flight Control LOW PRESSURE Lights

Illuminated (amber) -

- indicates low hydraulic system (A or B) pressure to ailerons, elevator and rudder
- deactivated when associated FLIGHT CONTROL switch is positioned to STBY RUD and standby rudder shutoff valve opens.

3 Flight SPOILER Switches

ON (guarded position) – normal operating position.

OFF – closes the respective flight spoiler shutoff valve.

Note: Used for maintenance purposes only.

4 YAW DAMPER Light

Illuminated (amber) – yaw damper is not engaged.

5 YAW DAMPER Switch

OFF – disengages yaw damper.

ON –

- engages main yaw damper to main rudder power control unit if the B FLT CONTROL switch is in the ON position
- engages standby yaw damper to standby rudder power control unit if both the A and B FLT CONTROL switches are in the STBY RUD position.

6 STANDBY HYD Lights

STANDBY HYDRAULIC LOW QUANTITY Light

Illuminated (amber) -

- indicates low quantity in standby hydraulic reservoir
- always armed.

STANDBY HYDRAULIC LOW PRESSURE Light

Illuminated (amber) -

- indicates output pressure of standby pump is low
- armed only when standby pump operation has been selected or automatic standby function is activated.

STBY RUD ON Light

- Illuminated (amber) - indicates the standby rudder system is commanded on to pressurize the standby rudder power control unit.

7 ALTERNATE FLAPS Master Switch

OFF (guarded position) – normal operating position.

ARM – closes TE flap bypass valve, activates standby pump, and arms the ALTERNATE FLAPS position switch.

8 ALTERNATE FLAPS Position Switch

Functions only when the ALTERNATE FLAPS master switch is in ARM.

UP –

- electrically retracts TE flaps
- LE devices remain extended and cannot be retracted by the alternate flaps system.

OFF – normal operating position.

DOWN (spring loaded to OFF) –

- (momentary) fully extends LE devices using standby hydraulic pressure
- (hold) electrically extends TE flaps until released.

9 Feel Differential Pressure (FEEL DIFF PRESS) Light

Armed when the TE flaps are up or down.

Illuminated (amber) -

- indicates excessive differential pressure in the elevator feel computer.

Note: Excessive differential pressure can be caused by erroneous activation of the Elevator Feel Shift module.

10 Speed Trim Failure (SPEED TRIM FAIL) Light

Illuminated (amber) –

- indicates failure of the speed trim system
- indicates failure of a single FCC channel when MASTER CAUTION light recall is activated and light extinguishes when Master Caution System is reset.

11 Mach Trim Failure (MACH TRIM FAIL) Light

Illuminated (amber) –

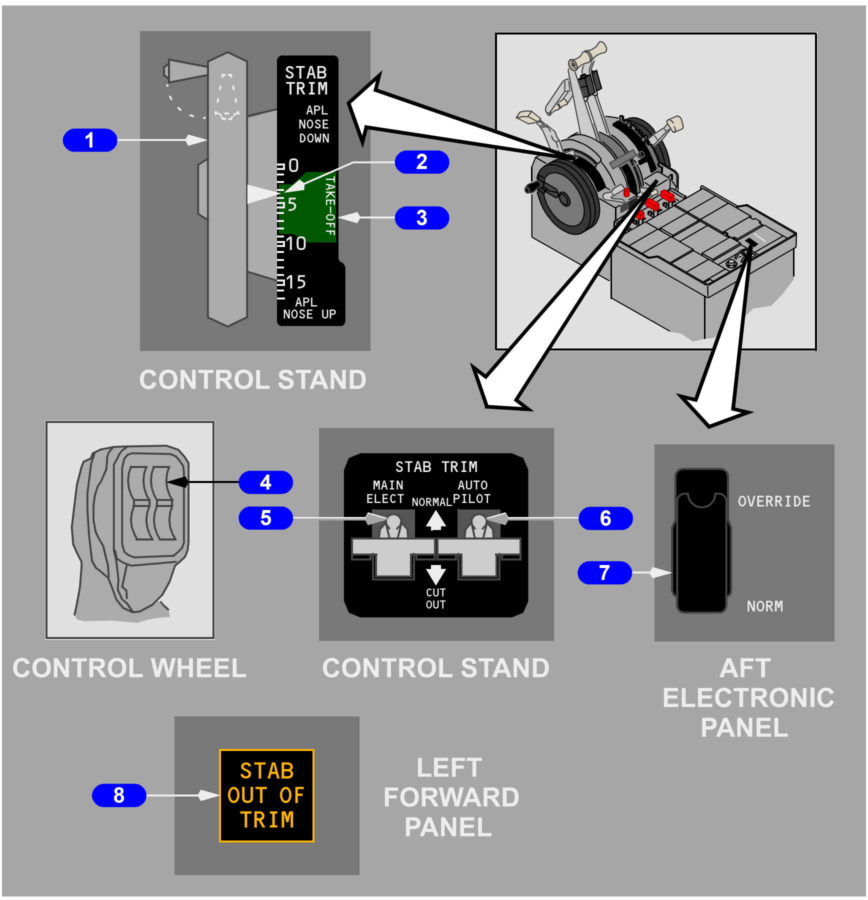
- indicates failure of the mach trim system
- indicates failure of a single FCC channel when MASTER CAUTION light recall is activated and light extinguishes when master caution system is reset.

12 Automatic Slat Failure (AUTO SLAT FAIL) Light

Illuminated (amber) –

- indicates failure of the auto slat system
- indicates failure of a single Stall Management/Yaw Damper (SMYD) computer when illuminated during MASTER CAUTION recall and extinguishes when master caution system is reset.

Stabilizer



1 **Stabilizer Trim Wheel**

- provides for manual operation of stabilizer
- overrides any other stabilizer trim inputs
- rotates when stabilizer is in motion.

Note: Handle should be folded inside stabilizer trim wheel for normal operation

2 **Stabilizer Trim Indicator**

Indicates units of airplane trim on the adjacent scale.

3 **Stabilizer Trim Green Band Range**

Corresponds to allowable range of trim settings for takeoff.

4 **Stabilizer Trim Switches (spring-loaded to neutral)**

Push (both) –

- electrically commands stabilizer trim in desired direction
- autopilot disengages if engaged.

5 **Stabilizer Trim Main Electric (MAIN ELECT) Cutout Switch**

NORMAL – normal operating position.

CUTOUT – deactivates stabilizer trim switch operation.

6 **Stabilizer Trim AUTOPILOT Cutout Switch**

NORMAL – normal operating position.

CUTOUT –

- deactivates autopilot stabilizer trim operation
- autopilot disengages if engaged.

7 **Stabilizer Trim Override Switch**

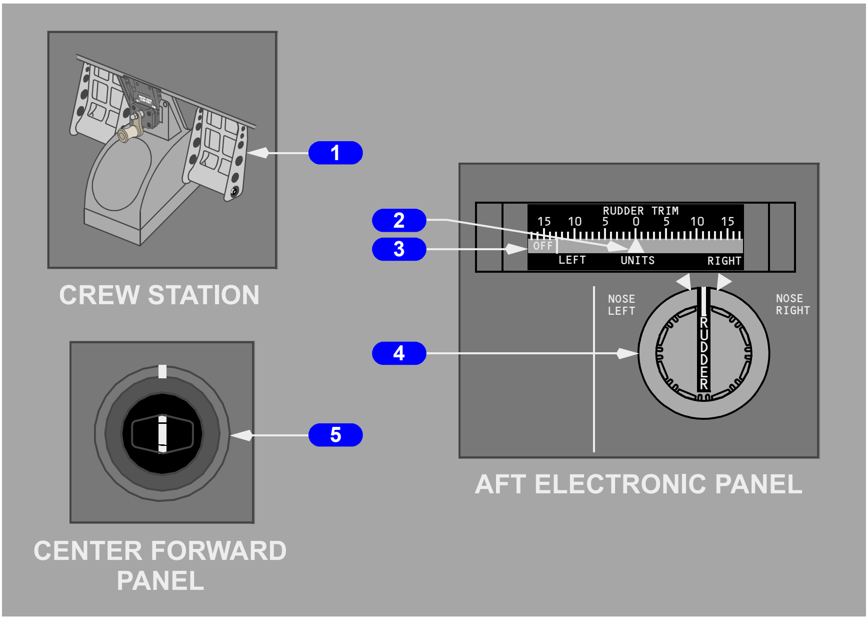
OVERRIDE – bypasses the control column actuated stabilizer trim cutout switches to restore power to the Stabilizer Trim Switches

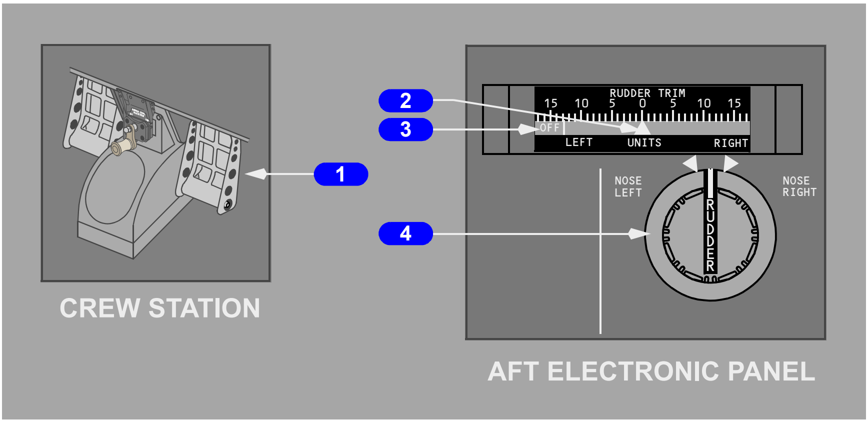
NORM (guarded position) – normal operating position.

8 **Stabilizer Out of Trim (STAB OUT OF TRIM) Light**

Refer to Chapter 4 – Automatic Flight

Rudder





1 Rudder Pedals

Push –

- controls rudder position
- permits limited nose gear steering up to 7 degrees each side of center.

2 **Rudder Trim Indicator**

Indicates units of rudder trim.

3 **Rudder Trim OFF Flag**

Illuminated (amber) (in view) – rudder trim indicator is inoperative.

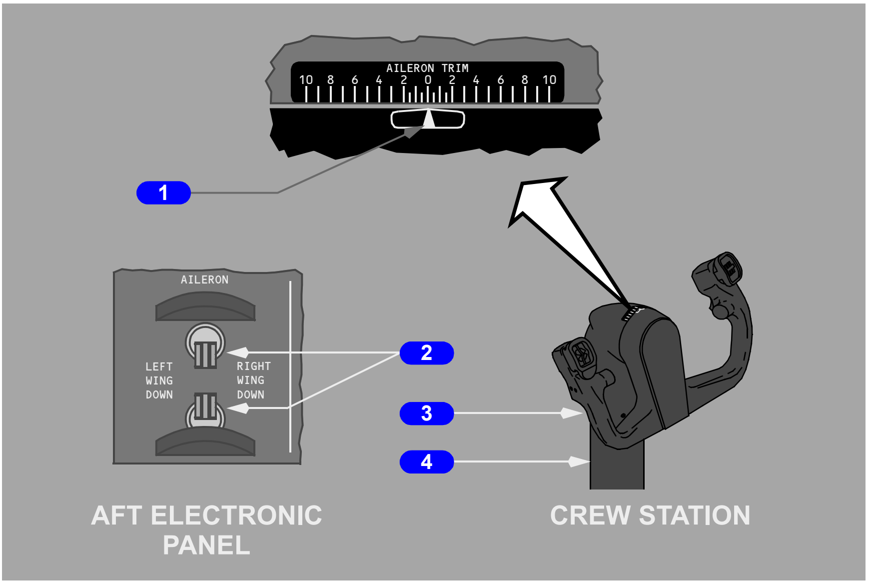
4 **Rudder Trim Control (spring-loaded to neutral)**

Rotate – electrically trims the rudder in the desired direction.

5 **YAW DAMPER Indicator**

- Indicates main yaw damper movement of rudder
- pilot rudder pedal inputs are not indicated.

Aileron / Elevator / Flight Spoilers



1 **AILERON TRIM Indicator**

Indicates units of aileron trim.

2 **AILERON Trim Switches (spring-loaded to the neutral position)**

Movement of both switches repositions the aileron neutral control position.

3 Control Wheel

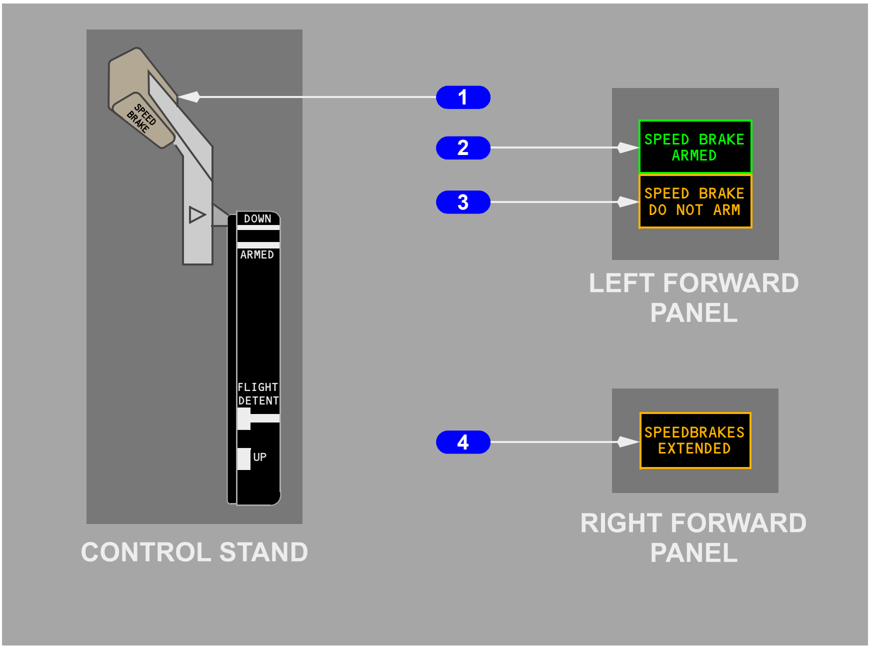
Rotate – operates ailerons and flight spoilers in desired direction.

4 Control Column

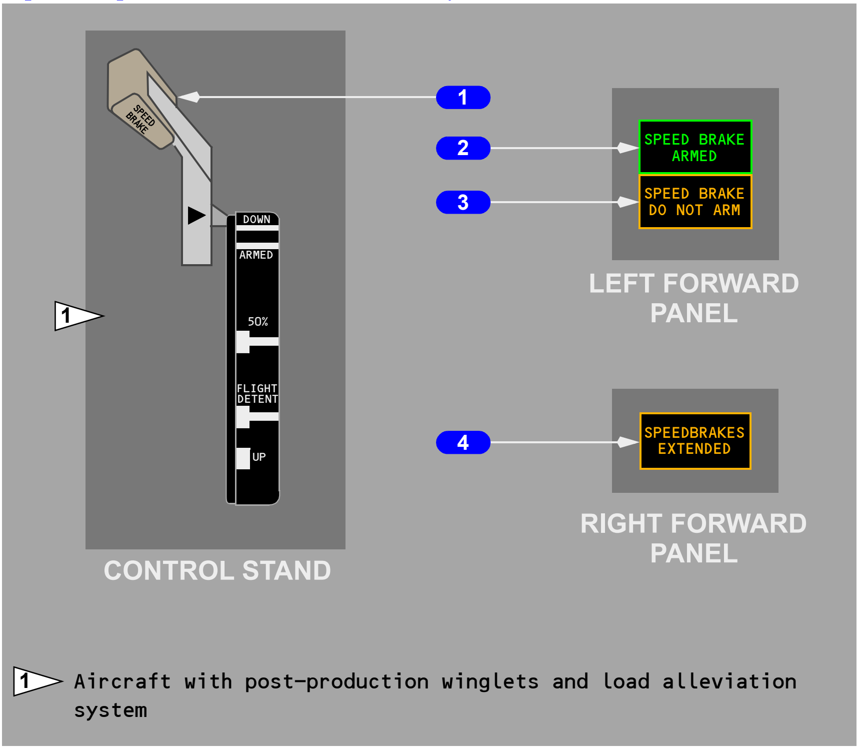
Push/Pull –

- operates elevators in the desired direction
- movement opposing stabilizer trim stops electric trimming.

Speed Brakes



[Option - Speed Brake Load Alleviation System]



1 SPEED BRAKE Lever

DOWN (detent) – all flight and ground spoiler panels in faired position.

ARMED –

- automatic speed brake system armed
- upon touchdown, the SPEED BRAKE lever moves to the UP position, and all flight and ground spoilers extend.

[Option - Speed Brake Load Alleviation System]
50% –

- if the speed brakes are deployed beyond the 50% position and the speed brake load alleviation feature is activated;
  - the speed brake lever moves to this position
  - all flight spoilers retract to one-half of their maximum position for inflight use.

FLIGHT DETENT – all flight spoilers are extended to their maximum position for inflight use.

UP – all flight and ground spoilers are extended to their maximum position for ground use.

2 SPEED BRAKE ARMED Light

Light deactivated when SPEED BRAKE lever is in the DOWN position.

Illuminated (green) – indicates valid automatic speed brake system inputs.

3 SPEED BRAKE DO NOT ARM Light

Light deactivated when SPEED BRAKE lever is in the DOWN position.

Illuminated (amber) –

[Without Load Alleviation System]
- indicates abnormal condition or test inputs to the automatic speed brake system, or
- during landing, indicates wheel speed has dropped below 60 kts, and the speedbrake lever is not in the DOWN position.

[With Load Alleviation System]
- indicates an abnormal condition or test input to the speed brake load alleviation system when the flaps are raised, or
- during landing, indicates wheel speed has dropped below 60 kts, and the speedbrake lever is not in the DOWN position.

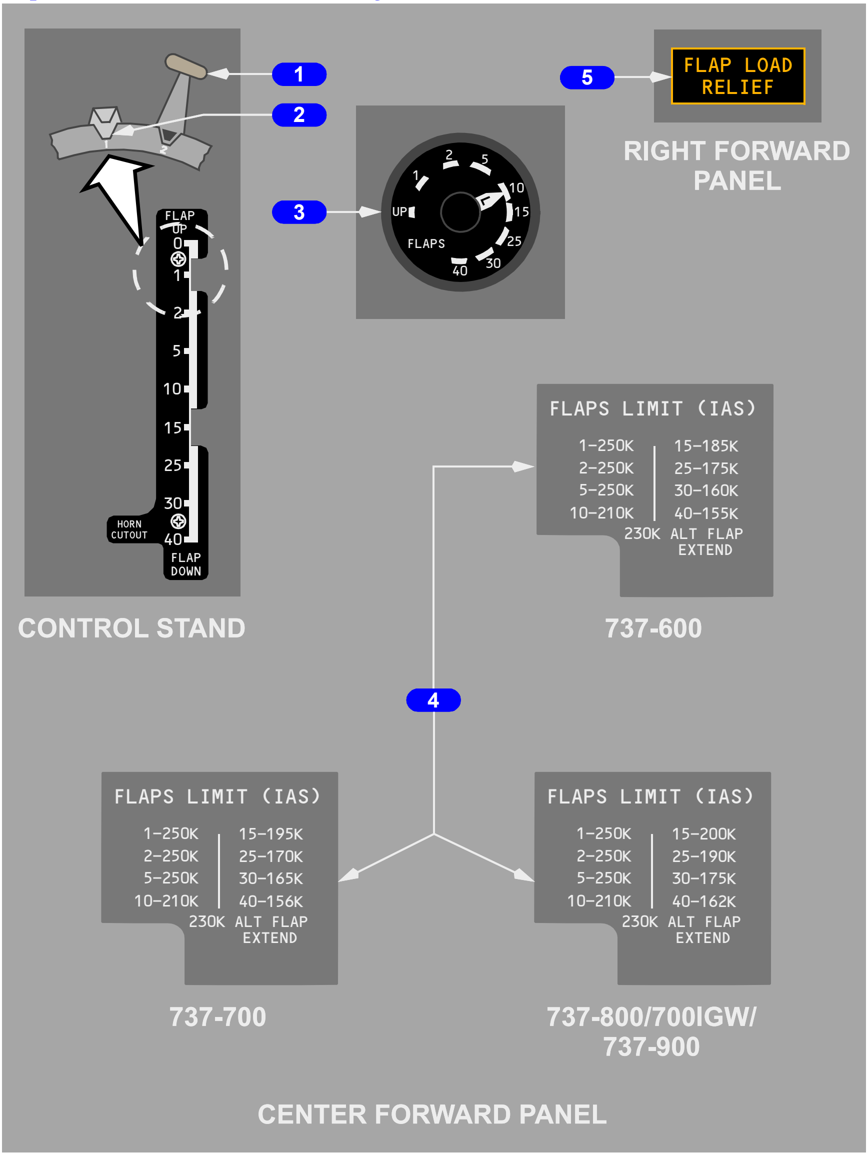
4 SPEEDBRAKES EXTENDED Light

Illuminated (amber) –
- in–flight -
  - SPEED BRAKE lever is beyond the ARMED position, and
  - TE flaps extended more than flaps 10, or
  - radio altitude less than 800 feet
- on the ground -
  - SPEED BRAKE lever is in the DOWN detent, and
  - ground spoilers are not stowed.

Note: On the ground, the SPEEDBRAKES EXTENDED light does not illuminate when hydraulic system A pressure is less than 750 psi.

Trailing Edge Flaps

[Option - FLAP LOAD RELIEF light]



1 FLAP Lever

- selects position of flap control valve, directing hydraulic pressure for flap drive unit
- position of the LE devices is determined by selecting TE flap position
- flap lever positions 30 and 40 arms the flap load relief system.

2 Flap Gates

Prevents inadvertent flap lever movement beyond:

- position 1 - to check flap position for one engine inoperative go-around
- position 15 - to check flap position for normal go-around.

3 Flap Position Indicator

- indicates position of left and right TE flaps
- provides TE flaps asymmetry and skew indication.

4 FLAPS LIMIT Placard

Indicates maximum speed for each flap setting.

[Option]

5 FLAP LOAD RELIEF Light

Illuminated (amber) –

- if flaps are set at 40:
  - flaps retract to 30 due to excess airspeed or
- if flaps are set at 30:
  - flaps retract to 25 due to excess airspeed.

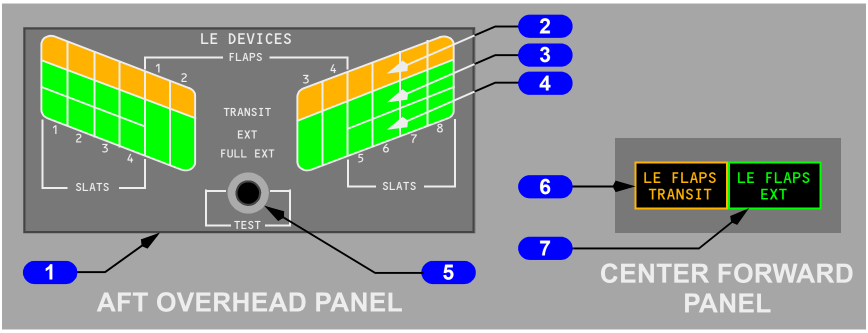
[Option]

5 FLAP LOAD RELIEF Light

Illuminated (amber) –

- if flaps are set at 40:
  - flaps retract to 30 due to excess airspeed or
- if flaps are set at 30:
  - flaps retract to 25 due to excess airspeed.
- if flaps are set at 25:
  - flaps retract to 15 due to excess airspeed.
- if flaps are set at 15:
  - flaps retract to 10 due to excess airspeed.
- if flaps are set at 10:
  - flaps retract to 5 due to excess airspeed.

Leading Edge Devices



1 Leading Edge Devices (LE DEVICES) Annunciator Panel

Indicates position of individual LE flaps and slats.

Extinguished – related LE device retracted.

2 Leading Edge Devices TRANSIT Lights

Illuminated (amber) – related LE flaps and slats in transit.

3 Leading Edge Devices Extended (EXT) Lights

Illuminated (green) – related LE flaps are fully extended and slats are in extended (intermediate) position.

4 Leading Edge Devices Full Extended (FULL EXT) Lights

Illuminated (green) – related LE slats fully extended.

5 Leading Edge Annunciator Panel TEST Switch

Press – tests all annunciator panel lights.

6 Leading Edge Flaps Transit (LE FLAPS TRANSIT) Light

Illuminated (amber) –

- any LE device in transit
- any LE device not in programmed position with respect to TE flaps
- a LE uncommanded motion condition exists (two or more LE flaps or slats have moved away from their commanded position)
- during alternate flap extension until LE devices are fully extended and TE flaps reach flaps 10.

Note: Light is inhibited during autoslat operation in flight.

6 Leading Edge Flaps Transit (LE FLAPS TRANSIT) Light

Illuminated (amber) –

- any LE device in transit
- any LE device not in programmed position with respect to TE flaps
- a LE uncommanded motion condition exists (two or more LE flaps or slats have moved away from their commanded position)
- during alternate flap extension until LE devices are fully extended and TE flaps reach flaps 15.

Note: Light is inhibited during autoslat operation in flight.

7 Leading Edge Flaps Extended (LE FLAPS EXT) Light

Illuminated (green) –

- all LE flaps extended and all LE slats in extended (intermediate) position (TE flap positions 1, 2 and 5)
- all LE devices fully extended (TE flap positions 10 through 40).

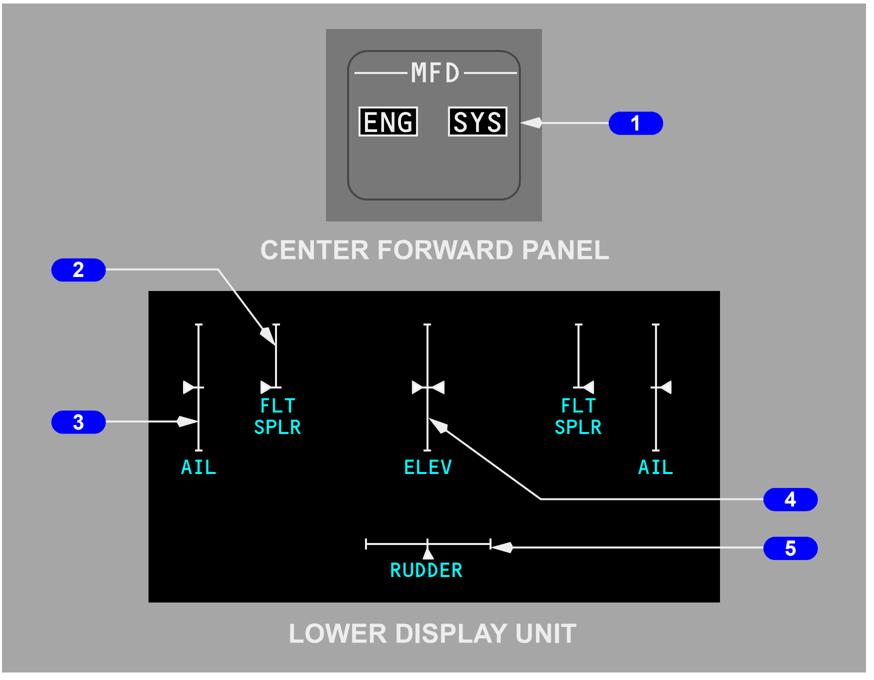
7 Leading Edge Flaps Extended (LE FLAPS EXT) Light

Illuminated (green) –

- all LE flaps extended and all LE slats in extended (intermediate) position (TE flap positions 1, 2, 5, 10, 15, and 25)
- all LE devices fully extended (TE flap positions 30 and 40).

Flight Control Surface Position Indicator

[Option]



1 MFD System (SYS) Switch

Push – SYS

- displays flight control surface position indications on lower DU; or the inboard DU if the MAIN PANEL DUs switch is placed to the INBD MFD position.
- second push removes indications from the respective DU.

2 Flight Spoilers (FLT SPLR) (white)

Indicates related (left/right) flight spoilers position:

- top mark depicts flight spoilers fully deployed
- bottom mark depicts the spoilers down.
- #4 and #9 spoiler positions are displayed.

3 Aileron (AIL) (white)

Indicates related (left/right) aileron position:

- top mark depicts maximum up position
- center mark depicts neutral position
- bottom mark depicts maximum down position.

4 Elevator (ELEV) (white)

Indicates elevator position:

- top mark depicts maximum up position
- center mark depicts neutral position when on the ground and trimmed in the green band
- bottom mark depicts maximum down position.

Note: Elevator neutral position varies with stabilizer position, flap position and Mach. The center index mark is set for nominal takeoff conditions. With certain airplane nose up trim settings, the pointer will be somewhat displaced.

5 RUDDER (white)

Indicates rudder position:

- left mark depicts maximum left position
- center mark depicts neutral position
- right mark depicts maximum right position.

Note: Main and standby yaw damper movement of the rudder are shown on this indicator.

Intentionally
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Introduction

The primary flight control system uses conventional control wheel, column and pedals linked mechanically to hydraulic power control units which command the primary flight control surfaces; ailerons, elevators and rudder. The flight controls are powered by redundant hydraulic sources; system A and system B. Either hydraulic system can operate all primary flight controls. The ailerons and elevators may be operated manually if required. The rudder may be operated by the standby hydraulic system if system A and system B pressure is not available.

The secondary flight controls, high lift devices consisting of Trailing Edge (TE) flaps and Leading Edge (LE) flaps and slats (LE devices), are powered by hydraulic system B. In the event hydraulic system B fails, the TE flaps can be operated electrically. Under certain conditions the Power Transfer Unit (PTU) automatically powers the LE devices. (Refer to Chapter 13, Hydraulics, Power Transfer Unit). They can also be extended using standby hydraulic pressure.

Pilot Controls

The pilot controls consist of:

- two control columns
- two control wheels
- two pairs of rudder pedals
- SPEED BRAKE lever
- FLAP lever
- STAB TRIM cutout switches
- STAB TRIM override switch
- stabilizer trim switches
- stabilizer trim wheel
- AILERON trim switches
- RUDDER trim control
- YAW DAMPER switch
- ALTERNATE FLAPS master switch
- alternate flaps position switch
- FLT CONTROL switches
- flight SPOILER switches

The columns and wheels are connected through transfer mechanisms which allow the pilots to bypass a jammed control or surface.

There is a rigid connection between both pairs of rudder pedals.

The SPEED BRAKE lever allows manual or automatic symmetric actuation of the spoilers.

Flight Control Surfaces

Pitch control is provided by:

- two elevators
- a movable horizontal stabilizer.

Roll control is provided by:

- two ailerons
- eight flight spoilers.

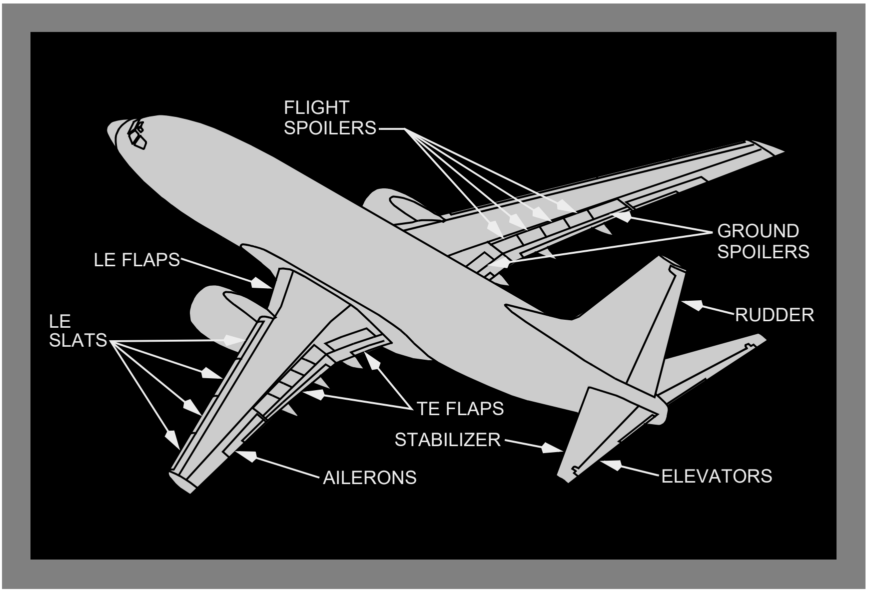
Yaw control is provided by a single rudder. During takeoff, the rudder becomes aerodynamically effective between 40 and 60 knots.

TE flaps and LE flaps and slats provide high lift for takeoff, approach and landing.

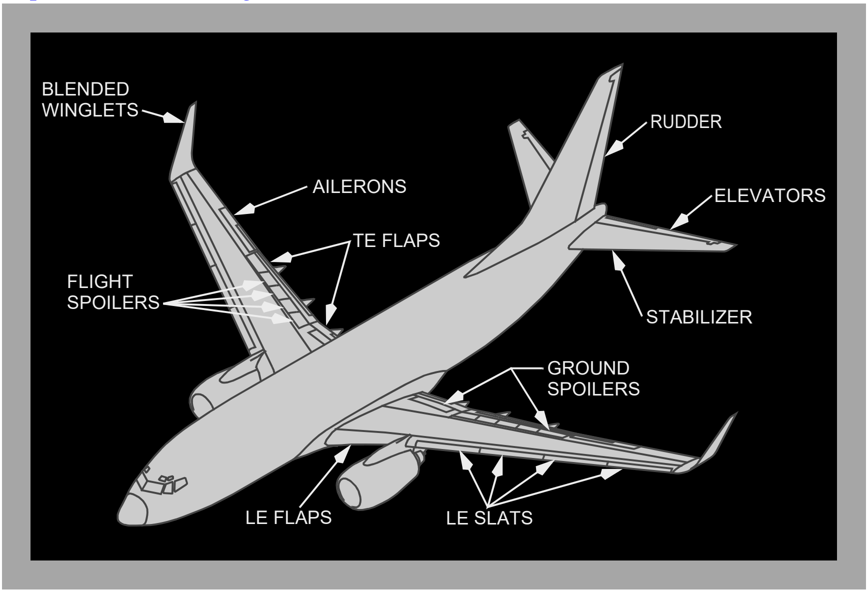
[Option: Blended Winglets]
Blended winglets provide enhanced performance, extended range and increased fuel efficiency.

In the air symmetric flight spoilers are used as speed brakes. On the ground symmetric flight and ground spoilers destroy lift and increase braking efficiency.

Flight Control Surfaces Location



[Option: Blended Winglets]



Roll Control

The roll control surfaces consist of hydraulically powered ailerons and flight spoilers, which are controlled by rotating either control wheel.

Ailerons

The ailerons provide roll control around the airplane's longitudinal axis. The ailerons are positioned by the pilots' control wheels. The A and B FLT CONTROL switches control hydraulic shutoff valves. These valves can be used to isolate each aileron, as well as the elevators and rudder, from related hydraulic system pressure.

The Captain's control wheel is connected by cables to the aileron Power Control Units (PCUs) through the aileron feel and centering unit. The First Officer's control wheel is connected by cables to the spoiler PCUs through the spoiler mixer. The two control wheels are connected by a cable drive system which allows actuation of both ailerons and spoilers by either control wheel. With total hydraulic power failure the ailerons can be mechanically positioned by rotating the pilots' control wheels. Control forces are higher due to friction and aerodynamic loads.

Aileron Transfer Mechanism

If the ailerons or spoilers are jammed, force applied to the Captain's and the First Officer's control wheels will identify which system, ailerons or spoilers, is usable and which control wheel, Captain's or First Officer's, can provide roll control. If the aileron control system is jammed, force applied to the First Officer's control wheel provides roll control from the spoilers. The ailerons and the Captain's control wheel are inoperative. If the spoiler system is jammed, force applied to the Captain's control wheel provides roll control from the ailerons. The spoilers and the First Officer's control wheel are inoperative.

Aileron Trim

Dual AILERON trim switches, located on the aft electronic panel, must be pushed simultaneously to command trim changes. The trim electrically repositions the aileron feel and centering unit, which causes the control wheel to rotate and redefines the aileron neutral position. The amount of aileron trim is indicated on a scale on the top of each control column.

If aileron trim is used with the autopilot engaged, the trim is not reflected in the control wheel position. The autopilot overpowers the trim and holds the control wheel where it is required for heading/track control. Any aileron trim applied when the autopilot is engaged can result in an out of trim condition and an abrupt rolling movement when the autopilot is disengaged.

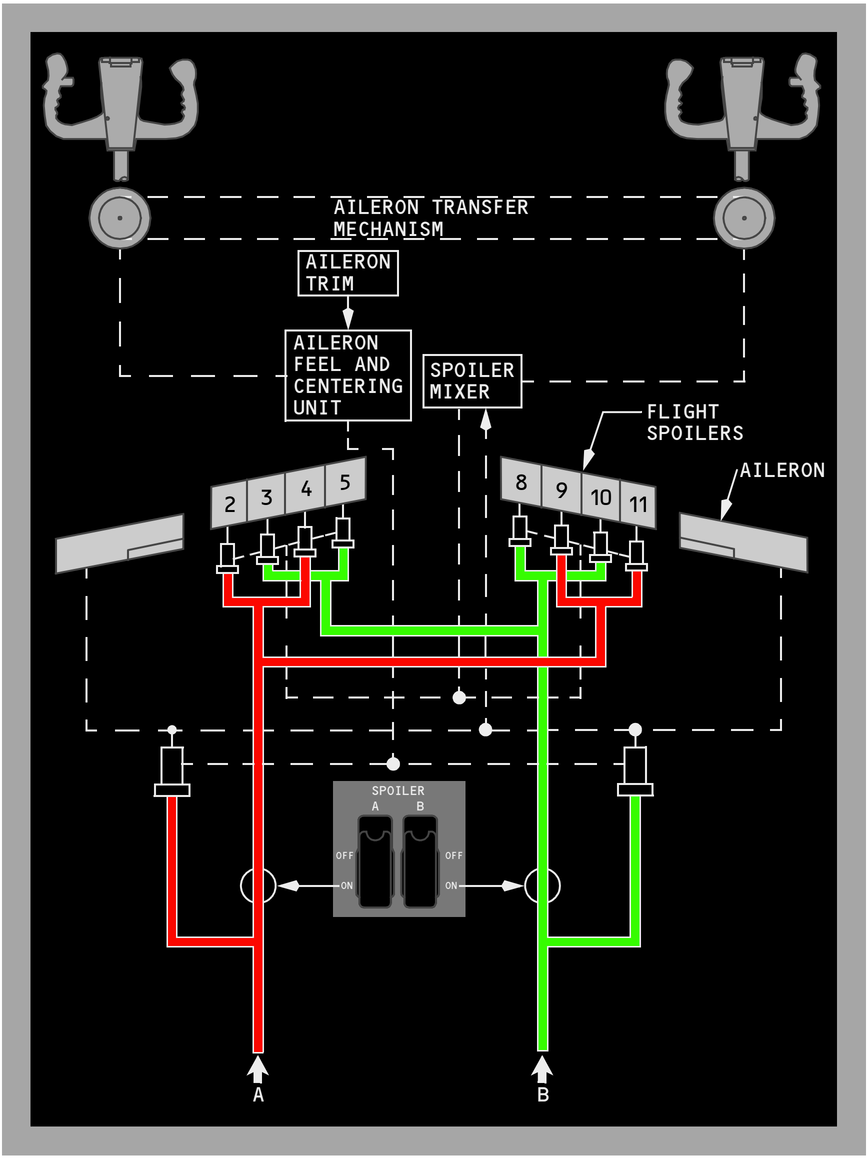
Flight Spoilers

Four flight spoilers are located on the upper surface of each wing. Each hydraulic system, A and B, is dedicated to a different set of spoiler pairs to provide isolation and maintain symmetric operation in the event of hydraulic system failure. Hydraulic pressure shutoff valves are controlled by the two flight SPOILER switches.

Flight spoiler panels are used as speed brakes to increase drag and reduce lift, both in flight and on the ground. The flight spoilers also supplement roll control in response to control wheel commands. A spoiler mixer, connected to the aileron cable-drive, controls the hydraulic power control units on each spoiler panel to provide spoiler movement proportional to aileron movement.

The flight spoilers rise on the wing with up aileron and remain faired on the wing with down aileron. When the control wheel is displaced more than approximately 10°, spoiler deflection is initiated.

Roll Control Schematic



Pitch Control

The pitch control surfaces consist of hydraulically powered elevators and an electrically powered stabilizer. The elevators are controlled by forward or aft movement of the control column. The stabilizer is controlled by autopilot trim or manual trim.

Elevators

The elevators provide pitch control around the airplane’s lateral axis. The elevators are positioned by the pilots’ control columns. The A and B FLT CONTROL switches control hydraulic shutoff valves for the elevators.

Cables connect the pilots’ control columns to elevator Power Control Units (PCUs) which are powered by hydraulic system A and B. The elevators are interconnected by a torque tube. With loss of hydraulic system A and B the elevators can be mechanically positioned by forward or aft movement of the pilots’ control columns. Control forces are higher due to friction and aerodynamic loads.

Elevator Control Column Override Mechanism

In the event of a control column jam, an override mechanism allows the control columns to be physically separated. Applying force against the jam will breakout either the Captain’s or First Officer’s control column. Whichever column moves freely after the breakout can provide adequate elevator control.

Although total available elevator travel is significantly reduced, there is sufficient elevator travel available for landing flare. Column forces are higher and exceed those experienced during manual reversion. If the jam exists during the landing phase, higher forces are required to generate sufficient elevator control to flare for landing. Stabilizer trim is available to counteract the sustained control column force.

Elevator Feel System

The elevator feel computer provides simulated aerodynamic forces using airspeed (from the elevator pitot system) and stabilizer position. Feel is transmitted to the control columns by the elevator feel and centering unit. To operate the feel system the elevator feel computer uses either hydraulic system A or B pressure, whichever is higher. When either hydraulic system or elevator feel pitot system fails, excessive differential hydraulic pressure is sensed in the elevator feel computer and the FEEL DIFF PRESS light illuminates.

Mach Trim System

A Mach trim system provides speed stability at the higher Mach numbers. Mach trim is automatically accomplished above Mach .615 by adjusting the elevators with respect to the stabilizer as speed increases. The flight control computers use Mach information from the ADIRU to compute a Mach trim actuator position. The Mach trim actuator repositions the elevator feel and centering unit which adjusts the control column neutral position.

Stabilizer

The horizontal stabilizer is positioned by a single electric trim motor controlled through either the stab trim switches on the control wheel or autopilot trim. The stabilizer may also be positioned by manually rotating the stabilizer trim wheel.

Stabilizer Trim

Stabilizer trim switches on each control wheel actuate the electric trim motor through the main electric stabilizer trim circuit when the airplane is flown manually. With the autopilot engaged, stabilizer trim is accomplished through the autopilot stabilizer trim circuit. The main electric and autopilot stabilizer trim have two speed modes: high speed with flaps extended and low speed with flaps retracted. If the autopilot is engaged, actuating either pair of stabilizer trim switches automatically disengages the autopilot. The stabilizer trim wheels rotate whenever electric stabilizer trim is actuated.

The STAB TRIM MAIN ELECT cutout switch and the STAB TRIM AUTOPILOT cutout switch, located on the control stand, are provided to allow the autopilot or main electric trim inputs to be disconnected from the stabilizer trim motor.

Control column actuated stabilizer trim cutout switches stop operation of the main electric and autopilot trim when the control column movement opposes trim direction. When the STAB TRIM override switch is positioned to OVERRIDE, electric trim can be used regardless of control column position.

Manual stabilizer control is accomplished through cables which allow the pilot to position the stabilizer by rotating the stabilizer trim wheels. The stabilizer is held in position by two independent brake systems. Manual rotation of the trim wheels can be used to override autopilot or main electric trim. The effort required to manually rotate the stabilizer trim wheels may be higher under certain flight conditions. Grasping the stabilizer trim wheel will stop stabilizer motion.

Stabilizer Trim Operation with Forward or Aft CG

In the event the stabilizer is trimmed to the end of the electrical trim limits, additional trim is available through the use of the manual trim wheels. If manual trim is used to position the stabilizer beyond the electrical trim limits, the stabilizer trim switches may be used to return the stabilizer to electrical trim limits.

Stabilizer Position Indication and Green Band

Stabilizer position is displayed in units on two STAB TRIM indicators located inboard of each stabilizer trim wheel. The STAB TRIM indicators also display the TAKEOFF green band indication.

The trim authority for each mode of trim is limited to:

- Main Electric Trim
  - flaps extended 0.05 to 14.5 units

  [737-600]
  - flaps retracted 4.10 to 14.5 units

  [737-700]
  - flaps retracted 4.30 to 14.5 units

  [737-800]
  - flaps retracted 3.95 to 14.5 units

  [737-900]
  - flaps retracted 3.90 to 14.5 units
- Autopilot Trim 0.05 to 14.5 units
- Manual Trim -0.20 to 16.9 units.

The green band range of the STAB TRIM indicator shows the takeoff trim range. An intermittent horn sounds if takeoff is attempted with the stabilizer trim outside the takeoff trim range.

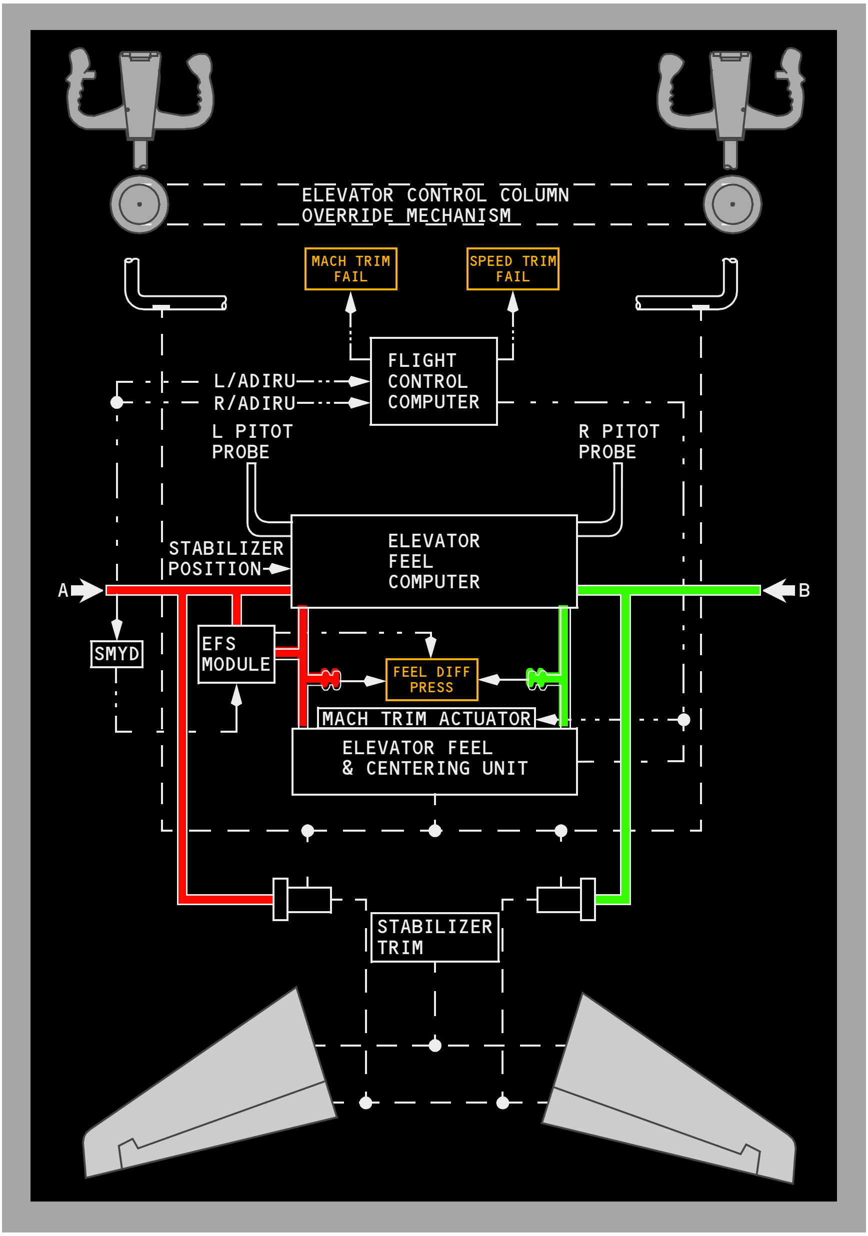
Speed Trim System

The Speed Trim System (STS) is a speed stability augmentation system designed to improve flight characteristics during operations with a low gross weight, aft center of gravity and high thrust when the autopilot is not engaged. The purpose of the STS is to return the airplane to a trimmed speed by commanding the stabilizer in a direction opposite the speed change. The STS monitors inputs of stabilizer position, thrust lever position, airspeed and vertical speed and then trims the stabilizer using the autopilot stabilizer trim. As the airplane speed increases or decreases from the trimmed speed, the stabilizer is commanded in the direction to return the airplane to the trimmed speed. This increases control column forces to force the airplane to return to the trimmed speed. As the airplane returns to the trimmed speed, the STS commanded stabilizer movement is removed.

STS operates most frequently during takeoffs, climb and go-arounds. Conditions for speed trim operation are listed below:

- STS Mach gain is fully enabled between 100 KIAS and Mach 0.60 with a fadeout to zero by Mach 0.68
- 10 seconds after takeoff
- 5 seconds following release of trim switches
- Autopilot not engaged
- Sensing of trim requirement

Pitch Control Schematic



Stall Identification

Stall identification and control is enhanced by the yaw damper, the Elevator Feel Shift (EFS) module and the speed trim system. These three systems work together to help the pilot identify and prevent further movement into a stall condition.

During high AOA operations, the Stall Management/Yaw Damper (SMYD) reduces yaw damper commanded rudder movement.

The EFS module increases hydraulic system A pressure to the elevator feel and centering unit during a stall. This approximately doubles control column forces. The EFS module is armed whenever an inhibit condition is not present. The EFS module is inhibited when any of the following conditions are met: the airplane is on the ground, radio altitude less than 100 feet, or autopilot engaged. However, if EFS is active when descending through 100 feet RA, it remains active until AOA is reduced below approximately stickshaker threshold. There are no flight deck indications that the system is properly armed or activated.

As airspeed decreases towards stall speed, the speed trim system trims the stabilizer nose down and enables speed trim above stickshaker AOA. With this trim schedule the pilot must pull more aft column to stall the airplane. With the column aft, the amount of column force increase with the onset of EFS module is more pronounced.

Yaw Control

Yaw control is accomplished by a hydraulically powered rudder and a digital yaw damper system. The rudder is controlled by displacing the rudder pedals. The yaw damping functions are controlled through the Stall Management/Yaw Damper (SMYD) computers.

Rudder

[737 modified rudder - not installed]
The rudder provides yaw control about the airplane's vertical axis. The A and B FLT CONTROL switches control hydraulic shutoff valves for the rudder and the standby rudder.

Each set of rudder pedals is mechanically connected by cables to the input levers of the main and standby rudder PCUs. The main rudder PCU is powered by hydraulic system A and B. The standby rudder PCU is powered by the standby hydraulic system. At speeds above approximately 135 kts, hydraulic system A pressure to the rudder PCU is limited by approximately 50%. This function limits full rudder authority in flight after takeoff and before landing.

The standby rudder PCU is powered by the standby hydraulic system. The standby hydraulic system is provided as a backup if system A and/or B pressure is lost. With the standby PCU powered the pilot retains adequate rudder control capability. It can be operated manually through the FLT CONTROL switches or automatically. (Refer to Chapter 13, Hydraulics, Standby Hydraulic System)

Rudder Trim

The RUDDER trim control, located on the aft electronic panel, electrically repositions the rudder feel and centering unit which adjusts the rudder neutral position. The rudder pedals are displaced proportionately. The RUDDER TRIM indicator displays the rudder trim position in units.

Rudder (with Rudder System Enhancement Program (RSEP) installed)

[737 modified rudder- installed]

The rudder provides yaw control about the airplane's vertical axis. The A and B FLT CONTROL switches control hydraulic shutoff valves for the rudder and the standby rudder.

Each set of rudder pedals is mechanically connected by cables to the input levers of the main and standby rudder PCUs. The main PCU consists of two independent input rods, two individual control valves, and two separate actuators; one for Hydraulic system A and one for Hydraulic system B. The standby rudder PCU is controlled by a separate input rod and control valve and powered by the standby hydraulic system. All three input rods have individual jam override mechanisms that allows input commands to continue to be transferred to the remaining free input rods if an input rod or downstream hardware is hindered or jammed.

At speeds above approximately 135 kts, both hydraulic system A and B pressure are each reduced within the main PCU by approximately 25% each. This function limits full rudder authority in flight after takeoff and before landing. It operates the same in the air and on the ground.

The main rudder PCU contains a Force Fight Monitor (FFM) that detects opposing pressure (force fight) between A and B actuators. This may occur if either system A or B input is jammed or disconnected. The FFM output is used to automatically turn on the Standby Hydraulic pump, open the standby rudder shutoff valve to pressurize the standby rudder PCU, and illuminate the STBY RUD ON, Master Caution, and Flight Control (FLT CONT) lights.

The standby rudder PCU is powered by the standby hydraulic system. The standby hydraulic system is provided as a backup if system A and/or B pressure is lost. With the standby PCU powered the pilot retains adequate rudder control capability. It can be operated manually through the FLT CONTROL switches or automatically. (Refer to Chapter 13, Hydraulics, Standby Hydraulic System)

An amber STBY RUD ON light illuminates when the electric motor driven standby pump is commanded on to pressurize the standby rudder PCU. The standby rudder system can be pressurized with either Flight Control switch, automatically during takeoff or landing (Refer to Chapter 13, Hydraulics, Standby Hydraulic System) or automatically by the Force Fight Monitor. The STBY RUD ON light illumination activates Master Caution and Flight Control warning lights on the Systems Annunciation Panel.

Rudder Trim

The RUDDER trim control, located on the aft electronic panel, electrically repositions the rudder feel and centering unit which adjusts the rudder neutral position. The rudder pedals are displaced proportionately. The RUDDER TRIM indicator displays the rudder trim position in units.

Yaw Damper

The yaw damper system consists of a main and standby yaw damper. Both yaw dampers are controlled through Stall Management/Yaw Damper (SMYD) computers. The SMYD computers receive inputs from both ADIRUs, both control wheels and the YAW DAMPER switch. SMYDs provide yaw damper inputs to the main rudder Power Control Unit (PCU) or standby rudder PCU, as appropriate.

Either yaw damper is capable of providing dutch roll prevention, gust damping and turn coordination. Yaw damper operation does not result in rudder pedal movement. The pilot can override either main or standby yaw damper inputs using either the rudder pedals or trim inputs.

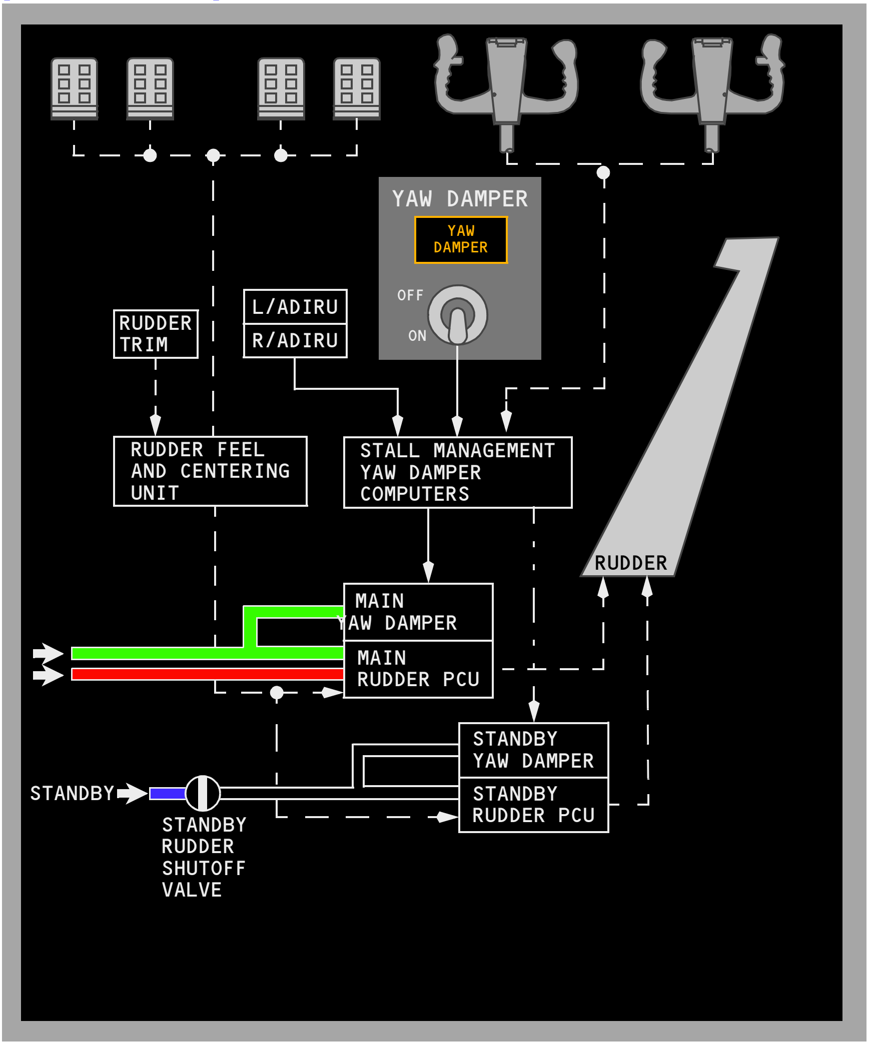
During normal operation the main yaw damper uses hydraulic system B and the SMYD computers provide continuous system monitoring. The YAW DAMPER Switch automatically moves to OFF, the amber YAW DAMPER light illuminates and the YAW DAMPER switch cannot be reset to ON when any of the following conditions occur:

- SMYD senses a yaw damper system fault,
- SMYD senses that the yaw damper does not respond to a command,
- B FLT CONTROL switch is positioned to OFF or STBY RUD.

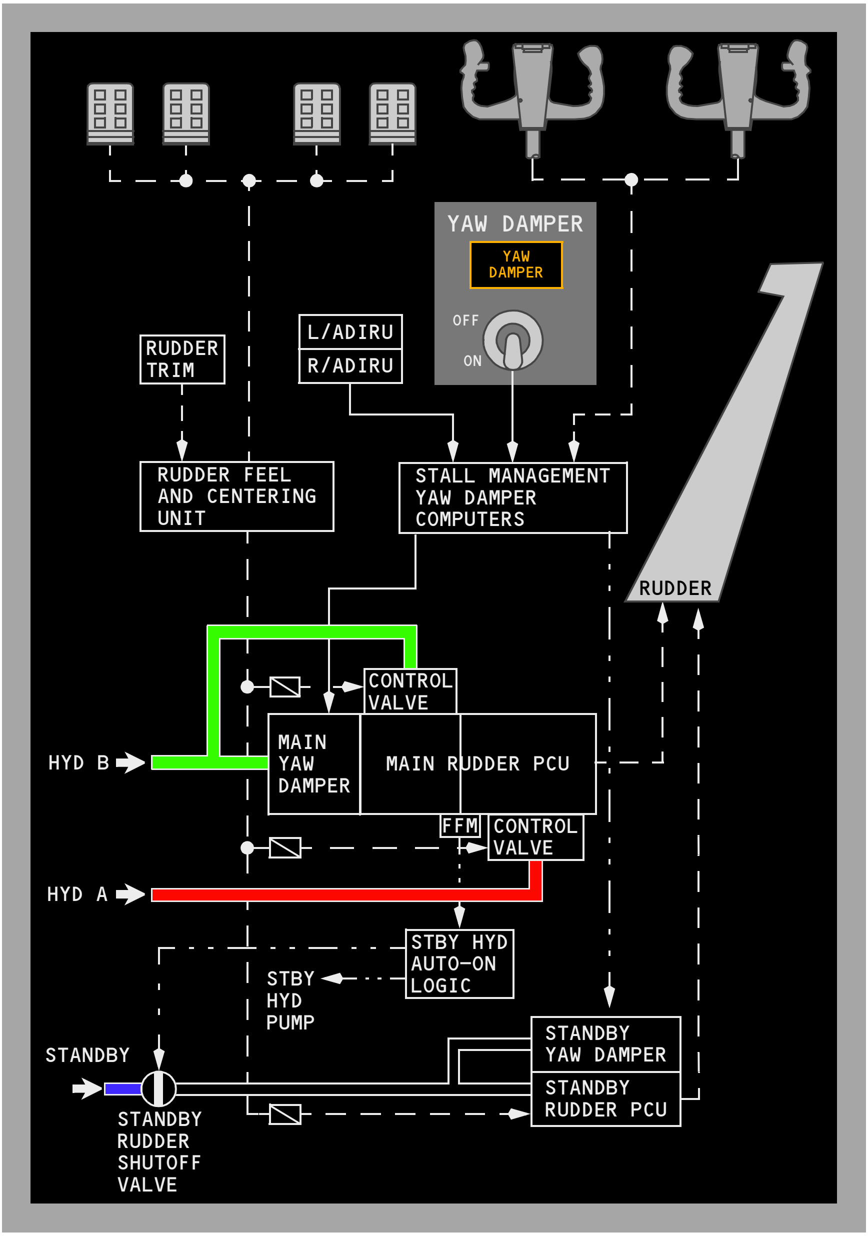
During manual reversion flight (loss of hydraulic system A and B pressure), both FLT CONTROL switches are positioned to STBY RUD. In this case, the YAW DAMPER switch can be reset to ON and the standby hydraulic system powers the standby yaw damper. During Standby Yaw Damper operation, movement of the control wheel sends a signal to the standby rudder PCU to move the rudder. This gives rudder assist to help turn the airplane when control of the ailerons is through manual reversion.

Yaw Control Schematic

[RSEP not installed]



[RSEP installed]



Speed Brakes

The speed brakes consist of flight spoilers and ground spoilers. Hydraulic system A powers all four ground spoilers, two on the upper surface of each wing. The SPEED BRAKE lever controls the spoilers. When the SPEED BRAKE lever is actuated all the spoilers extend when the airplane is on the ground and only the flight spoilers extend when the airplane is in the air.

The SPEEDBRAKES EXTENDED light provides an indication of spoiler operation in-flight and on the ground. In-flight, the light illuminates to warn the crew that the speed brakes are extended while in the landing configuration or below 800 feet AGL. On the ground, the light illuminates when hydraulic pressure is sensed in the ground spoiler shutoff valve with the speed brake lever in the DOWN position.

In-Flight Operation

Operating the SPEED BRAKE lever in flight causes all flight spoiler panels to rise symmetrically to act as speed brakes. Caution should be exercised when deploying flight spoilers during a turn, as they greatly increase roll rate. When the speed brakes are in an intermediate position roll rates increase significantly. Moving the SPEED BRAKE lever beyond the FLIGHT DETENT causes buffeting and is prohibited in flight.

[Option: Speed Brake Load Alleviation System]
The speed brake load alleviation feature limits the deployment of the speed brakes under certain high gross weight/airspeed combinations. Under these conditions, if the speed brakes are deployed to the FLIGHT DETENT, they automatically retract to 50 percent of the FLIGHT DETENT. The SPEED BRAKE lever moves to reflect the position of the speed brakes. Manual override is available. Increased force is needed to move the SPEED BRAKE lever beyond the 50 percent position with load alleviation active. The SPEED BRAKE lever must be held in place when manual override is used between 50 percent and the UP position. The SPEED BRAKE lever will remain stationary if moved to UP with load alleviation active. When load alleviation deactivates, the speed brakes can be manually returned to the FLIGHT DETENT position.

Ground Operation

During landing, the auto speed brake system operates when these conditions occur:

- SPEED BRAKE lever is in the ARMED position
- SPEED BRAKE ARMED light is illuminated
- radio altitude is less than 10 feet

- landing gear strut compresses on touchdown

  Note: Compression of any landing gear strut enables the flight spoilers to deploy. Compression of the right main landing gear strut enables the ground spoilers to deploy.

- both thrust levers are retarded to IDLE
- main landing gear wheels spin up (more than 60 kts).

The SPEED BRAKE lever automatically moves to the UP position and the spoilers deploy.

If a wheel spin-up signal is not detected, when the air/ground system senses ground mode (any gear strut compresses) the SPEED BRAKE lever moves to the UP position and flight spoiler panels deploy automatically. When the right main landing gear strut compresses, a mechanical linkage opens the ground spoiler interlock valve and the ground spoilers deploy.

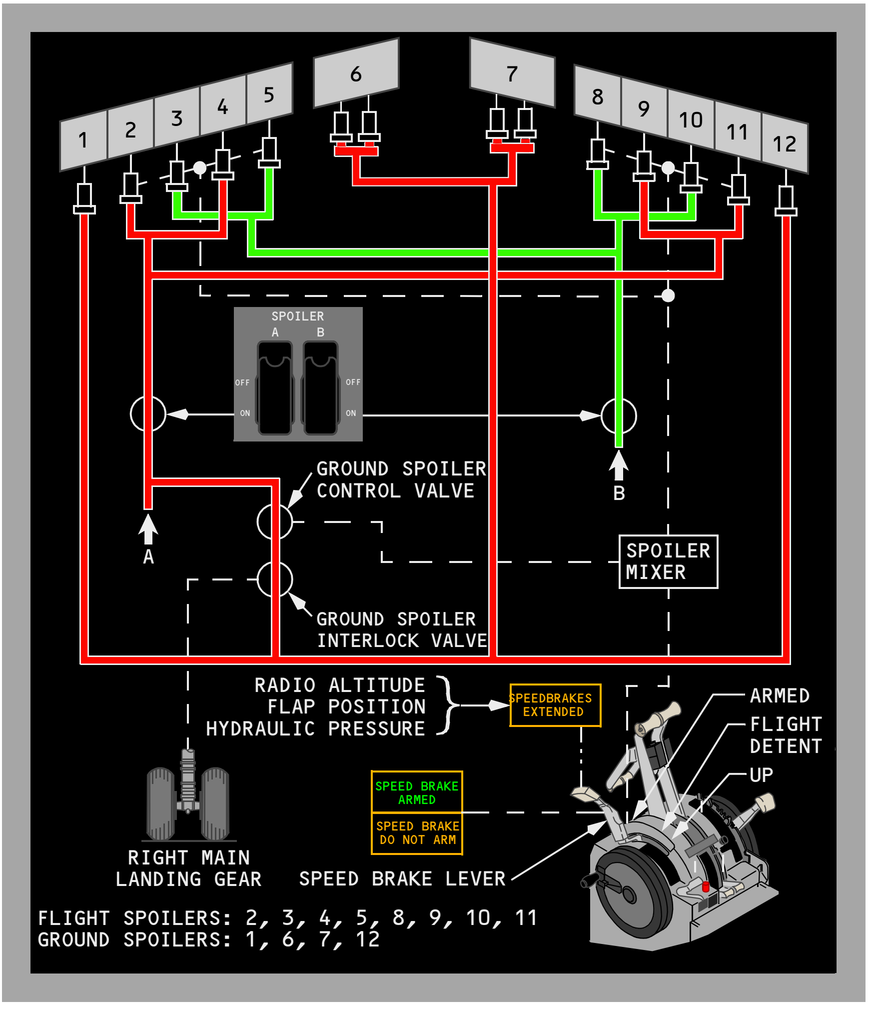
If the SPEED BRAKE lever is in the DOWN position during landing or rejected takeoff, the auto speed brake system operates when these conditions occur:

- main landing gear wheels spin up (more than 60 kts)
- both thrust levers are retarded to IDLE
- reverse thrust levers are positioned for reverse thrust.

The SPEED BRAKE lever automatically moves to the UP position and spoilers deploy.

After an RTO or landing, if either thrust lever is advanced, the SPEED BRAKE lever automatically moves to the DOWN detent and all spoiler panels retract. The spoiler panels may also be retracted by manually moving the SPEED BRAKE lever to the DOWN detent.

Speed Brakes Schematic



Flaps and Slats

The flaps and slats are high lift devices that increase wing lift and decrease stall speed during takeoff, low speed maneuvering and landing.

LE devices consist of four flaps and eight slats: two flaps inboard and four slats outboard of each engine. Slats extend to form a sealed or slotted leading edge depending on the TE flap setting. The TE devices consist of double slotted flaps inboard and outboard of each engine.

TE flap positions 1–15 provide increased lift; positions 15–40 provide increased lift and drag. Flaps 15, 30 and 40 are normal landing flap positions. Flaps 15 is normally limited to airports where approach climb performance is a factor. Runway length and conditions must be taken into account when selecting a landing flap position.

[Option: JAA]
TE flap positions 1–15 provide increased lift; positions 15–40 provide increased lift and drag. Flap positions 30 and 40 are normal landing flap positions.

To prevent excessive structural loads from increased Mach at higher altitude, flap extension above 20,000 feet should not be attempted.

Flap and Slat Sequencing

LE devices and TE flaps are normally extended and retracted by hydraulic power from system B. When the FLAP lever is in the UP detent, all flaps and LE devices are commanded to the retracted or up position. Moving the FLAP lever aft allows selection of flap detent positions 1, 2, 5, 10, 15, 25, 30, or 40. The LE devices deployment is sequenced as a function of TE flaps deployment.

When the FLAP lever is moved from the UP position to the 1, 2, or 5 position, the TE flaps extend to the commanded position and the LE:

- flaps extend to the full extended position and
- slats extend to the extend position.

When the FLAP lever is moved beyond the 5 position the TE flaps extend to the commanded position and the LE:

- flaps remain at the full extended position and
- slats extend to the full extended position.

The LE devices sequence is reversed upon retraction.

Mechanical gates hinder inadvertent FLAP lever movement beyond flaps 1 for one engine inoperative go–around and flaps 15 for normal go–around.

Indicator lights on the center instrument panel provide overall LE devices position status. The LE DEVICES annunciator panel on the aft overhead panel indicates the positions of the individual flaps and slats.

Flap Load Relief

Flap load relief protects the trailing edge flaps from excessive air loads. Flap load relief is a function of the Flap Slat Electronic Unit (FSEU), which receives data from the left Air Data Inertial Reference Unit (ADIRU). The left ADIRU is also the source for the captain’s airspeed indication. When the captain’s indicated airspeed is too high for the selected flap setting, flap load relief activates and retracts the TE flaps to the next lower setting below the selected flap lever position.

If the Captain's airspeed is erroneously high, the flap load relief function can activate and retract the flaps to the next lower setting from the flap detent selected with the flap lever. In this case the desired flap position can be achieved by selecting the next higher flap detent beyond the desired flap position. For example, if the desired flap position is Flaps 30, select Flaps 40 and the flaps will extend to the Flaps 30 position. This applies for all flap selections protected by flap load relief.

[Option - Airplanes with LOAD RELIEF light]
When the flap load relief function activates, the FLAP lever does not move, but the flap position indicator shows flap retraction and re–extension. The LOAD RELIEF light illuminates when the flaps retract and extinguishes when the flaps re–extend.

[Option - Airplanes without LOAD RELIEF light]
When the flap load relief function activates, the FLAP lever does not move, but the flap position indicator shows flap retraction and re–extension.

[Option: Short Field Performance]
Flap load relief is available when flaps are selected to 10, 15, 25, 30, or 40. Flap load relief is not available during alternate flap extension.

[Option - Flap Load Relief for 737-800/900 with Short Field Performance]
When the flaps are set at 40, the TE flaps:

- retract to 30 if airspeed exceeds 163 knots
- re–extend when airspeed is reduced below 158 knots.

When the flaps are set at 30, the TE flaps:

- retract to 25 if the airspeed exceeds 176 knots
- re–extend when airspeed is reduced below 171 knots.

When the flaps are set at 25, the TE flaps:

- retract to 15 if the airspeed exceeds 191 knots
- re–extend when airspeed is reduced below 186 knots.

When the flaps are set at 15, the TE flaps:

- retract to 10 if the airspeed exceeds 201 knots
- re–extend when airspeed is reduced below 196 knots.

When the flaps are set at 10, the TE flaps:

- retract to 5 if the airspeed exceeds 211 knots
- re–extend when airspeed is reduced below 206 knots.

[Option - Flap Load Relief for 737-900ER or 737-900ER with Short Field Performance]
When the flaps are set at 40, the TE flaps:

- retract to 30 if airspeed exceeds 171 knots
- re–extend when airspeed is reduced below 166 knots.

When the flaps are set at 30, the TE flaps:

- retract to 25 if the airspeed exceeds 181 knots
- re–extend when airspeed is reduced below 176 knots.

When the flaps are set at 25, the TE flaps:

- retract to 15 if the airspeed exceeds 196 knots
- re–extend when airspeed is reduced below 191 knots.

When the flaps are set at 15, the TE flaps:

- retract to 10 if the airspeed exceeds 201 knots
- re–extend when airspeed is reduced below 196 knots.

When the flaps are set at 10, the TE flaps:

- retract to 5 if the airspeed exceeds 206 knots
- re–extend when airspeed is reduced below 201 knots.

[Option - Not Short Field Performance]
Flap load relief is available when flaps are selected to 30, or 40. Flap load relief is not available during alternate flap extension.

When the flaps are set at 40, the TE flaps:

- retract to 30 if airspeed exceeds 163 knots
- re–extend when airspeed is reduced below 158 knots.

When the flaps are set at 30, the TE flaps:

- retract to 25 if the airspeed exceeds 176 knots
- re–extend when airspeed is reduced below 171 knots.

Autoslats

Autoslat operation is normally powered by hydraulic system B. An alternate source of power is provided by system A through a Power Transfer Unit (PTU) if a loss of pressure is sensed from the higher volume system B engine driven pump. The PTU uses system A pressure to power a hydraulic motorized pump, pressurizing system B fluid to provide power for the autoslat operation. (Refer to Chapter 13, Hydraulics, Power Transfer Unit)

At flap positions 1, 2, and 5 an autoslat function is available that moves the LE slats to full extended if the airplane approaches a stall condition.

The autoslat system is designed to enhance airplane stall characteristics at high angles of attack during takeoff or approach to landing. When TE flaps 1 through 5 are selected, the LE slats are in the extend position. As the airplane approaches the stall angle, the slats automatically begin driving to the full extended position prior to stick shaker activation. The slats return to the extend position when the pitch angle is sufficiently reduced below the stall critical attitude.

[Option - Short Field Performance]
At flap positions 1, 2, 5, 10, 15, and 25 an autoslat function is available that moves the LE slats to full extended if the airplane approaches a stall condition.

[Option: Short Field Performance]
The autoslat system is designed to enhance airplane stall characteristics at high angles of attack during takeoff or approach to landing. When TE flaps 1 through 25 are selected, the LE slats are in the extend position. As the airplane approaches the stall angle, the slats automatically begin driving to the full extended position prior to stick shaker activation. The slats return to the extend position when the pitch angle is sufficiently reduced below the stall critical attitude.

Alternate Extension

In the event that hydraulic system B fails, an alternate method of extending the LE devices and extending and retracting the TE flaps is provided.

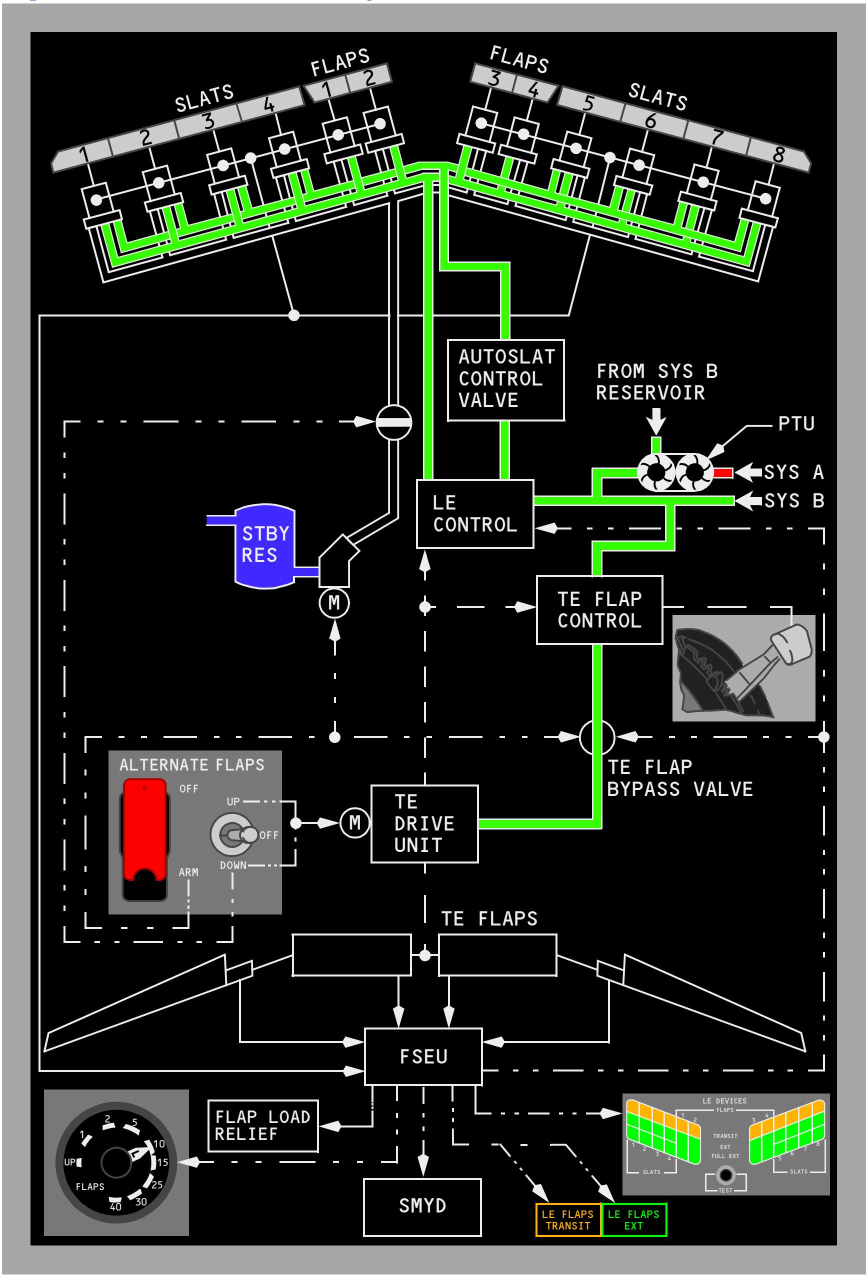
The TE flaps can be operated electrically through the use of two alternate flap switches. The guarded ALTERNATE FLAPS master switch closes a flap bypass valve to prevent hydraulic lock of the flap drive unit and arms the alternate flaps position switch. The ALTERNATE FLAPS position switch controls an electric motor that extends or retracts the TE flaps. The switch must be held in the DOWN position until the flaps reach the desired position. No asymmetry or skew protection is provided through the alternate (electrical) flap drive system.

When using alternate flap extension the LE flaps and slats are driven to the full extended position using power from the standby hydraulic system. In this case the ALTERNATE FLAPS master switch energizes the standby pump and the ALTERNATE FLAPS position switch, held in the down position momentarily, fully extends the LE devices.

Note: The LE devices cannot be retracted by the standby hydraulic system.

Leading Edge Devices and Trailing Edge Flaps Schematic

[Option: FLAP LOAD RELIEF light]



Asymmetry and Skew Detection and Protection

The Flap Slat Electronic Unit (FSEU) continuously monitors the position of wing LE and TE high lift devices. If a device on one wing does not align with the symmetrical device on the other wing, there is an asymmetry condition. A skew condition occurs when symmetrical TE flaps do not operate at the same rate causing the panels to twist during extension or retraction. Should a skew occur, the FSEU automatically protects against roll by maintaining flap symmetry.

Note: When the FSEU detects an asymmetric condition, the SMYD will enable the stall warning system at a lower AOA value (from 13 to 15 degrees less at Flaps 40). Subsequently, the PLI values will be lower on both PFDs.

Note: A wing asymmetry condition will result in both an increased minimum operating speed and minimum maneuver speed (amber arc).

Trailing Edge Flap Position Indication

Wing TE position indications come from the FSEU. When the FSEU detects a TE asymmetry or skew condition, the FSEU:

- closes the TE flap bypass valve
- displays a needle split on the flap position indicator
- shows position of left and right wing trailing edge flaps.

Leading Edge Device Improper Position Indication

Wing LE position indications come from the FSEU. When the FSEU detects a LE device in an improper position, the LE FLAPS TRANSIT light remains illuminated and one of the following indications is displayed on the LE DEVICES annunciator panel:

- TRANSIT (amber) - Leading edge flaps and slats are in transit, or are not in the selected position
- EXT (green) - Leading edge flaps and slats in extend position, or are in the selected position
- FULL EXT (green) - Leading edge slats are in the full extend position
- no lights illuminated - Leading edge devices are in the retract position.

Uncommanded Motion Detection, Protection and Indication

The FSEU provides protection from uncommanded motion by the LE devices or TE flaps.

Note: When the FSEU detects uncommanded motion, the SMYD will enable the stall warning system at a lower AOA value (from 13 to 15 degrees less at Flaps 40). Subsequently, the PLI values will be lower on both PFDs.

Note: Uncommanded motion will result in both an increased minimum operating speed and minimum maneuver speed (amber arc).

Leading Edge Uncommanded Motion

Uncommanded motion is detected when no TE flap position or autoslat command is present and:

- two LE flaps move on one wing, or
- two or more slats move on one wing.

The FSEU shuts down the LE control and illuminates the amber LE FLAPS TRANSIT light.

In addition, to prevent uncommanded motion from occurring on the LE devices during cruise, the FSEU maintains pressure on the retract lines and depressurizes the extend and full extend lines.

Trailing Edge Uncommanded Motion

Uncommanded motion is detected when no FLAP lever or flap load relief command is present and the TE flaps:

- move away from the commanded position
- continue to move after reaching a commanded position, or
- move in a direction opposite to that commanded.

The FSEU shuts down the TE drive unit by closing the TE flap bypass valve. The TE flap shutdown cannot be reset by the flight crew and they must use the alternate flap system to control TE flaps. The shutdown is indicated by the flap position indicator disagreeing with the FLAP lever position. There is no flap needle split.

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Flight Instruments, Displays — Chapter 10
Table of Contents — Section TOC

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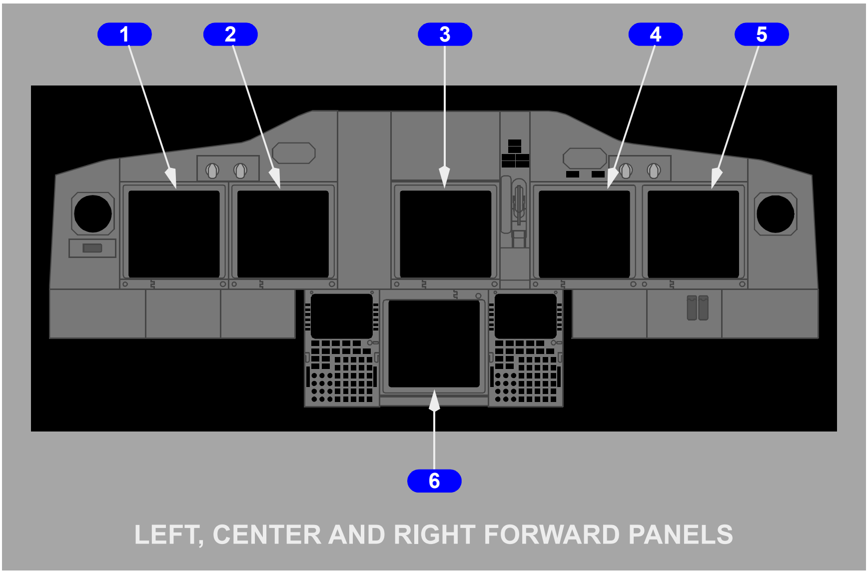
EFIS/Map Display System – Overview

Display Units



1 Captain Outboard Display Unit

2 Captain Inboard Display Unit

3 Upper Display Unit

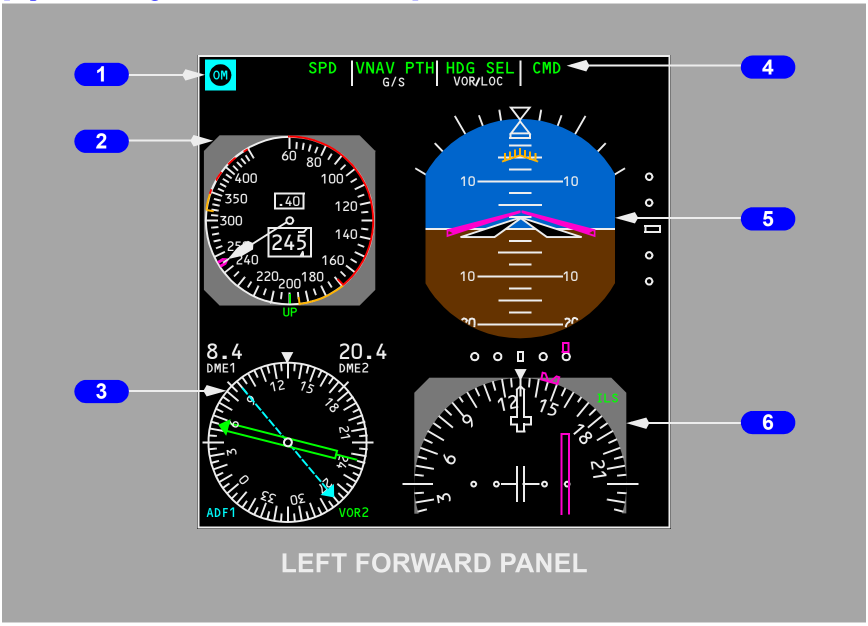
4 First Officer Inboard Display Unit

5 First Officer Outboard Display Unit

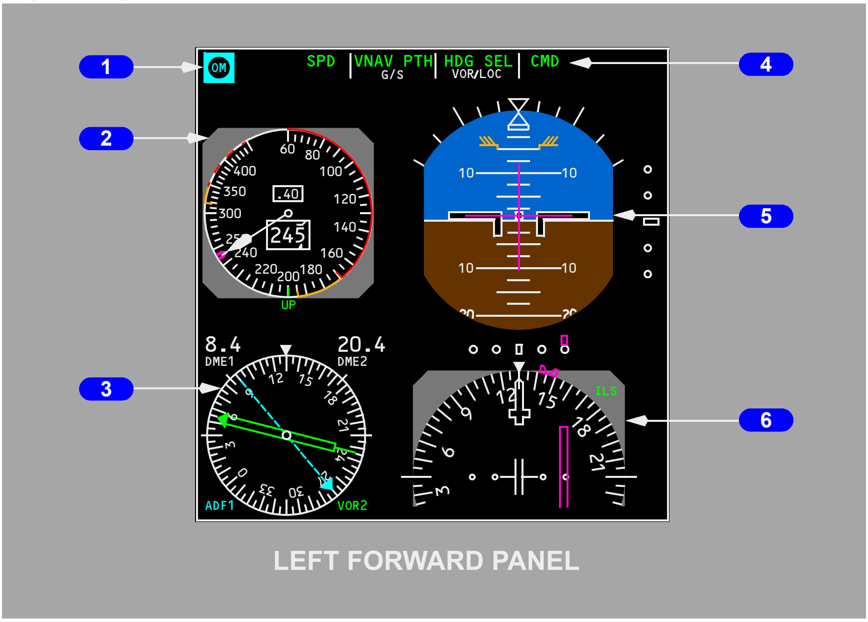
6 Lower Display Unit

Captain Outboard Display

[Option - Integrated cue command bar]



[Option - Split axis command bars]



1 Marker Beacon

2 Mach/Airspeed Indicator

3 Radio Distance Magnetic Indicator

4 Flight Mode Annunciations

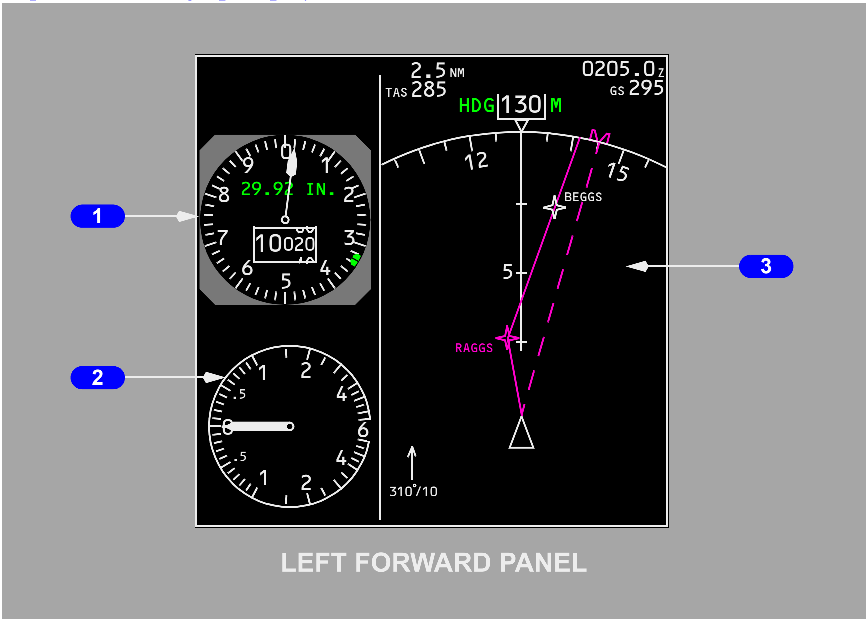
Displays current flight modes; refer to Chapter 4, Automatic Flight.

5 Attitude Indicator

6 Horizontal Situation Indicator

Captain Inboard Display

[Option - Heading-up display]



1 Altimeter

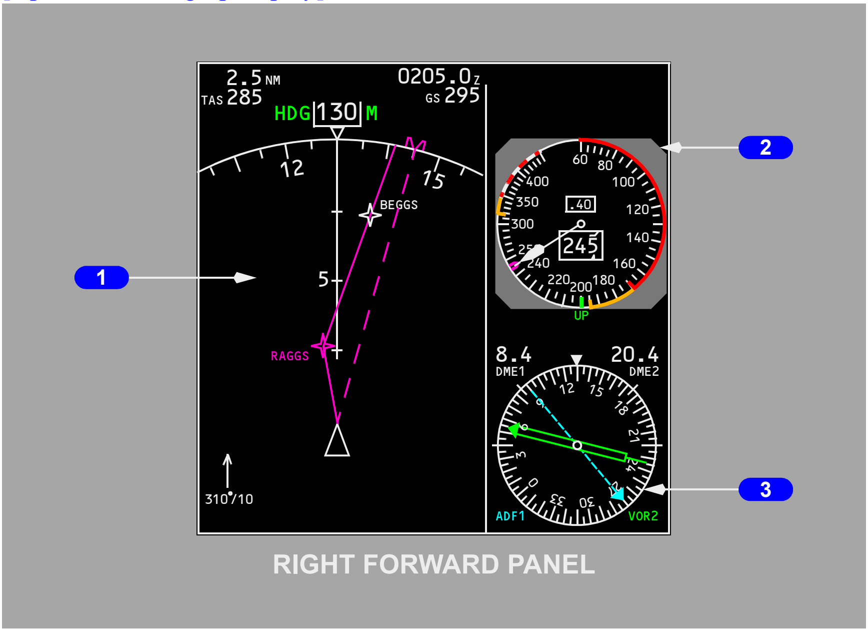
2 Vertical Speed Indicator

3 Navigation Display

Displays approach, VOR, moving map, or static map as selected on the EFIS control panel.

First Officer Inboard Display

[Option - Heading-up display]



1 **Navigation Display**

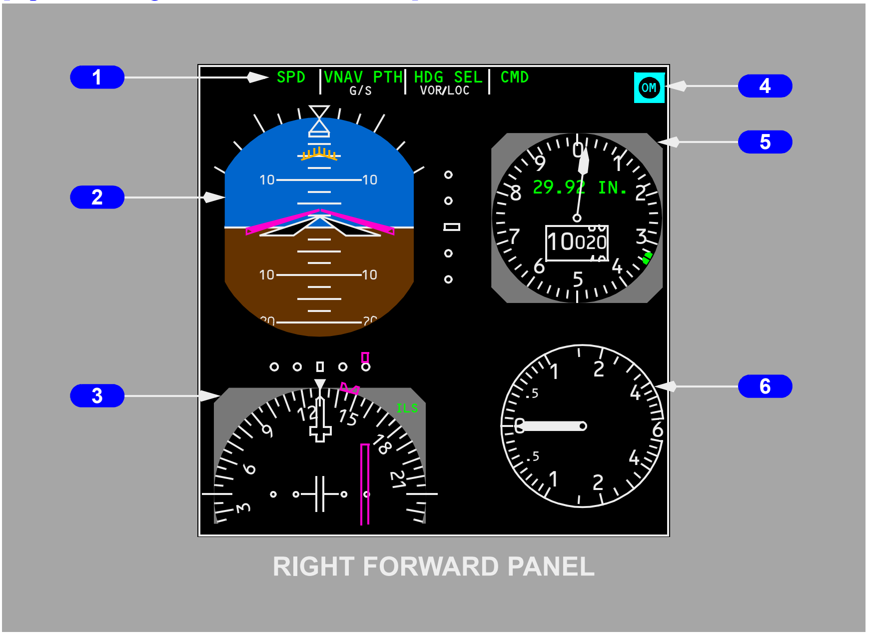
Displays approach, VOR, moving map, or static map as selected on the EFIS control panel.

2 **Mach/Airspeed Indicator**

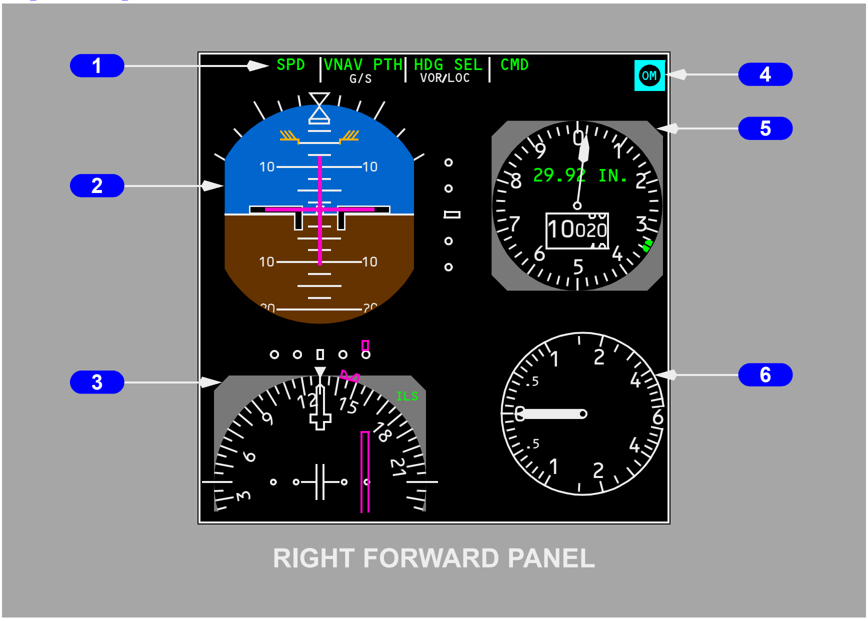
3 **Radio Distance Magnetic Indicator**

First Officer Outboard Display

[Option - Integrated cue command bar]



[Option - Split axis command bars]



1 Flight Mode Annunciations

Displays current flight modes; refer to Chapter 4, Automatic Flight.

2 Attitude Indicator

3 Horizontal Situation Indicator

4 Marker Beacon

5 Altimeter

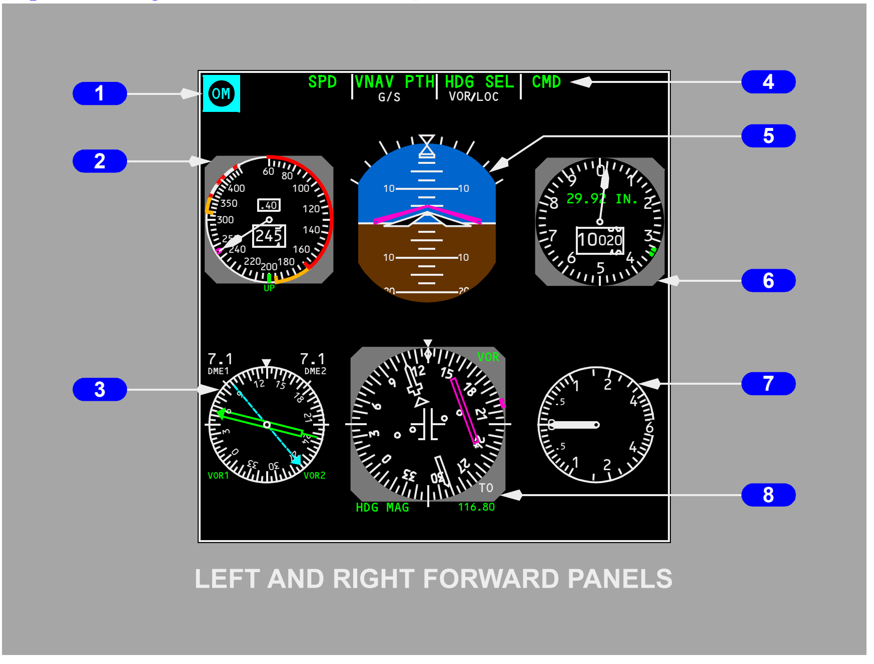
6 Vertical Speed Indicator

Compact EFIS Format

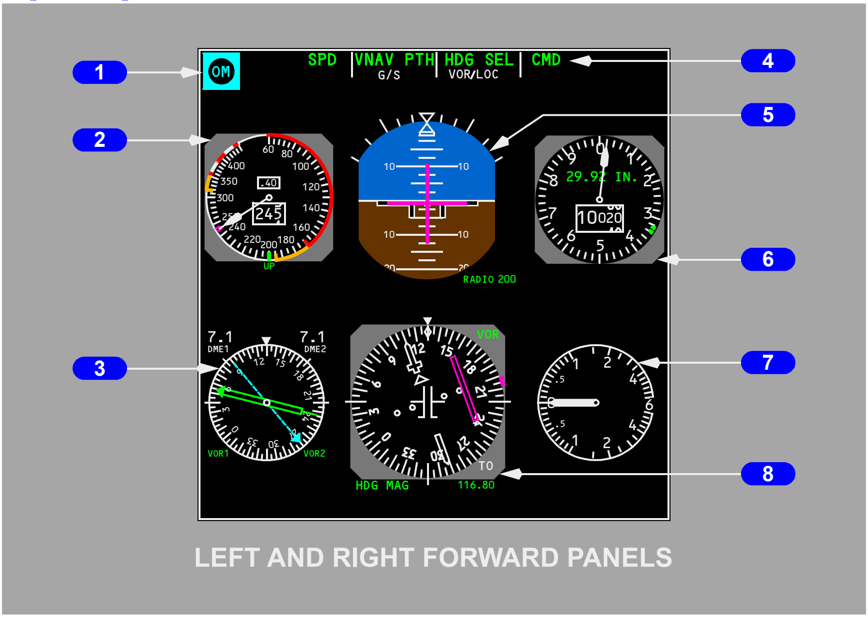
The compact EFIS format is displayed automatically upon failure of either an inboard or an outboard display unit. The compact format can also be selected manually with the MAIN PANEL DUs selectors on the display select panel.

In the compact format, a full rose HSI is displayed. Other displays are about 25% smaller than normal.

[Option - Integrated cue command bar]



[Option - Split axis command bars]



1 Marker Beacon

2 Mach/Airspeed Indicator

3 Radio Distance Magnetic Indicator

4 Flight Mode Annunciations

5 Attitude Indicator

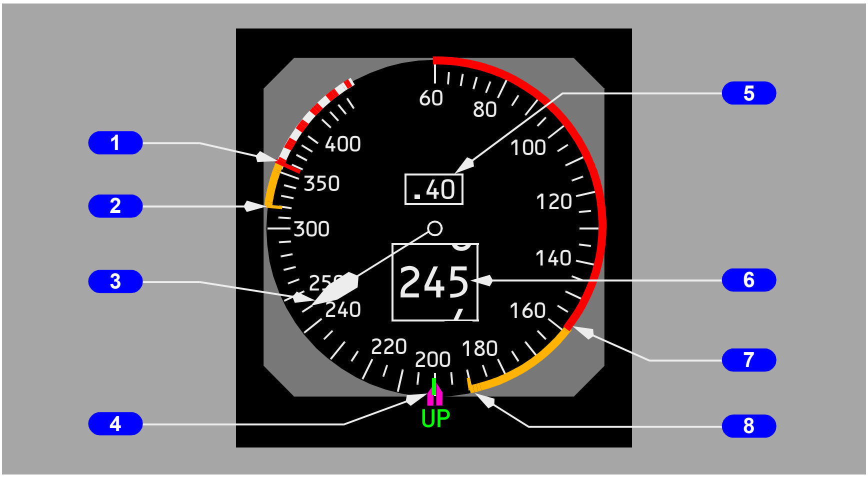
6 Altimeter

7 Vertical Speed Indicator

8 Horizontal Situation Indicator

EFIS – Mach/Airspeed Indicator (MASI)
Mach/Airspeed Indicator – General

The mach/airspeed indicator displays air data inertial reference system (ADIRS) airspeed and other airspeed related information.



1 Maximum Operating Speed (red and white)

Start of the arc indicates the maximum speed as limited by the lowest of the following:

- Vmo/Mmo
- landing gear placard speed
- flap placard speed.

2 Maximum Maneuver Speed/Next Flap Position Placard Speed (amber)

Shortly after takeoff the amber arc may be displayed until airspeed exceeds 160 knots or until first flap retraction.

When flaps are up, the start of the amber arc indicates the maximum maneuver speed. This airspeed provides 1.3g maneuver capability to high speed buffet (or an alternative approved maneuver capability set in the FMC maintenance pages). The arc may be displayed when operating at high altitude at relatively high gross weights.

Note: 1.3g maneuver capability occurs at 40 degrees of bank in level flight.

[Option] - CDS Software Upgrade - Block point 02/04/06

When flaps are not up, the start of the amber arc indicates the placard speed for the next normal flap setting. The display logic is based on a normal flap setting sequence of 1, 5, 15, 30, 40. The arc is removed when the flap handle is moved to the landing flap setting selected on the APPROACH REF page or when the flap lever is moved to flaps 40. It is also removed with any flap retraction.

3 Airspeed Pointer (white)

Indicates current calibrated airspeed in knots.

4 Airspeed Cursor (magenta)

Displays target airspeed:

- indicates the airspeed manually selected in the IAS/MACH window
- indicates the FMC computed airspeed when the IAS/MACH window is blank.

5 Mach Digital Counter (white)

Indicates current Mach number:

- displays when airspeed increases above 0.40 Mach
- blanks when airspeed decreases below 0.38 Mach.

6 Airspeed Digital Counter (white)

Indicates current calibrated airspeed in knots.

7 Stick Shaker Speed (red)

Red index mark indicates the speed at which stick shaker occurs.

8 Minimum Maneuver Speed (amber)

The amber arc is displayed with the first flap retraction after takeoff or when a valid Vref is entered.

The start of the amber arc indicates minimum maneuver speed. This airspeed provides:

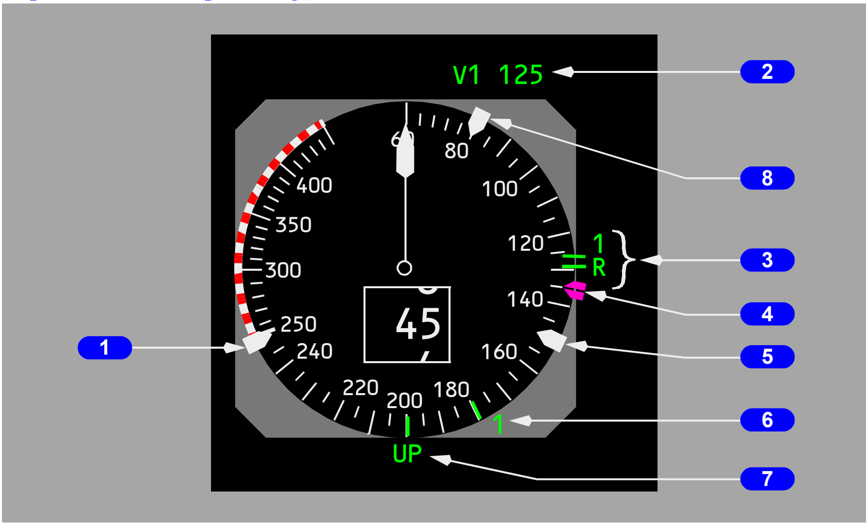
- 1.3g maneuver capability to stick shaker below approximately 20,000 ft.
- 1.3g maneuver capability to low speed buffet (or an alternative approved maneuver capability set in the FMC maintenance pages) above approximately 20,000 ft.

Note: 1.3g maneuver capability occurs at 40 degrees of bank in level flight.

CAUTION: Reduced maneuver capability exists when operating within the amber regions below the minimum maneuver speed or above the maximum maneuver speed. During non-normal conditions the target speed may be below the minimum maneuver speed.

Mach/Airspeed Indicator – Takeoff

[Option - 80 knot speed bug]



1 Bug 5 (white)

Displayed if the speed reference selector on the engine display control panel is in the bug 5 position and a value greater than 60 knots has been selected. Not available if the speed reference selector is in the AUTO position.

2 Speed Reference Display (green)

Displayed if the airspeed and/or weight is entered via the speed reference selector on the engine display control panel:

- on the ground, V1, VR, and takeoff gross weight may be selected; if VREF is selected, INVALID ENTRY is displayed
- in flight, VREF and landing gross weight may be selected; if V1 or VR is selected, INVALID ENTRY is displayed
- removed when the speed reference selector is moved to the SET position.

3 Takeoff Reference Speeds (green)

Indicates V1 (decision speed “V1”) and VR (rotation speed “VR”) as selected on the CDU TAKEOFF REF page (refer to Chapter 11, Flight Management, Navigation) or as set with the SPD REF selector switch:

- amber NO VSPD flag is displayed on the ground if V1 and VR are not selected on the CDU or not set with the SPD REF selector
- displayed for takeoff when speed is greater than 80 knots
- removed at lift–off.

[Option - V1 aural enabled]
- V1 is automatically called out by voice aural.

4 Airspeed Cursor (magenta)

Set with the speed selector on the mode control panel.

5 V2+15 (white)

Displayed for takeoff.

Removed when either of the following occurs:

- at first flap retraction
- when VREF is entered.

6 Flap Maneuvering Speed (green)

Indicates flap maneuvering speed for the displayed flap position:

- when the V2+15 bug is displayed for takeoff, the flap maneuvering speed bug for the current flap setting is not displayed except for a flaps 1 takeoff
- flap bugs inhibited if less than VREF +4.

7 Flaps Up Airspeed (green)

Displayed after zero fuel weight is entered in the CDU and takeoff gross weight is calculated, or after takeoff gross weight is set with the speed reference selector.

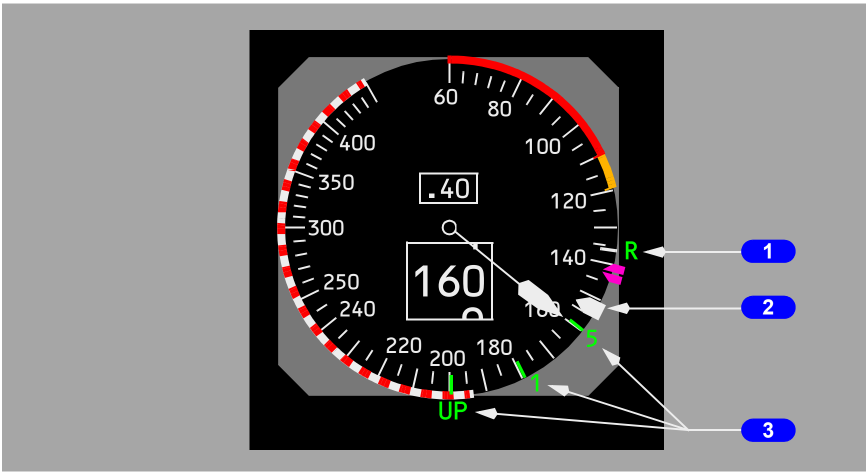
Not displayed above approximately 20,000 feet altitude.

[Option - 80 knot speed bug]
8 80 Knots Airspeed Bug (white)

Indicates 80 knots:

- displayed automatically during preflight
- removed at first flap retraction or when VREF is entered.

Mach/Airspeed Indicator – Approach



1 Landing Reference Speed (green)

Indicates VREF (reference speed) as selected on the CDU APPROACH REF page (refer to Chapter 11, Flight Management, Navigation) or as set with the speed reference selector on the engine display control panel.

2 VREF+15 (white)

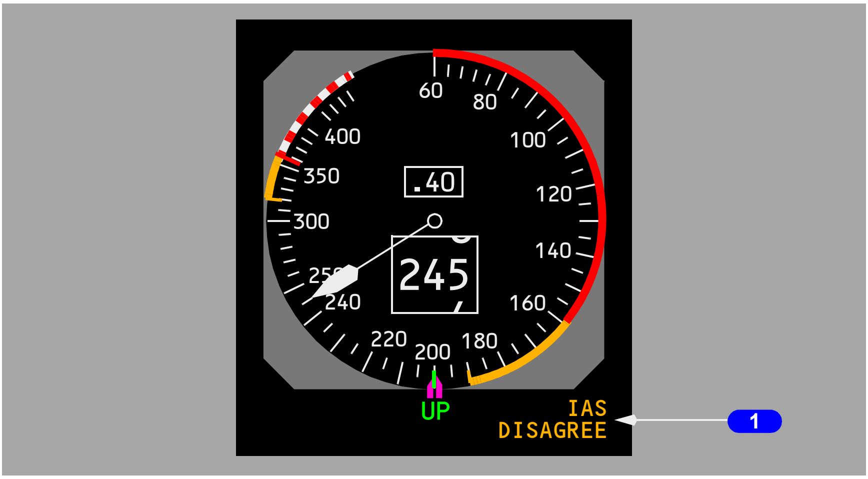
Displayed with selection of VREF.

3 Flap Maneuvering Speeds (green)

Indicate flap maneuvering speeds for the displayed flap position:

- not shown if less than or equal to VREF+4
- numbered flap maneuvering speed bugs are removed when the flap lever is moved to flaps 30 or 40.

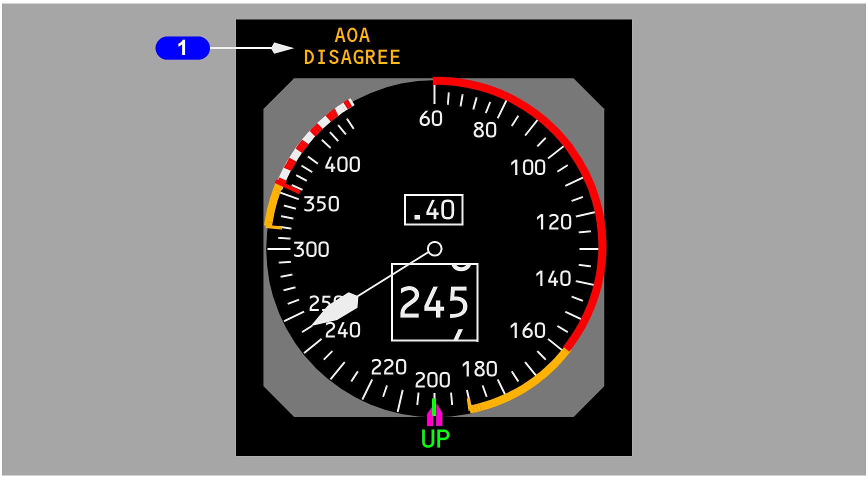
Mach/Airspeed Indicator – IAS Disagree Alert



1 Airspeed Disagree Alert (amber)

Indicates the Captain's and F/O's airspeed indications disagree by more than 5 knots for 5 continuous seconds.

Mach/Airspeed Indicator – Angle of Attack (AOA) Disagree Alert

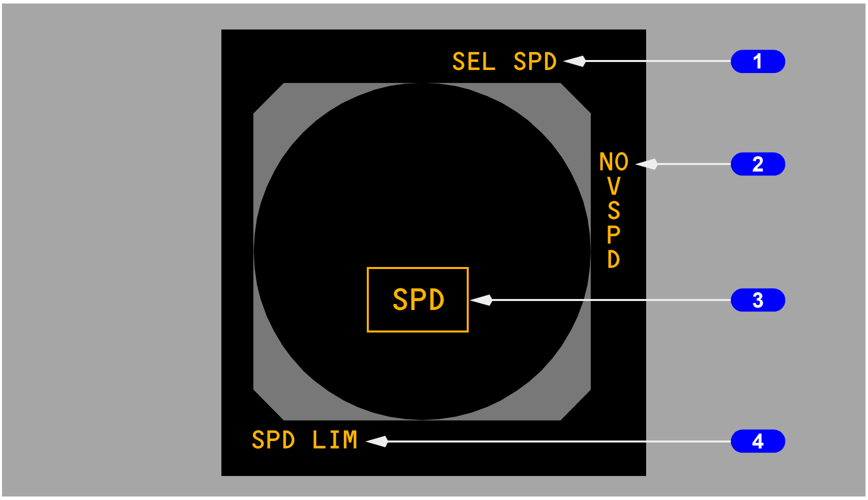


1 AOA Disagree Alert (amber)

Indicates the Captain’s (left) and First Officer’s (right) angle of attack values disagree by more than 10 degrees for more than 10 continuous seconds.

Mach/Indicator - Failure Flags

The flag replaces the appropriate display to indicate source system failure or lack of computed information.



1 Selected Speed Flag (amber)

The airspeed cursor is inoperative. The airspeed cursor is removed.

2 NO VSPD Flag (amber)

Displayed when the aircraft is on the ground and both V1 (decision speed) and VR (rotation speed) are not valid or are set to less than 80 knots.

3 Speed Flag (amber)

Speed data failed. Mach/airspeed indicator is inoperative.

4 Speed Limit Flag (amber)

Display related to stick shaker or maximum operating speed has failed:

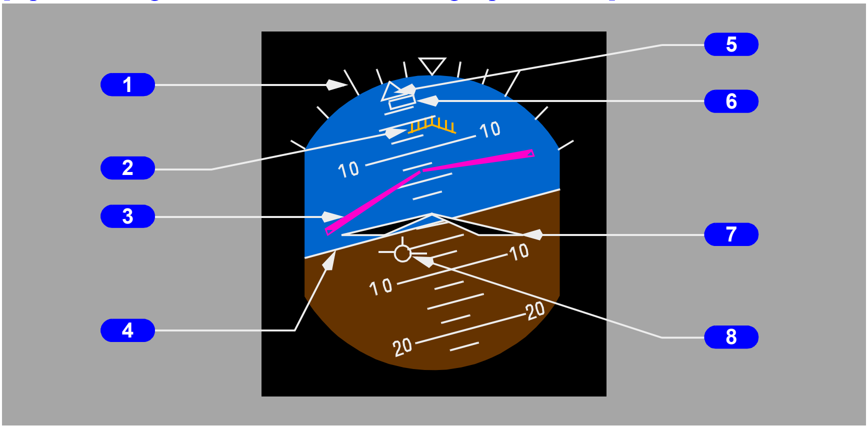
- if the stick shaker warning has failed, the red stick shaker speed arc is removed
- if the maximum operating speed has failed, the red and white maximum operating speed arc is removed.

EFIS – Attitude Indicator

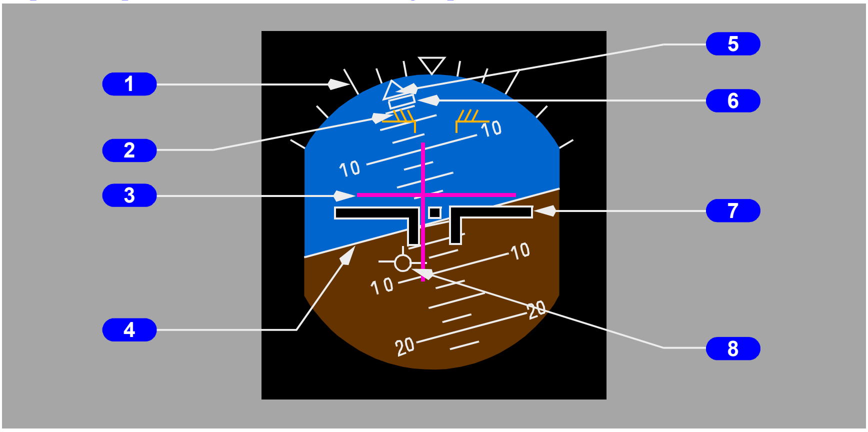
Attitude Indicator – General

The attitude indicator displays ADIRS attitude information.

[Option - Integrated cue command bar, flight path vector]



[Option - Split axis command bars, flight path vector]



1 Bank Scale (white)

Provides fixed reference for the bank pointer; scale marks are at 0, 10, 20, 30, 45, and 60 degrees.

2 Pitch Limit Indicator (amber)

Indicates pitch limit (stick shaker activation for existing flight conditions).

- displayed when flaps are not up.

[Option - PLI pop-up]
- displayed at slow speed with flaps up.

3 Flight Director (magenta)

Indicates flight director steering commands. (Refer to Chapter 4, Automatic Flight).

4 Horizon Line and Pitch Scale (white)

Indicates the horizon relative to the airplane symbol; pitch scale is in 2.5 degree increments.

5 Bank Pointer

Indicates bank angle; fills and turns amber if bank angle is 35 degrees or more.

- indicates direction towards wings level.

6 Slip/Skid Indication

Displaces beneath the bank pointer to indicate slip or skid:

- fills white at full scale deflection
- turns amber if bank angle is 35 degrees or more; fills amber if the slip/skid indicator is also at full scale deflection.

7 Airplane Symbol

Indicates airplane attitude relative to the horizon.

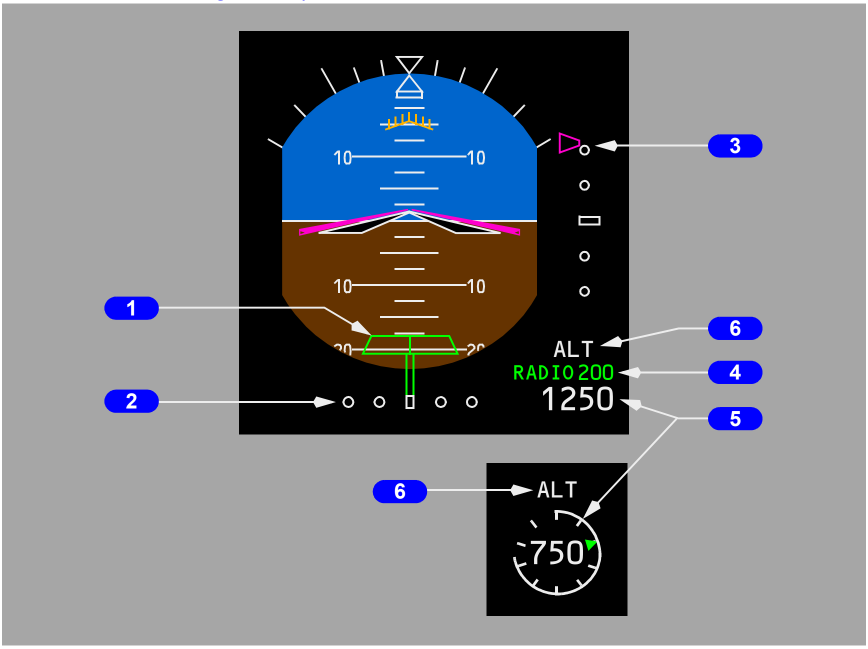
[Option - Flight path vector]
8 Flight Path Vector (FPV) Indication (white)

Displays flight path angle and drift when selected on the EFIS control panel:

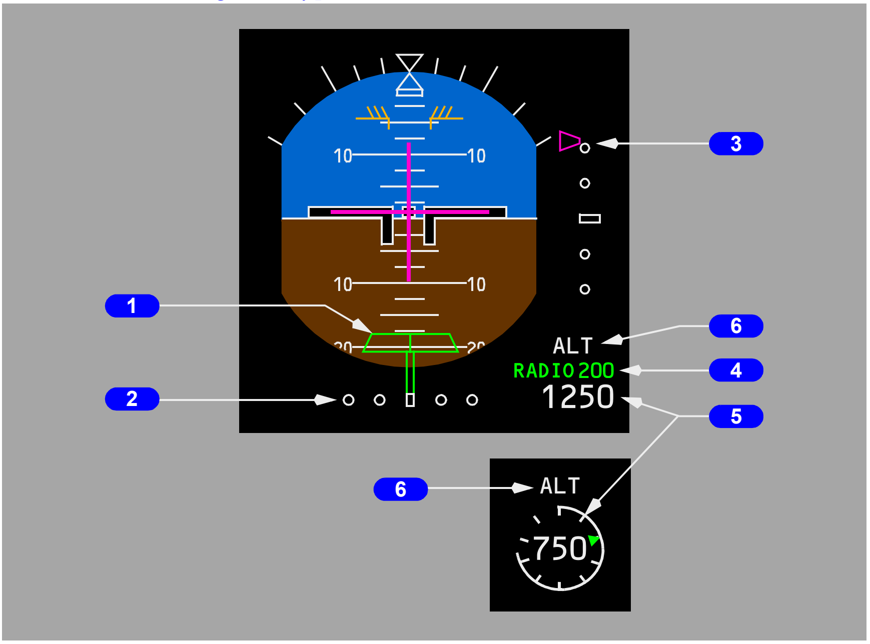
- flight path angle is displayed relative to the horizon line
- drift angle is displayed relative to display center.

Attitude Indicator – Instrument Landing System Indications

[Option - Integrated cue command bar, radio altitude height alert, round dial, radio altitude below, rising runway]



[Option - Split axis command bars, radio altitude height alert, round dial, radio altitude below, rising runway]



[Option - Rising runway]

1 Rising Runway (green)

- displayed when localizer pointer is in view and radio altitude is less than 2500 feet
- rises towards airplane symbol when radio altitude is below 200 feet
- is not displayed when the localizer signal is unusable.

2 Localizer Pointer and Deviation Scale

The pointer:

- indicates localizer position relative to the airplane
- in view when the localizer signal is received.

The scale:

- indicates deviation
- expands when the localizer is engaged and deviation is slightly more than ½ dot.

[Option - Localizer/Glideslope fail flags displayed]

- in view when the localizer signal is received.

At low radio altitudes with autopilot engaged, the scale turns amber and the pointer flashes to indicate excessive localizer course deviation.

Each pilot’s deviation alerting system self-tests upon becoming armed at 1500 feet radio altitude. This self-test generates a two second LOC deviation alerting display on each attitude indicator.

3 Glideslope Pointer and Deviation Scale

The pointer:

- indicates glideslope position
- in view when the glideslope signal is received.
- the pointer is not displayed when the track and the front course on the mode control panel differ by more than 90 degrees (backcourse).

The scale:

- indicates deviation

[Option - Localizer/Glideslope fail flags displayed]

- in view when the localizer signal is received.

At low radio altitudes with autopilot engaged, the scale turns amber and the pointer flashes to indicate excessive glideslope deviation.

Each pilot’s deviation alerting system self-tests upon becoming armed at 1500 feet radio altitude. This self-test generates a two second G/S deviation alerting display on each attitude indicator.

4 Selected Radio Altitude Approach Minimums (green)

- displays selected minimums as set on the EFIS control panel
- blank when an altitude less than 0 feet is selected
- “RADIO” legend and readout turn amber and flash for 3 seconds when descending through the selected minimum altitude; the legend and readout become steady amber after 3 seconds
- changes back to green:
  - when passing the selected minimum altitude plus 75 feet during go–around
  - at touchdown
  - after pressing the RST switch on the EFIS control panel.

[Option - Round dial]

5 Radio Altitude (display –white, selected radio altitude pointer–green)

- displayed below 2500 feet AGL
- blanked above 2500 feet AGL
- digital display from 2500 to 1000 feet AGL
- round dial display below 1000 feet AGL:
  - pointer replaces digital display of selected radio minimum altitude
  - the circumference of the dial is added to, or taken away from, to depict the airplane’s radio altitude

- dial and readout turn amber and dial flashes for 3 seconds when descending through the selected minimum altitude; the dial becomes steady amber after 3 seconds
- changes back to white:
  - when passing through the selected minimum altitude plus 75 feet during go–around
  - at touchdown
  - after pressing the RST switch on the EFIS control panel.

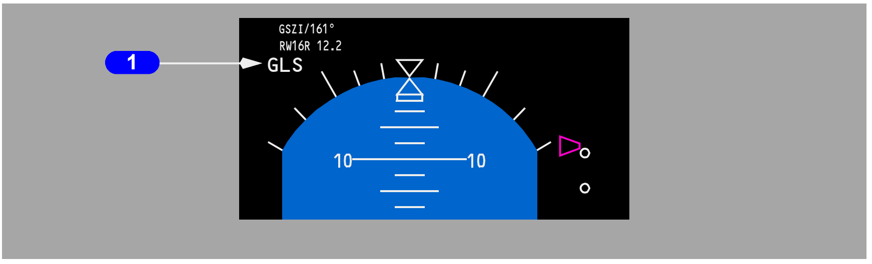
[Option - 2500 ft height alert]

6 Radio Altitude Height Alert (white)

Displayed when radio altitude is less than or equal to 2500 feet. Blanked when descent continues below 500 feet AGL, or after pressing the RST switch on the EFIS control panel.

Attitude Indicator – GLS Source Annunciation Indication

[Option - GLS]

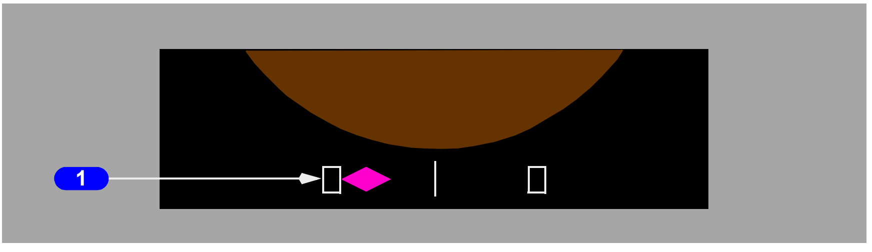


1 GLS Source Annunciation

Displays the selected GLS identifier, channel, selected course and source annunciation.

If the Captain’s and First Officer’s tuned GLS channels or approach courses disagree for more than one minute, the indication turns amber with an amber horizontal line until set identically.

Expanded Localizer Indications



1 Expanded Localizer Scale

[Option - Autopilot or flight director activated]
Displayed when the autopilot or flight director is in LOC mode, deviation is slightly more than ½ dot and track is within 5 degrees of the MCP selected course.

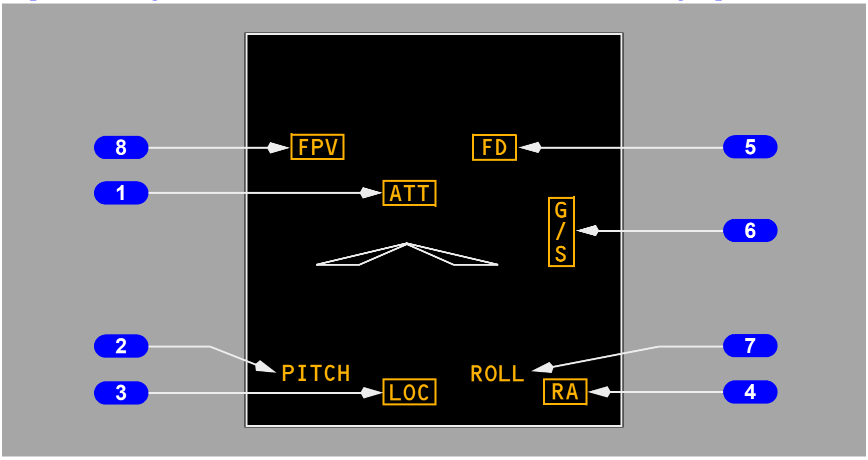
Reverts to standard scale when out of LOC mode, and groundspeed is less than 30 knots or radio altitude is greater than 200 feet.

A rectangle equals ½ dot deviation.

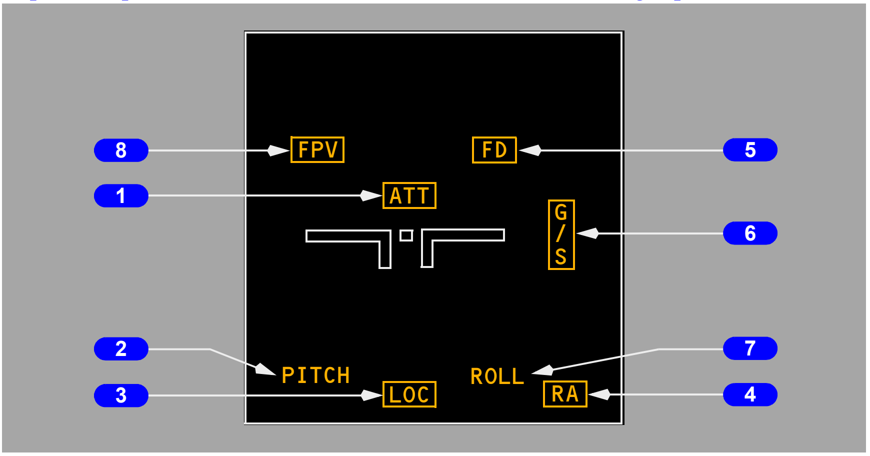
Attitude Indicator Failure Flags

Flags replace the attitude displays to indicate source system failure or lack of computed information.

[Option - Integrated cue command bar, radio altitude below, flight path vector]



[Option - Split axis command bars, radio altitude below, flight path vector]



1 Attitude Flag (amber)

The attitude display has failed.

2 Pitch Flag (amber)

The Captain and First Officer pitch angle displays differ by more than 5 degrees.

[Option - Attitude comparator flashing]
The flag flashes for 10 seconds then remains steady.

3 Localizer Flag (amber)

An ILS frequency is tuned and ILS localizer course guidance indication has failed.

4 Radio Altitude Flag (amber)

Radio altitude indication has failed.

5 Flight Director Flag (amber)

The flight director has failed.

6 Glideslope Flag (amber)

An ILS frequency is tuned and ILS glideslope indication has failed.

7 Roll Flag (amber)

The Captain and First Officer roll displays differ by more than 5 degrees.

[Option - Attitude comparator flashing]
The flag flashes for 10 seconds then remains steady.

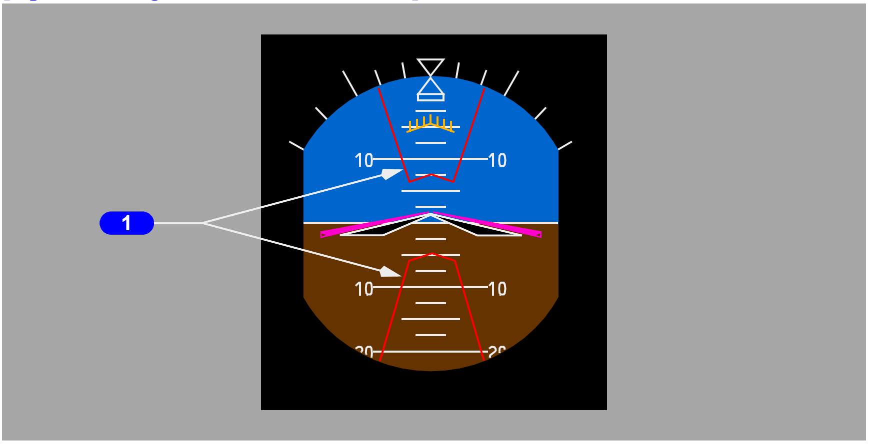
[Option - Flight path vector]

8 Flight Path Vector Flag (amber)

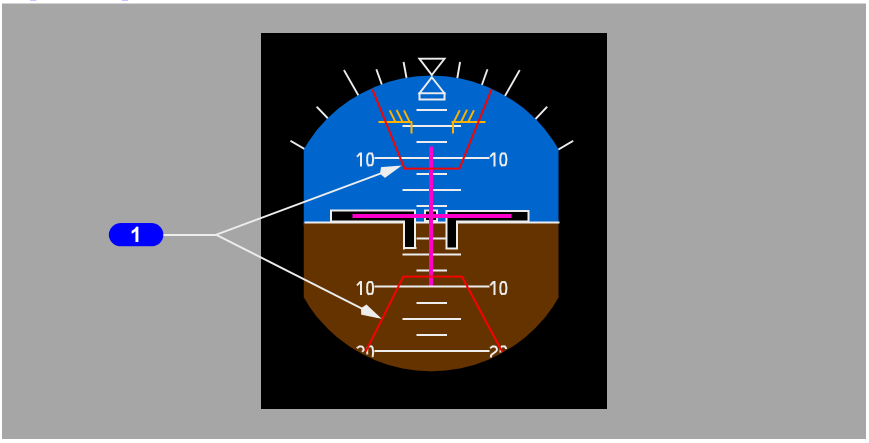
FPV is selected on the EFIS control panel, but has failed. De-selection of FPV removes the flag.

Traffic Alert and Collision Avoidance Indications

[Option - Integrated cue command bar]



[Option - Split axis command bars]

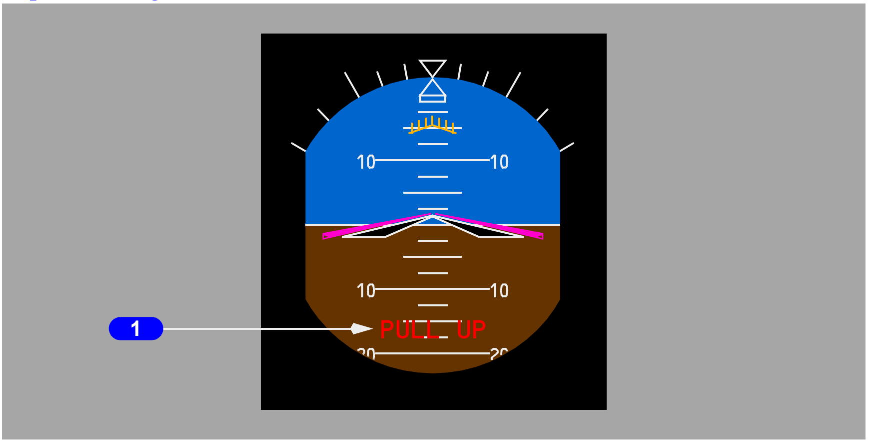


1 Traffic Alert and Collision Avoidance System Pitch Command (red)

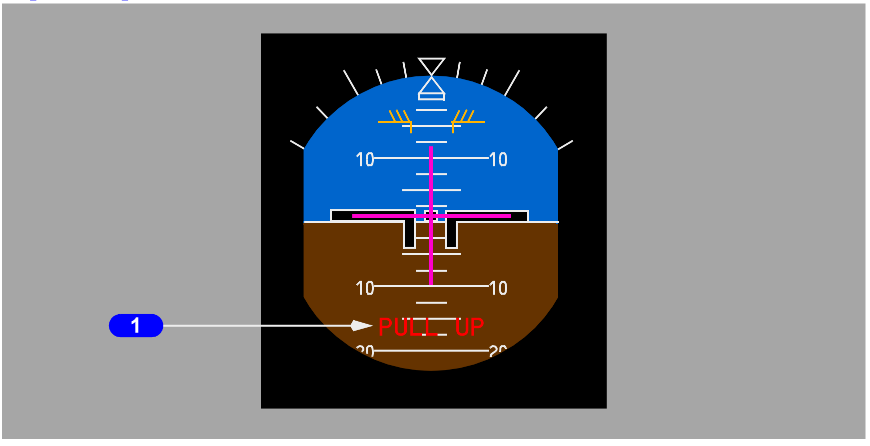
The area(s) inside the red lines indicate(s) the pitch region(s) to avoid in order to resolve the traffic conflict. The airplane symbol must be outside the TCAS pitch command area(s) to ensure traffic avoidance. Refer to Chapter 15, Warning Systems.

GPWS Annunciations

[Option - Integrated cue command bar]



[Option - Split axis command bars]

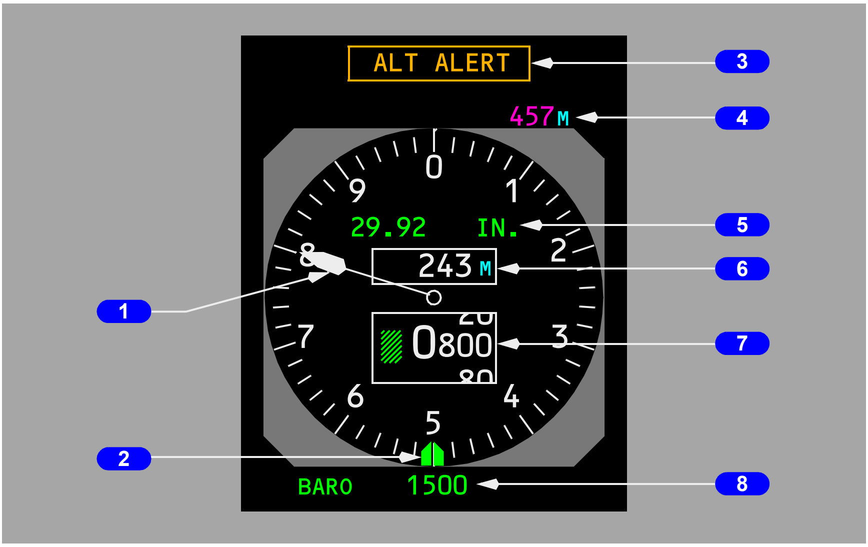


1 GPWS Annunciations (red)

Refer to Chapter 15, Warning Systems.

EFIS – Altimeter
Altimeter – General

The altimeter displays ADIRS altitude and other altitude related information.



1 Altitude Pointer

Makes one revolution each one thousand feet.

2 Reference Altitude Marker (green)

Indicates the barometric minimums as set by the minimums selector on the EFIS control panel.

The minimums reference selector must be in the BARO position to adjust the reference altitude marker.

Color:

- turns amber when descending through the selected minimum altitude
- changes back to green after pushing the RST switch on the EFIS control panel.

3 Altitude Alert Annunciation (amber)

- appears steady for altitude acquisition
- flashes during altitude deviation
- refer to Chapter 15, Warning Systems.

4 Metric Selected Altitude Readout (readout–magenta, caption–cyan)

Displays MCP altitude in meters when MTRS is selected on the EFIS control panel. Not available in compact mode.

5 Barometric Setting (green)

Indicates the barometric setting in either inches of mercury (IN) or hectopascals (HPA) as selected on the EFIS control panel.

6 Metric Digital Readout (readout–white, caption–cyan)

Displays current altitude in meters when MTRS is selected on the EFIS control panel. Not available in compact mode.

7 Digital Readout (white)

Displays current altitude in increments of thousands, hundreds and twenty feet:

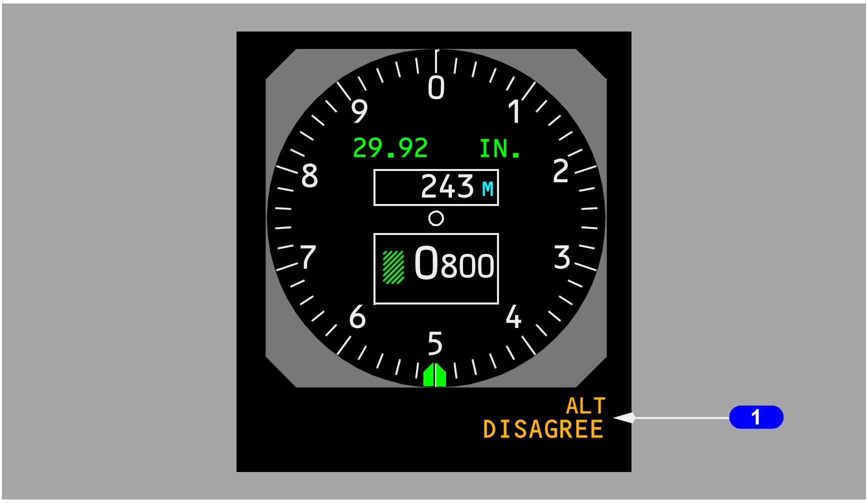
- for positive values of altitude below 10,000 feet, a green crosshatch symbol is displayed
- a negative sign appears when altitude below zero feet is displayed.

8 Selected Minimums Barometric Readout (Green)

Indicates the barometric minimums as set by the minimums selector on the EFIS control panel:

- turns amber and flashes when descending through the selected minimum altitude
- changes back to green after pressing the RST switch on the EFIS control panel
- pressing the RST switch when above the selected altitude removes the readout.

Altimeter – Altitude Disagree Alert

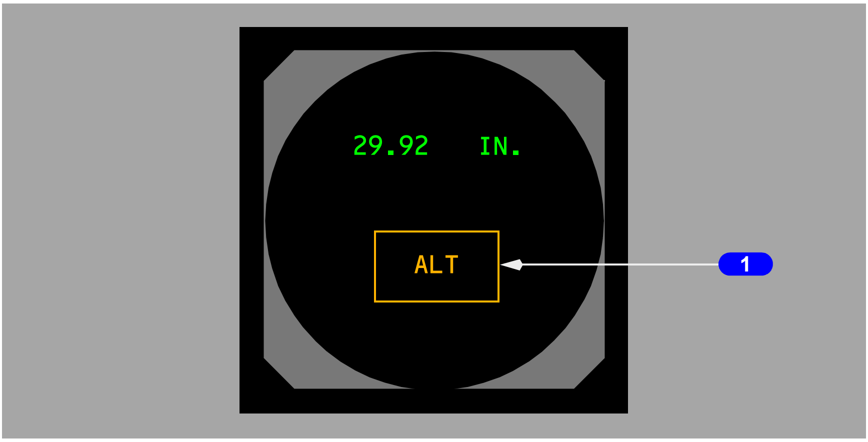


1 Altitude Disagree Alert (amber)

Indicates the Captain’s and F/O’s altitude indications disagree by more than 200 feet for more than 5 continuous seconds.

Altimeter Failure Flag

The failure flag replaces the altitude displays to indicate system failure.



1 Altitude Failure Flag (amber)

The barometric altitude or barometric correction has failed:

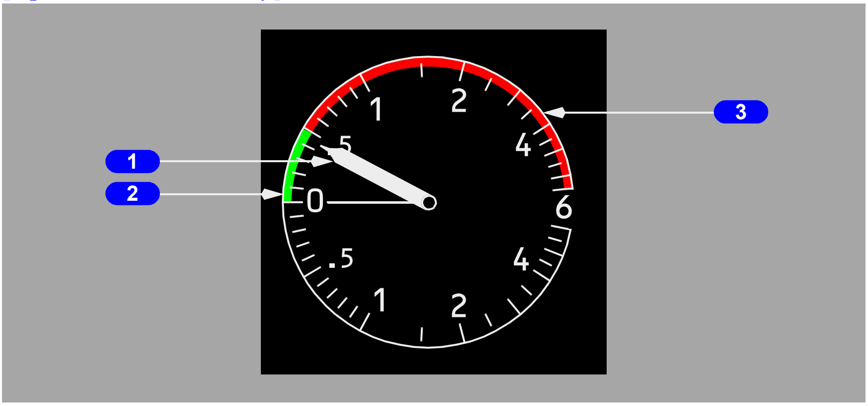
- all altimeter symbols are removed except the ALT ALERT annunciation and the barometric setting.

EFIS – Vertical Speed Indicator

Vertical Speed Indicator – General

The vertical speed indicator displays ADIRS instantaneous vertical speed.

[Option - TCAS advisory]



1 Vertical Speed Pointer (white)

Depicts rate of climb or descent from 0 to 6000 feet per minute.

[Option - TCAS advisory]

2 TCAS Corrective Advisory (green)

Indicates range of recommended vertical speed.

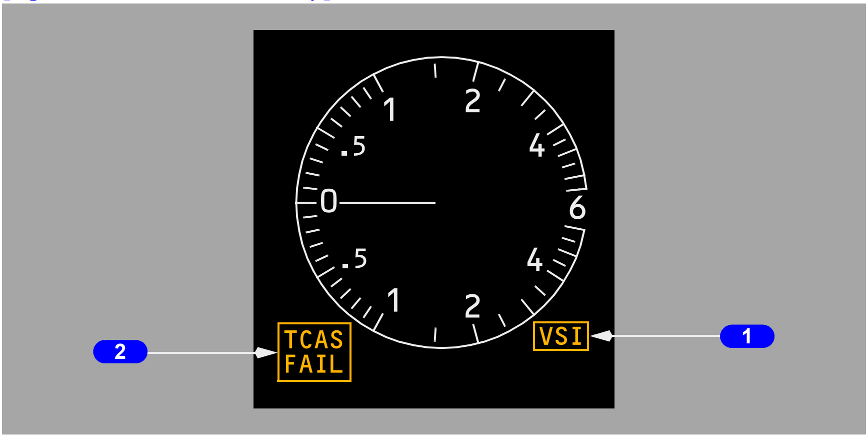
[Option - TCAS advisory]

3 TCAS Preventative Advisory (red)

Indicates range of vertical speed to be avoided.

Vertical Speed Indicator Failure Flag

[Option - VSI TCAS advisory]



1 VSI Failure Flag (amber)

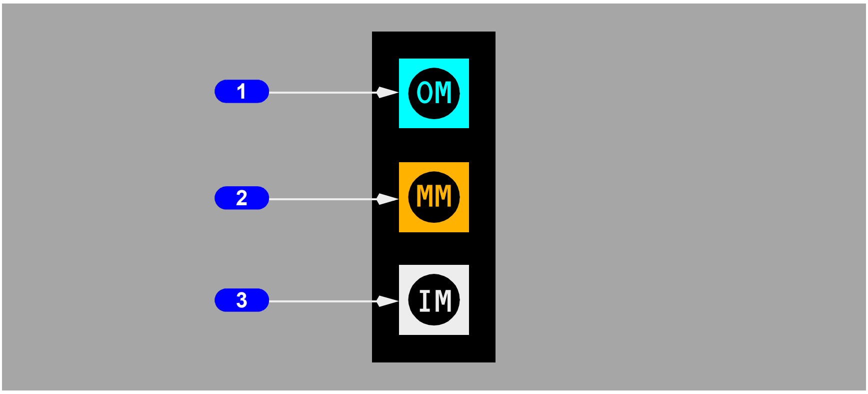
Vertical speed has failed. The pointer is also removed.

[Option - VSI TCAS advisory]
2 TCAS Failure Flag (amber)

TCAS advisory function has failed. Compact format only.

EFIS – Marker Beacon Indications
Marker Beacon Indications

The marker beacon indication flashes when over one of the marker beacon transmitters.



1 Outer Marker (cyan)

Flashes when over an outer marker beacon.

2 Middle Marker (amber)

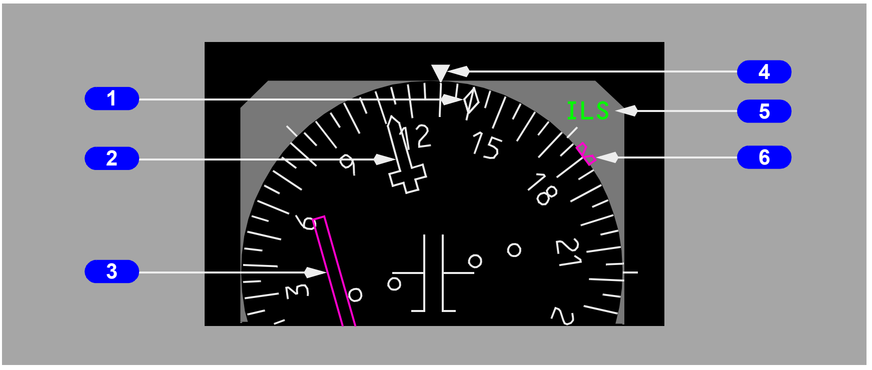
Flashes when over a middle marker beacon.

3 Inner Marker (white)

Flashes when over an inner marker beacon.

Navigation Displays –
Horizontal Situation Indicator (HSI)
Horizontal Situation Indicator – General

The HSI displays current ADIRS heading, track and other information.



1 Drift Angle Pointer (white)

Indicates current drift angle or track.

2 Selected Course Pointer (white)

Indicates the course set on the mode control panel. Set by the related mode control panel course selector.

3 Course Deviation Indicator (magenta)

Indicates deviation from the selected localizer or VOR course.

4 Heading Pointer (white)

Indicates current heading.

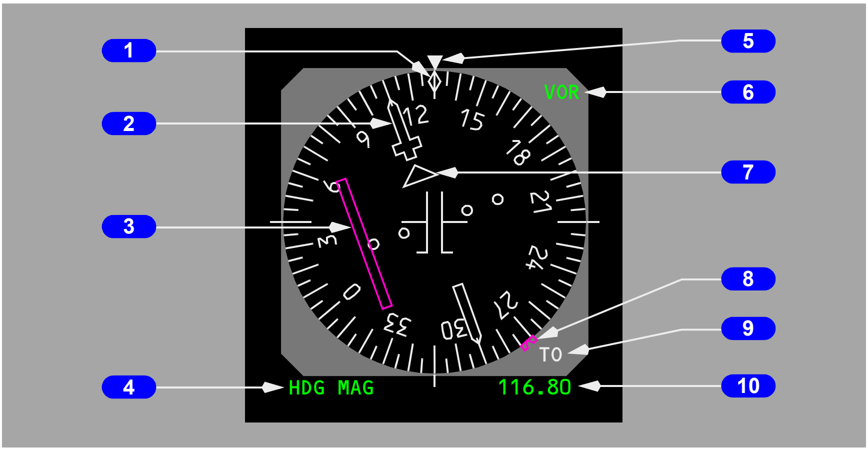
5 **Lateral Deviation Source Annunciation (green)**

Identifies the selected navigation source as VOR or ILS.

6 **Selected Heading Bug (magenta)**

Indicates the heading selected on the mode control panel. If the selected heading exceeds the display range, the bug parks on the side of the compass rose in the direction of the shorter turn to the heading.

Horizontal Situation Indicator – Compact Display



1 **Drift Angle Pointer (white)**

Indicates current drift angle or track.

2 **Selected Course Pointer (white)**

Indicates the course set on the mode control panel. Set by the related mode control panel course selector.

3 **Course Deviation Indicator (magenta)**

Indicates deviation from the selected localizer or VOR course.

4 **Magnetic/True Heading Annunciation (green)**

Indicates the HSI reference:

- HDG MAG (green) indicates display is oriented relative to magnetic north
- TRU HDG (green) indicates display is oriented relative to true north; a white box is displayed continuously around TRU HDG

- transition from TRU HDG to HDG MAG results in a green box around HDG MAG for 10 seconds
- when TRU HDG is displayed and the airplane descends more than 2000 feet at a descent rate greater than –800 feet per minute, an amber box is drawn around TRU HDG; the box flashes for 10 seconds, then turns steady amber.

5 **Heading Pointer (white)**

Indicates current heading.

6 **Lateral Deviation Source Annunciation (green)**

Identifies the selected navigation source as VOR or ILS.

7 **TO/FROM Pointer (white)**

8 **Selected Heading Bug (magenta)**

Indicates the heading selected on the mode control panel.

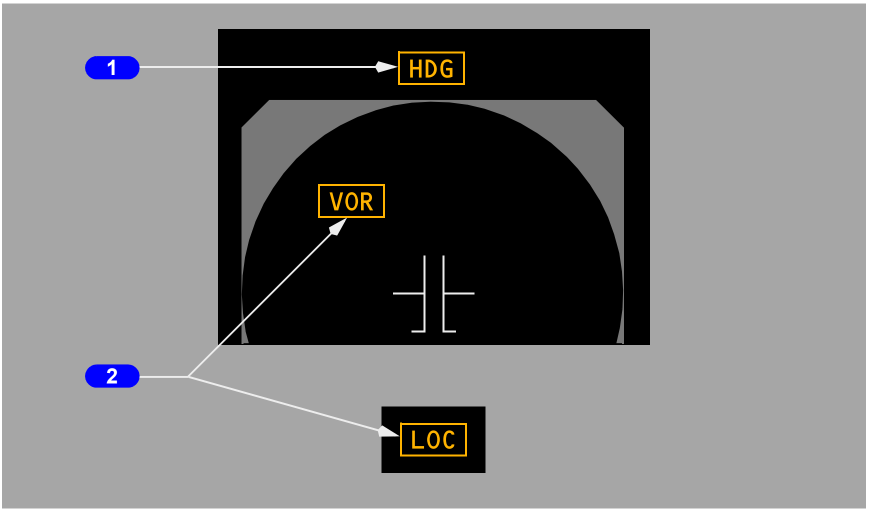
9 **TO/FROM Annunciation (white)**

10 **Frequency Display (green)**

Indicates selected navigation radio frequency.

Horizontal Situation Indicator Failure Flags

The flags replace the horizontal situation indicator displays to indicate source system failure or lack of computed data.



1 Heading Failure Flag (amber)

The heading source has failed. The compass rose is removed.

2 VOR/LOC Failure Flag (amber)

The airplane navigation data source has failed.

Navigation Displays –
Radio Distance Magnetic Indicator (RDMI)
Radio Distance Magnetic Indicator – General

The RDMI provides the same information as a conventional RDMI.

1 DME Indications (white)

Displayed if DME information is available from the navigation aid tuned in the VHF navigation control panel.

2 Bearing Pointers (VOR source–green, ADF source–cyan)

- narrow pointer uses signals from the VHF NAV receiver No. 1 or ADF receiver No. 1

[Option - 2 ADF receivers]

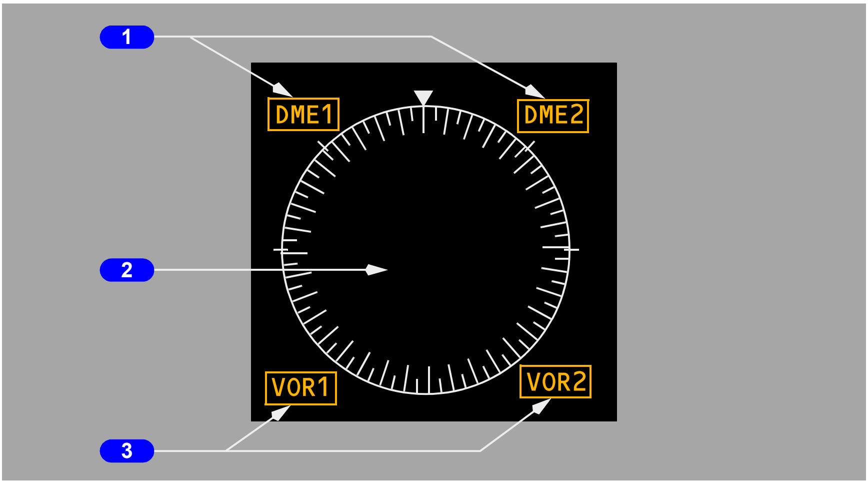
- wide pointer uses signals from the VHF NAV receiver No. 2 or ADF receiver No. 2.

3 Bearing Source Indications (VOR source–green, ADF source–cyan)

- indicates “OFF” (white) if related VOR/ADF switch on the EFIS control panel is in the OFF position

Radio Distance Magnetic Indicator Failure Flags

The flags replace the RDMI displays to indicate source system failure.



1 DME Failure Flags (amber)

The DME system has failed.

2 Heading Failure

The heading display is removed if heading information has failed.

3 VOR, ADF Failure Flags (amber)

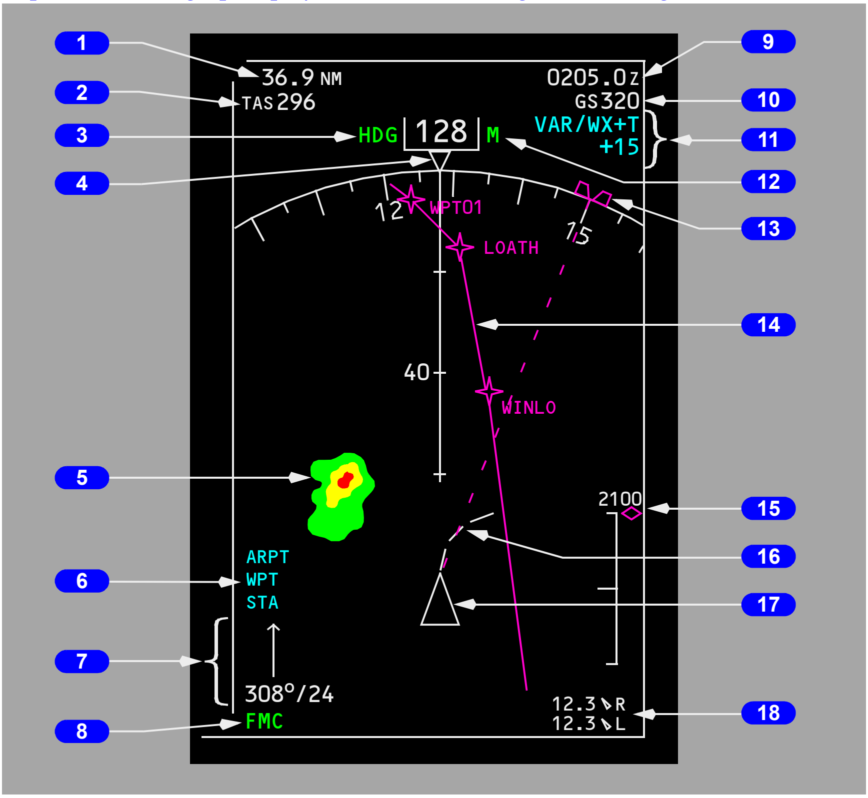
Selected VOR or ADF information is invalid.

Navigation Displays – MAP Mode

Note: Refer to section 40 of this chapter for a detailed explanation of the navigation symbology shown on the following pages.

Expanded MAP Mode

[Option - Heading-up display, weather radar range marks, single FMC]



1 **Distance to Next Active Waypoint**

2 **True Airspeed**

[Option - Heading-up display]

3 **Current Heading**

4 **Heading Pointer**

5 **Weather Radar Returns**

6 **MAP Options**

7 **Wind Direction and Speed**

8 **MAP Source Annunciation**

9 **Estimated Time of Arrival at Next Active Waypoint**

10 **Groundspeed**

11 **Weather Radar Annunciations**

12 **Magnetic/True Reference**

13 **Selected Heading Bug**

14 **Active LNAV Route**

15 **Vertical Deviation Scale and Pointer**

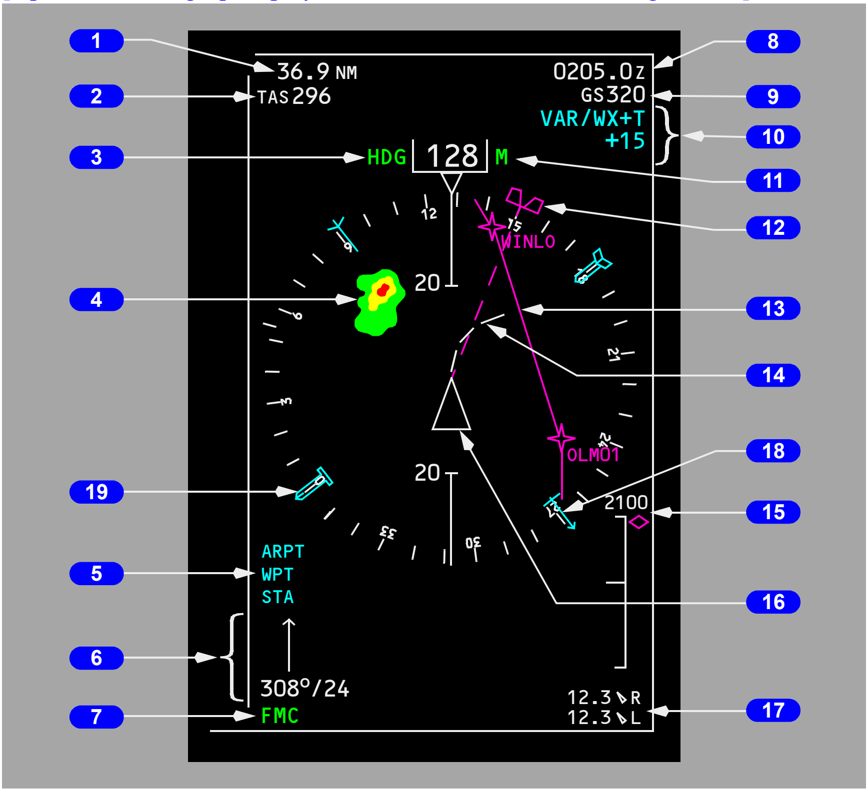
16 **Position Trend Vector**

17 **Airplane Symbol**

18 **Position Difference Display**

Center MAP Mode

[Option - Heading-up display, full-time ADF, dual ADF, single FMC]



1 **Distance to Next Active Waypoint**

2 **True Airspeed**

[Option - Heading-up display]
3 **Current Heading**

4 **Weather Radar Returns**

5 **MAP Options**

6 **Wind Direction and Speed**

7 **MAP Source Annunciation**

8 **Estimated Time of Arrival at Next Active Waypoint**

9 **Groundspeed**

10 **Weather Radar Annunciations**

11 **Magnetic/True Reference**

12 **Selected Heading Bug**

13 **Active Route**

14 **Position Trend Vector**

15 **Vertical Deviation Scale and Pointer**

16 **Airplane Symbol**

17 **Position Difference Display**

[Option - Full-time ADF]
18 **ADF 1 Bearing Pointer**

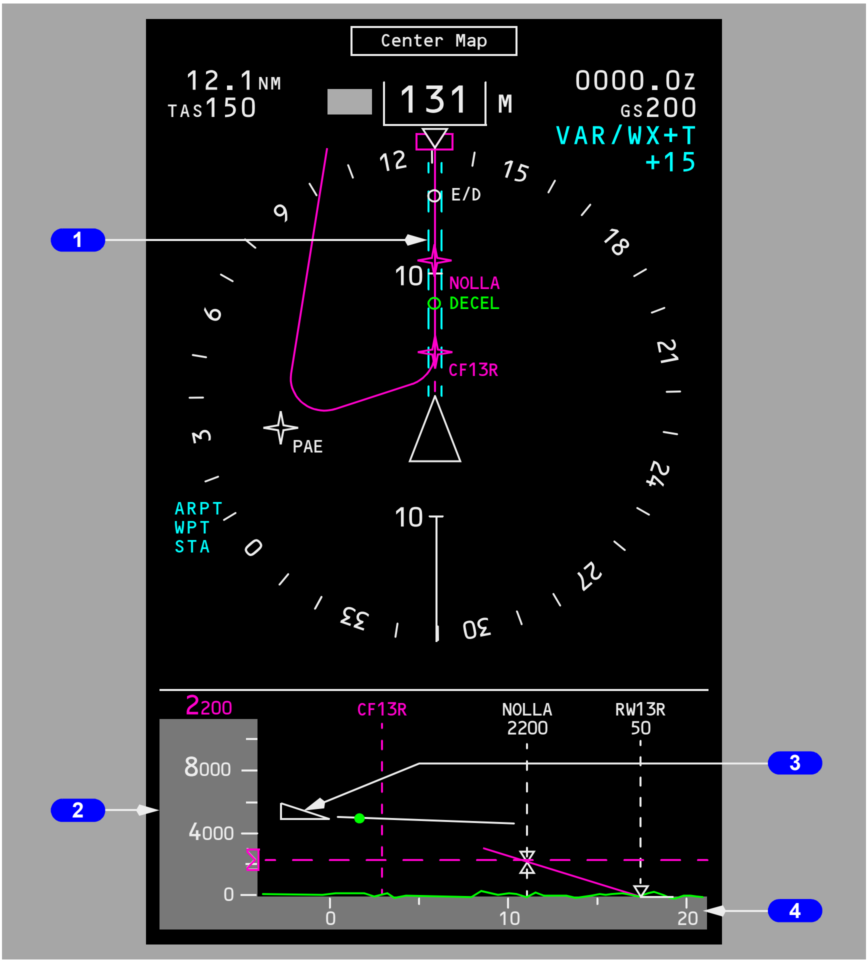
[Option - Full-time ADF, 2 ADF receivers]
19 **ADF 2 Bearing Pointer**

Vertical Situation Display (VSD)

[Option VSD]

The VSD represents a profile view of the airplane and its environment along the current track. Information shown within the cyan dashed lines (enroute corridor) on the ND is shown in profile on the VSD.

Vertical Situation Display (VSD) - Reference Scales



1 Enroute Swath

Indicates area mapped by the VSD.

2 Altitude Reference Scale

Displays altitude in reference to the vertical position of the airplane symbol, terrain, and other objects in the VSD background display.

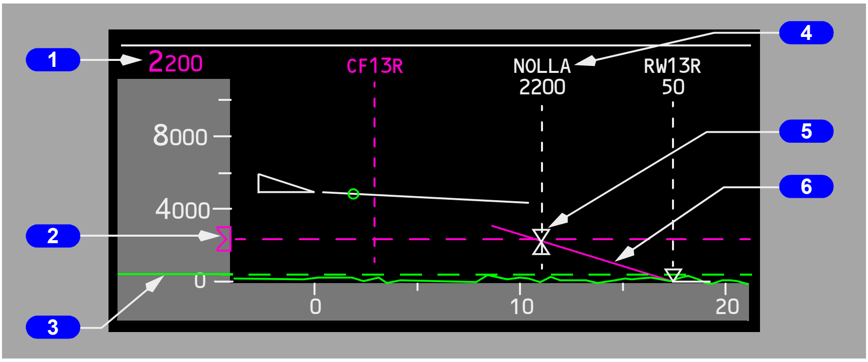
3 Airplane Symbol

Indicates current airplane altitude (bottom of the triangle) and lateral position (point of the triangle) relative to terrain.

4 Horizontal Reference Scale

Displays range in nautical miles. Actual range shown on VSD is one half the range selected on the EFIS control panel.

Vertical Situation Display (VSD) - General Background



1 MCP Selected Altitude Readout

Displays the altitude set in the MCP altitude window.

2 Selected Altitude Bug

Indicates the altitude set in the MCP altitude window.

When the selected altitude is off scale, the bug is parked at the top or bottom, with only one half the bug visible. The dashed line does not park.

3 Reference Altitude Marker

Indicates the barometric minimums selected on the EFIS control panel:

- marker and dashed line turn amber when airplane descends below selected minimum altitude
- reset with the RST switch on the EFIS control panel.

4 Waypoint ID and Anchor Line

Displayed with any altitude constraint directly beneath. Dashed vertical line depicts lateral position.

5 Altitude Constraint Symbol

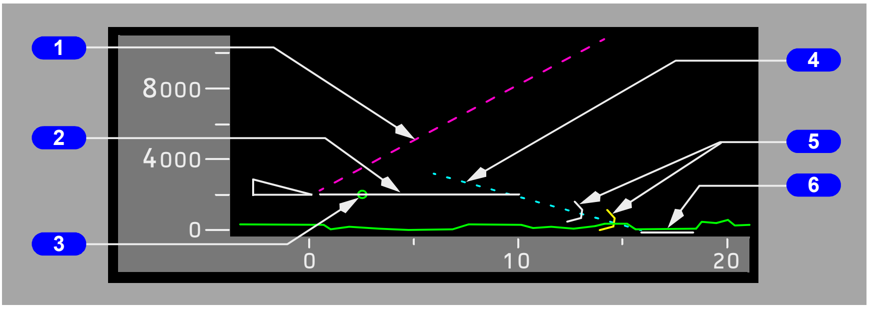
Displayed as triangle(s) on waypoint anchor line.

6 FMC Approach Glide Path Angle Line

Displayed for approaches that include a designated approach angle.

- extends 10 NM for situational awareness
- anchored to the missed approach waypoint, not the runway.
- manual altitude corrections do not change the displayed navigation Database defined glidepath.

Vertical Situation Display (VSD) - Flight Path Background



1 MCP Selected Vertical Speed (V/S)

Displays the selected vertical speed as a dashed target angle line when the MCP V/S mode is selected.

2 Vertical Flight Path Vector

Indicates current flight path angle as a function of vertical speed and ground speed. The length of the vector is fixed at one half of the VSD range.

3 Range to Target Speed Dot (RTSD)

Indicates where the airplane will achieve the FMC or MCP target speed.

- dot is blanked within 5 knots of target speed
- dot reappears if speed increases 10 knots or more faster than target speed
- replaced with an unfilled dot at vector end if target speed will not be achieved within length of the vertical flight path vector line.

4 3-Degree Reference Line

Displayed for approaches that do not have a designated approach angle.

- dashed line extends 10 NM for situational awareness
- anchored to the runway threshold
- for reference only, line may intersect terrain.

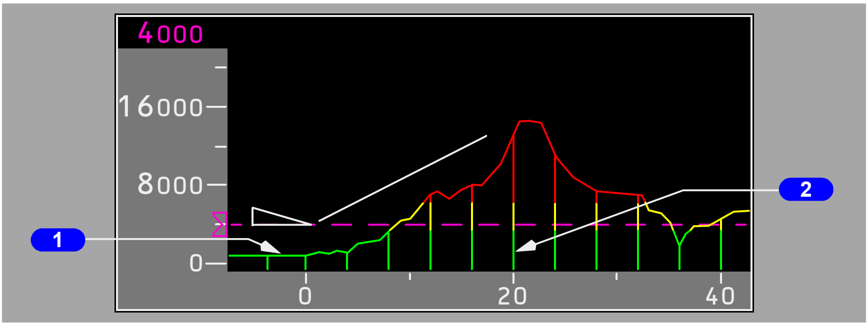
5 Decision Gates

Displayed on the FMC approach glide path angle line or 3 degree reference line at 500 feet and 1000 feet above field elevation.

6 Runway

Represents the selected runway.

Vertical Situation Display (VSD) - Terrain Background



1 Terrain Profile Line

Represents the highest terrain within the enroute swath.

- highest points of the terrain below and ahead of the airplane
- terrain is depicted so the true altitude separation between the airplane and terrain is shown
- terrain behind the airplane is drawn equal to the terrain at the current position
- VSD terrain uses the same color coding that is used to depict EGPWS terrain on the lateral map –
  - green: terrain is more than 500 feet (250 feet gear down) below the airplane
  - amber: terrain ranges from 500 feet below (250 feet gear down) to 2000 feet above the airplane
  - red: terrain is 2000 feet above the airplane.

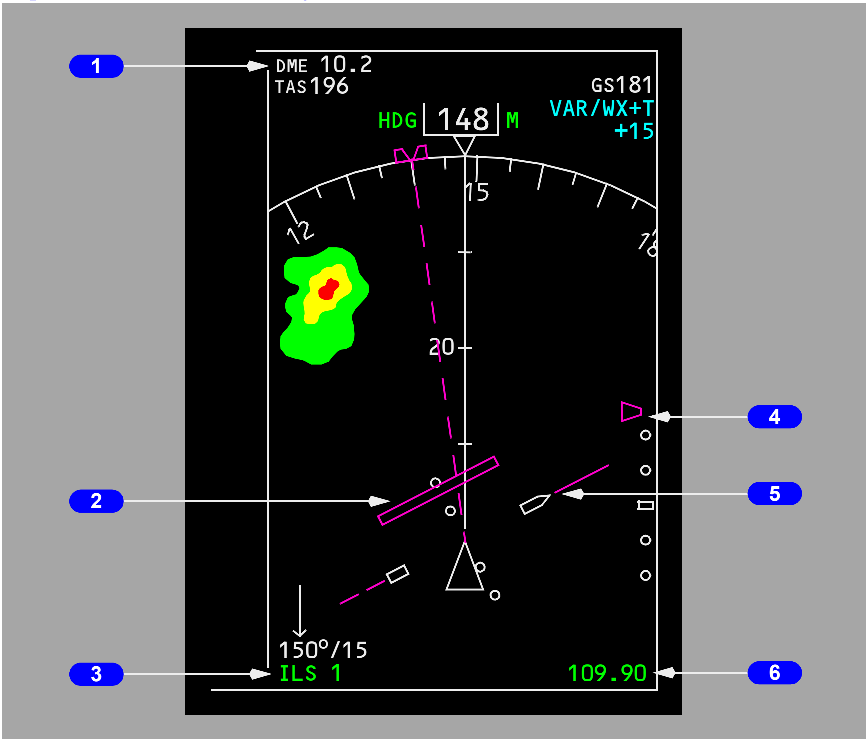
Note: See Chapter 15, Section 10, for Terrain Warnings.

2 Vertical Support Lines

Vertical terrain vectors placed at constant intervals along the terrain profile line.

Navigation Displays – Approach Mode
Expanded Approach Mode

[Option - Weather radar range marks]



1 Reference ILS DME

2 Localizer Deviation Indication and Scale

3 Reference ILS Receiver

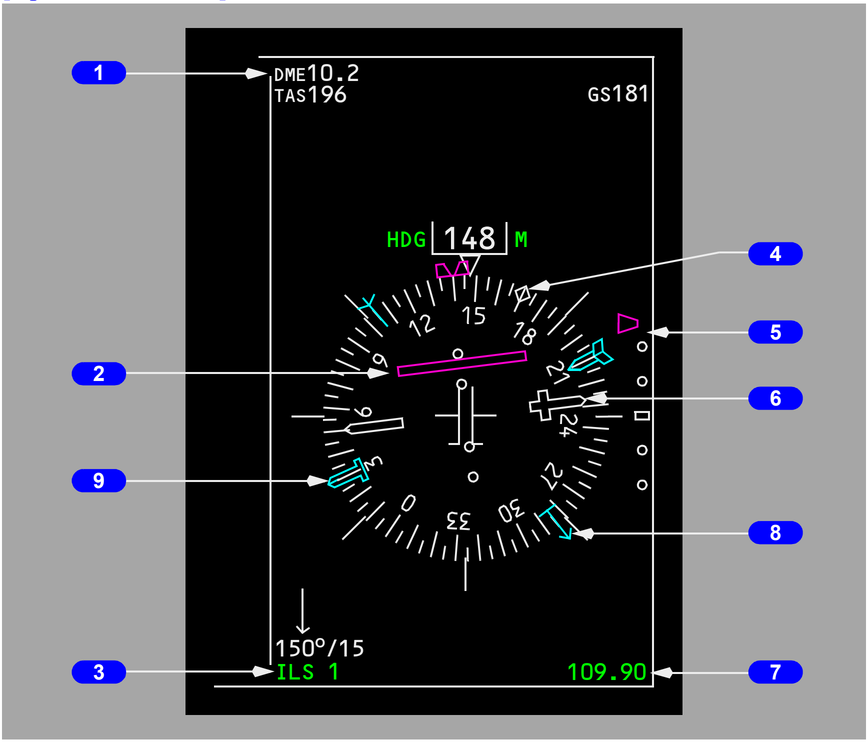
4 Glideslope Pointer and Scale

5 Selected Course Pointer

6 Reference ILS Frequency

Center Approach Mode

[Option - Dual ADF]



1 **Reference ILS DME**

2 **Localizer Deviation Indication and Scale**

3 **Reference ILS Receiver**

4 **Drift Angle Pointer**

5 **Glideslope Pointer and Scale**

6 **Selected Course Pointer**

7 **Reference ILS Frequency**

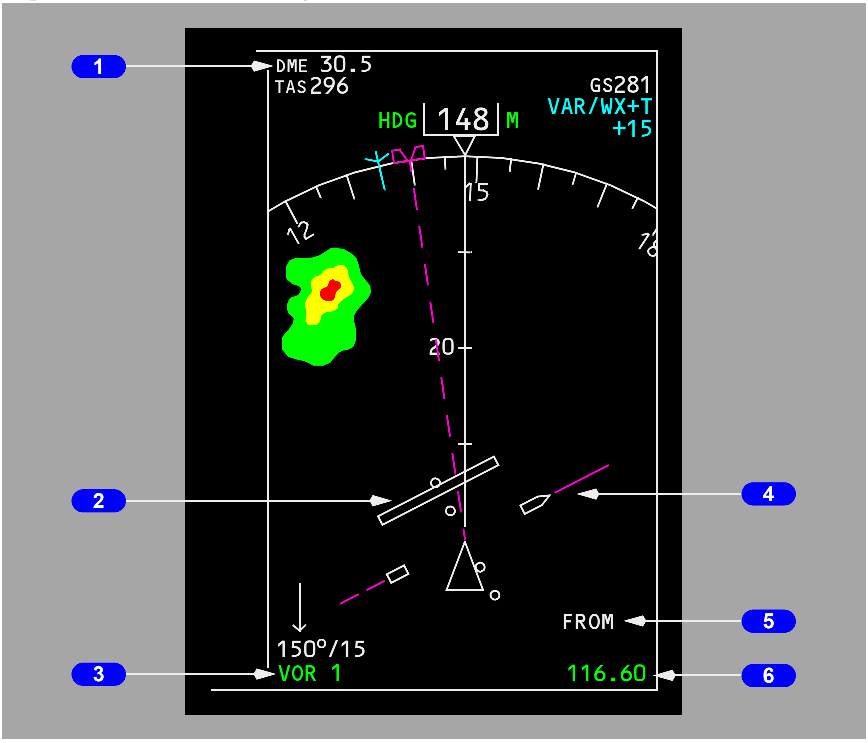
8 **ADF 1 Bearing Pointer**

[Option - Dual ADF]

9 ADF 2 Bearing Pointer

Navigation Displays – VOR Mode
Expanded VOR Mode

[Option - Weather radar range marks]



1 **Reference VOR DME**

2 **Lateral Deviation Indication and Scale**

3 **Reference VOR Receiver**

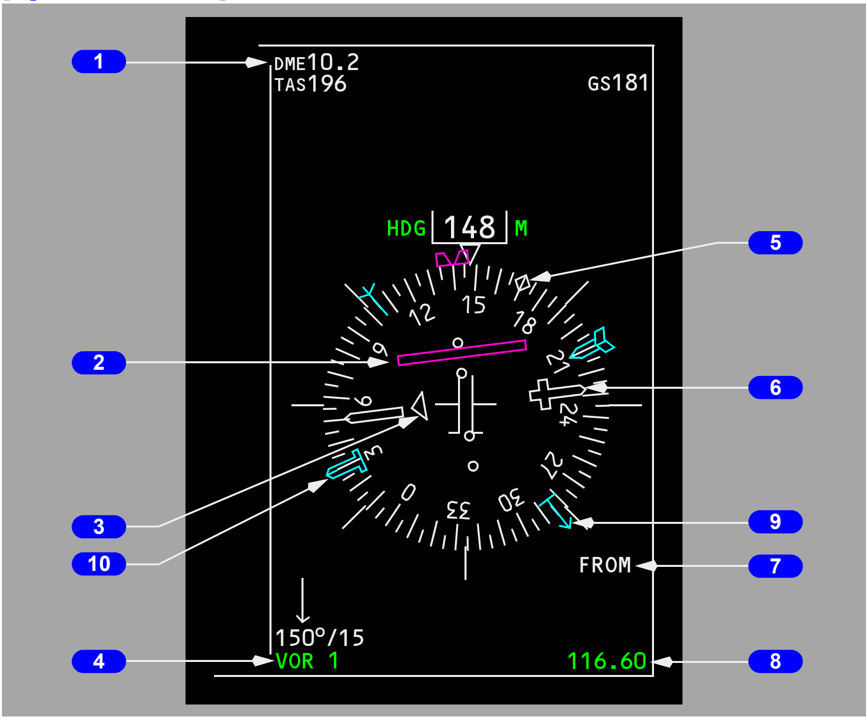
4 **Selected Course Pointer**

5 **TO/FROM Indication**

6 **Reference VOR Frequency**

Center VOR Mode

[Option - Dual ADF]



1 Reference VOR DME

2 Lateral Deviation Indication and Scale

3 TO/FROM Pointer

4 Reference VOR Receiver

5 Drift Angle Pointer

6 Selected Course Pointer

7 TO/FROM Indication

8 Reference VOR Frequency

9 ADF 1 Bearing Pointer

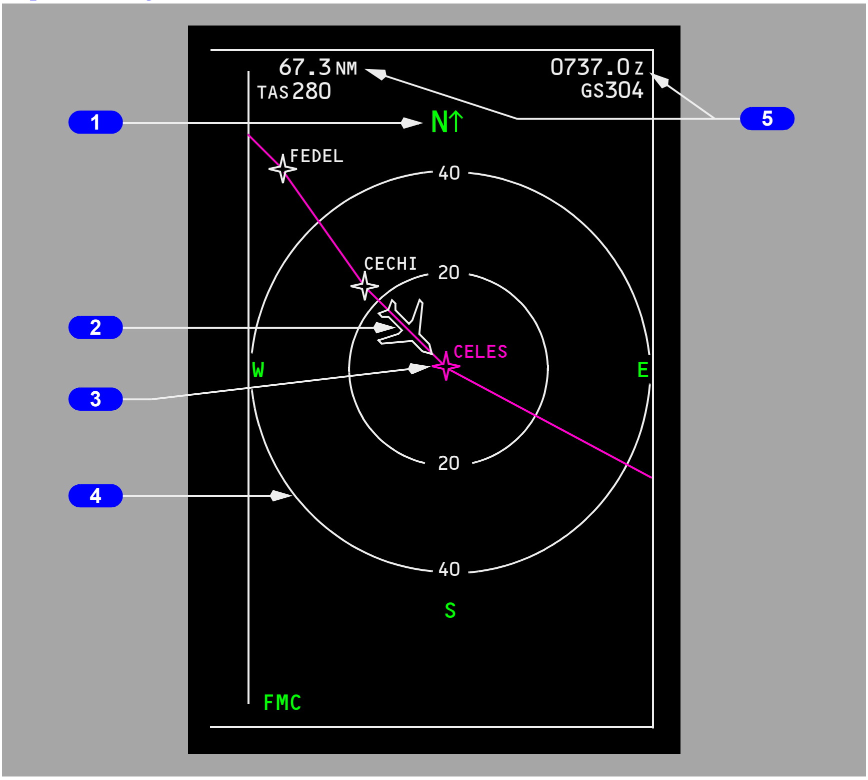
[Option - Dual ADF]

10 **ADF 2 Bearing Pointer**

Navigation Displays – Plan Mode

Plan Mode

[Option - Single FMC]



1 **True North Up Arrow**

2 **Airplane Symbol**

Denotes current position and true heading. Symbol does not display north of 82N latitude or south of 82S latitude.

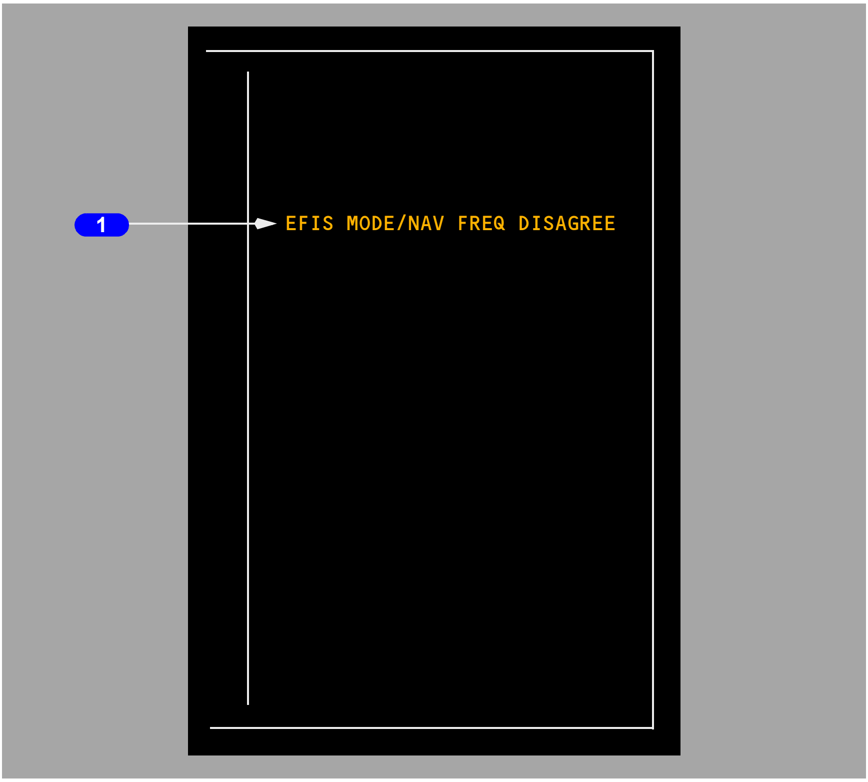
3 **Center Waypoint**

The waypoint located at the display center is identified as CTR on the CDU RTE LEGS page.

4 **Range Circle**

5 **Active Waypoint Information**

Navigation Displays – Alerts and Advisory Messages
Mode/Frequency Disagree Annunciation

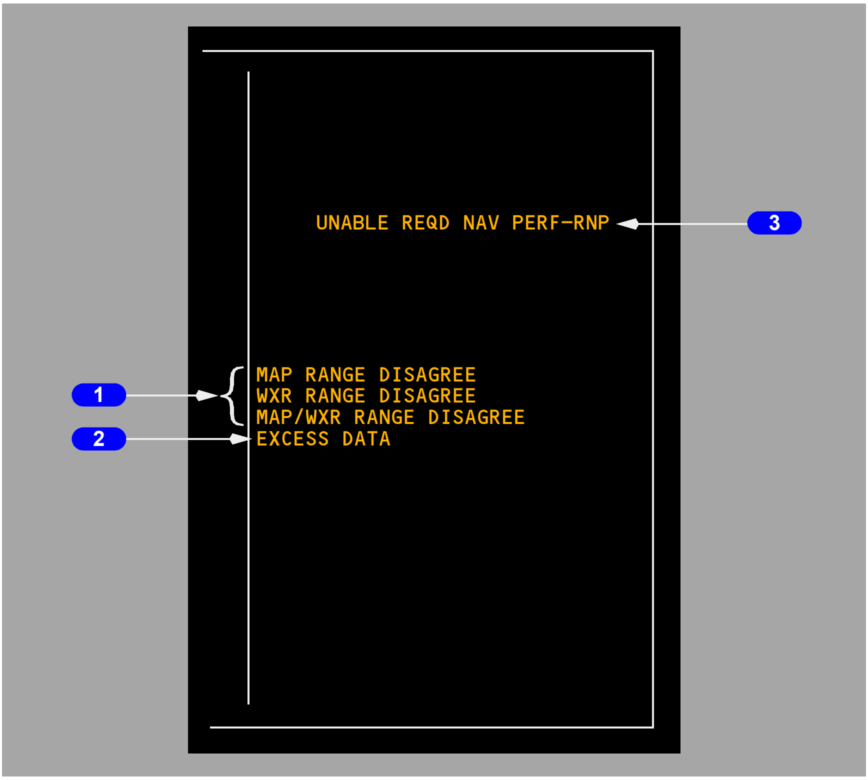


1 **Mode/Frequency Disagree Annunciation (amber)**

Indicates APP is selected with a VOR frequency tuned, or VOR is selected with an ILS frequency tuned.

- the annunciation only applies to an on–side comparison of the EFIS control panel mode and tuned VOR/ILS frequency
- applicable to expanded and center APP and VOR modes
- dashes displayed on DME display and ILS/VOR frequency display
- localizer course deviation bar, VOR course deviation bar, and glideslope pointer (for APP mode) are not displayed.

Navigation Advisory Messages



1 Range Disagreement Annunciations (amber)

MAP RANGE DISAGREE – Indicates selected range on the EFIS control panel is different than the MAP display range.

WXR RANGE DISAGREE – Indicates selected range on the EFIS control panel is different than the WXR display range.

MAP/WXR RANGE DISAGREE – Indicates selected range on the EFIS control panel is different than the MAP and WXR display ranges.

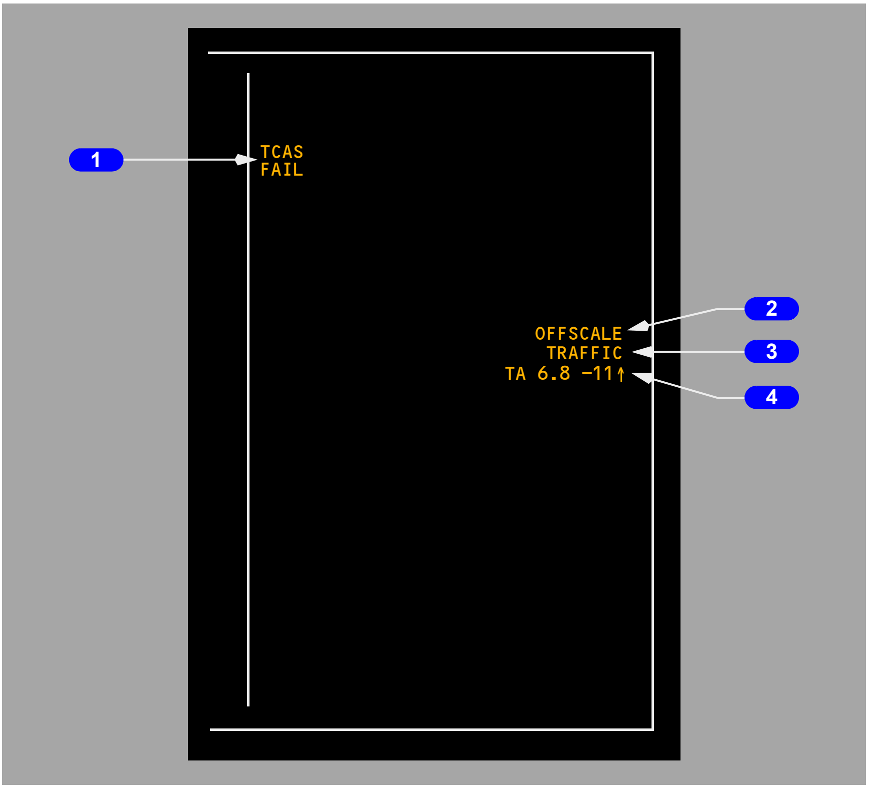
2 EXCESS DATA Annunciation (amber)

The amount of data sent to the navigation display exceeds the display capability.

3 **Nav Advisory Message (amber)**

UNABLE REQD NAV PERF– RNP – Displayed in MAP modes when FMC actual navigation performance is not sufficient for the displayed RNP. Refer to Chapter 11, Section 60, FMC Messages.

TCAS Messages



1 **TCAS Annunciations**

TFC (cyan) – TFC selected on the EFIS control panel in Expanded MAP, Center MAP, Expanded APP or Expanded VOR modes.

TCAS TEST (cyan) – TCAS in test mode.

TCAS FAIL (amber) – TCAS has failed.

TA ONLY (cyan) – TCAS TA only mode.

TCAS OFF (amber) – TCAS off.

2 **OFFSCALE (red or amber)**

TA (amber) or RA (red) is beyond the display range.

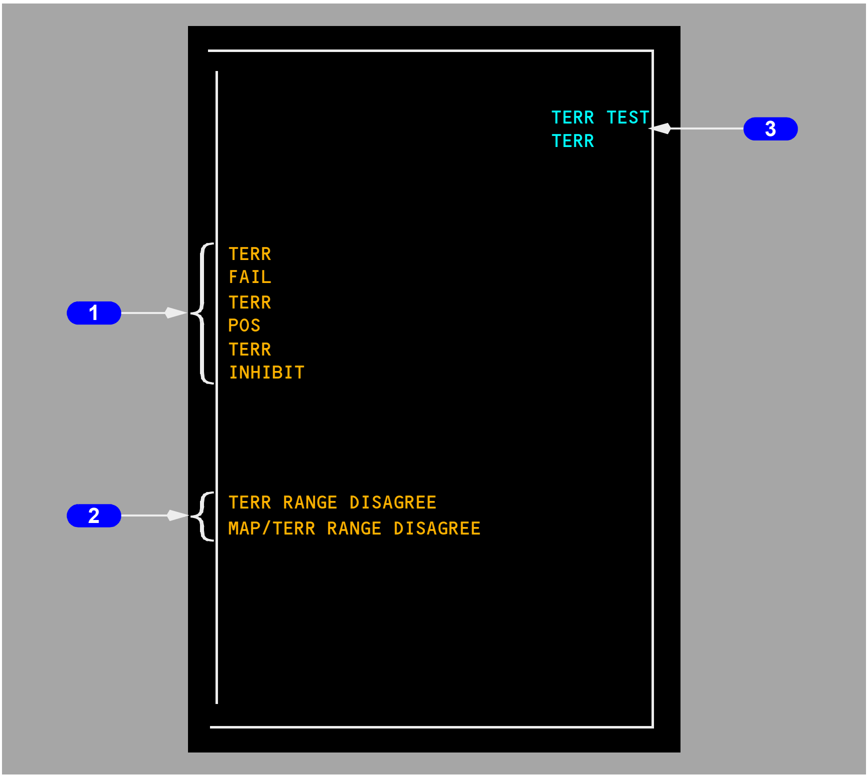
3 **TRAFFIC (red or amber)**

Displayed during a TA (amber) or RA (red) condition.

4 **No Bearing Message (red or amber)**

Displayed when no bearing information is available for traffic.

Look-Ahead Terrain Messages (GPWS)



1 **Terrain Status Annunciation (amber)**

TERR FAIL – Look-ahead terrain alerting and display have failed.

TERR POS – Look-ahead terrain alerting and display unavailable due to position uncertainty.

TERR INHIBIT – GPWS terrain inhibit switch in TERR INHIBIT position.

2 Terrain Range Status Annunciation (amber)

TERR RANGE DISAGREE –

- terrain display enabled, and
- terrain output range disagrees with selected EFIS control panel range.

MAP/TERR RANGE DISAGREE –

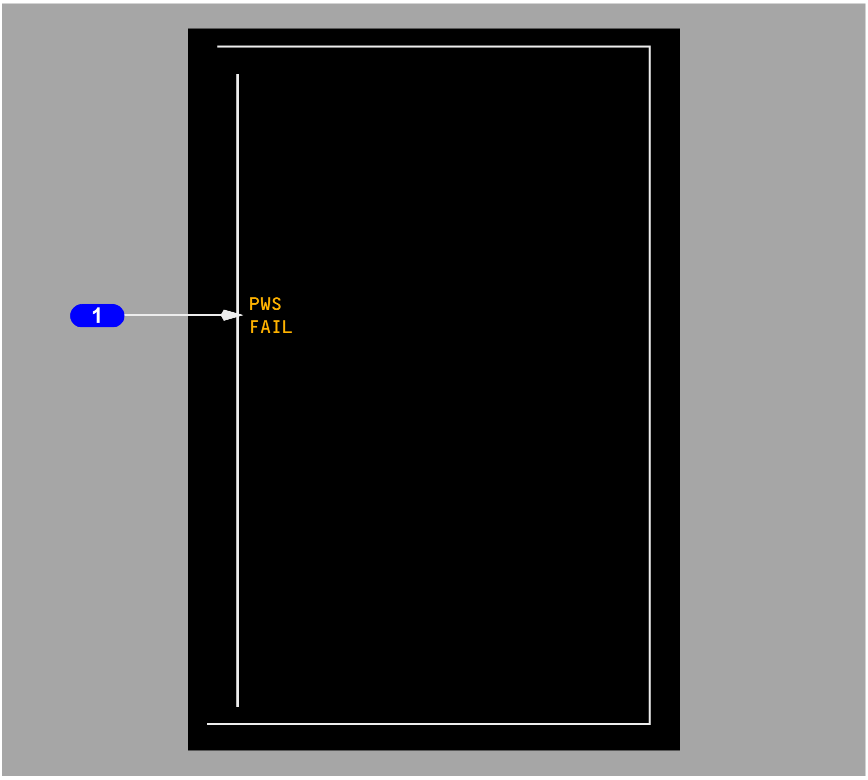
- terrain display enabled, and
- terrain output range disagrees with selected EFIS control panel range, and
- map display output range disagrees with selected EFIS control panel range.

3 Terrain Mode Annunciation (cyan)

TERR TEST – GPWS is operating in self-test mode.

TERR – Terrain display enabled (manual or automatic display).

Predictive Windshear System (PWS) Message



1 **PWS FAIL Annunciation (amber)**

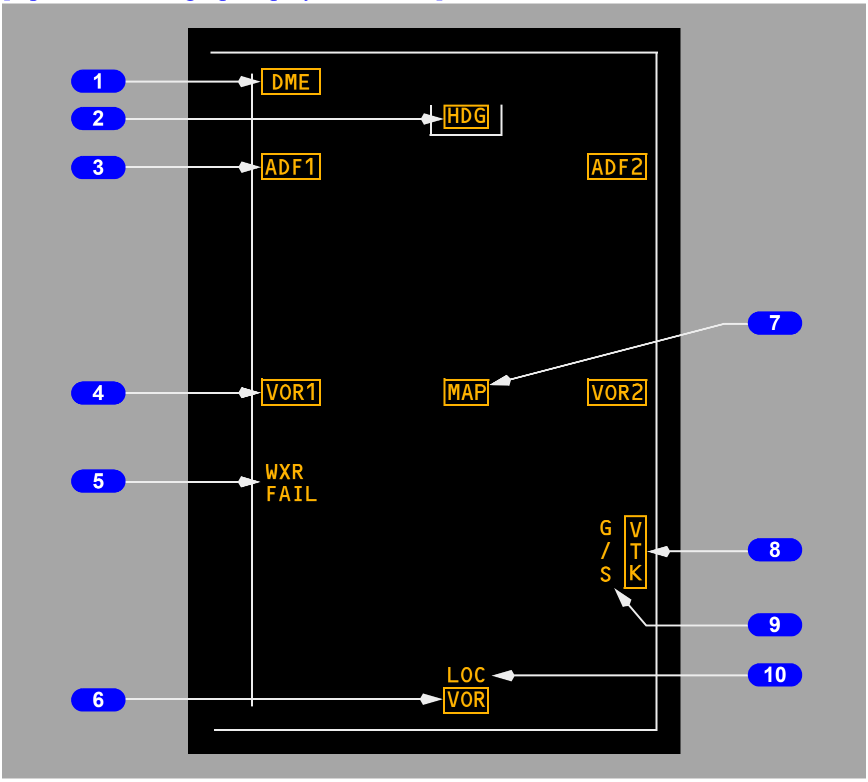
Predictive windshear alerting and display have failed.

Navigation Displays – Failure Indications and Flags

Dashes replace numbers if there is no computed information. Failure flags replace symbols or failure messages are displayed, as appropriate.

Expanded MAP, Center MAP, Expanded APP, Expanded VOR Modes

[Option - Heading-up display, dual ADF]



1 DME Failure Flag (APP and VOR modes)

DME indication has failed.

[Option - Heading-up display]

2 Heading Failure Flag (MAP, APP and VOR modes)

Heading information failed. Heading cannot be displayed.

[Option - Full time ADF in MAP mode]

3 ADF Failure Flag (MAP, APP and VOR modes)

ADF indication has failed.

4 VOR Failure Flag (MAP modes)

EFIS control panel POS switch selected and VOR has failed.

5 Weather Radar Annunciations (MAP, APP and VOR modes)

WXR FAIL – Weather radar has failed. No weather data are displayed.

WXR WEAK – Weather radar calibration fault.

WXR ATT – Attitude stabilization for antenna has been lost.

WXR STAB – Antenna stabilization is off.

WXR DSP – Display unit cooling has been lost or an overheat condition has occurred. Weather radar display is blanked.

6 VOR Failure Flag (VOR modes)

VOR indication has failed.

7 MAP Failure Flag (MAP modes)

The related FMC generated map display has failed.

8 Vertical Track Failure Flag (MAP modes)

FMC vertical track data is invalid.

9 ILS Glideslope Failure Flag (APP modes)

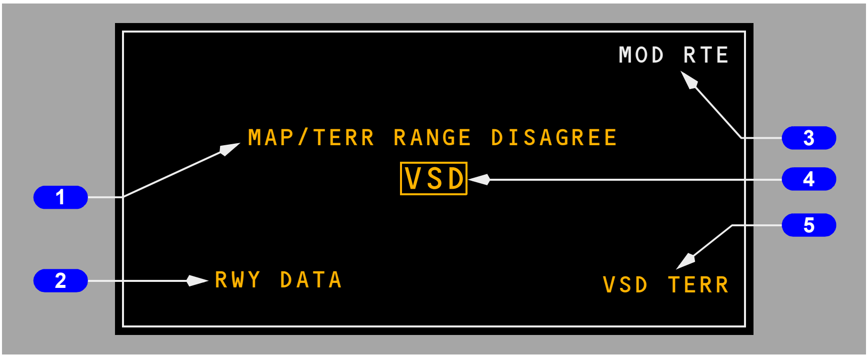
ILS glideslope has failed.

10 ILS Localizer Failure Flag (APP modes)

ILS localizer course indication has failed.

Vertical Situation Display (VSD)

[Option VSD]



1 Range Disagreement Annunciations (amber)

MAP RANGE DISAGREE – Indicates selected range on the EFIS control panel is different than the MAP display range.

TERR RANGE DISAGREE – Indicates selected range on the EFIS control panel is different than the Terrain display range.

MAP/TERR RANGE DISAGREE – Indicates selected range on the EFIS control panel is different than the MAP and Terrain display ranges.

2 Runway Data Annunciation (amber)

FMC runway data is not available.

3 Route Waypoints Modification Annunciation (white)

FMC active route is being modified. Only active waypoint is displayed.

4 VSD Failure Flag (amber)

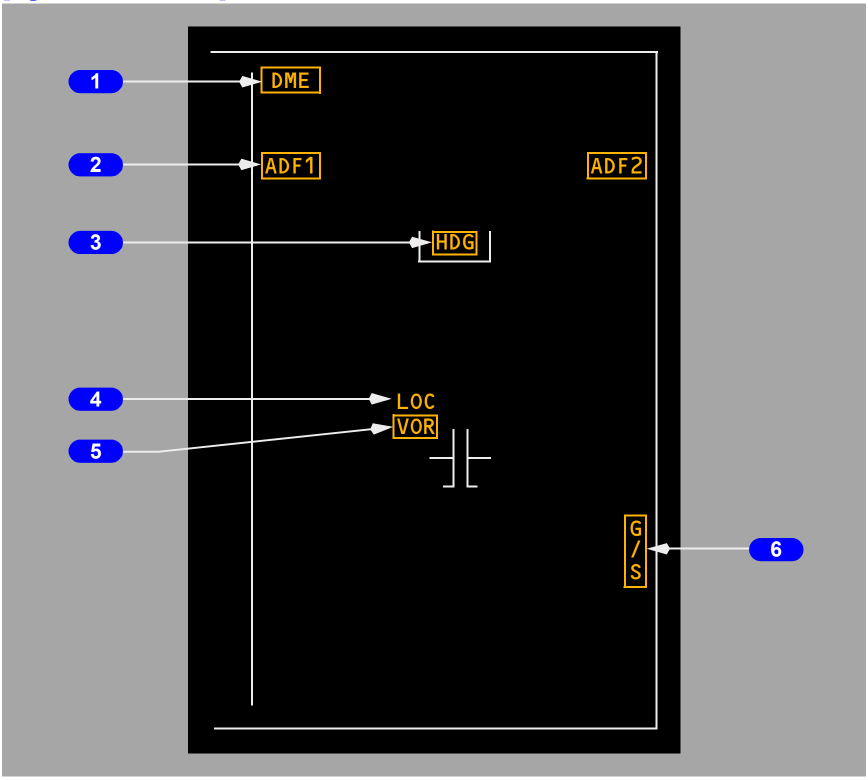
VSD cannot be displayed.

5 Terrain Data Failure Annunciation (amber)

EGPWS terrain data is not available. Annunciation is replaced with VSD TERR INHIBIT when GPWS control panel TERR INHIBIT switch is in the inhibit position.

Center APP and Center VOR Modes

[Option - Dual ADF]



1 DME Failure Flag (APP and VOR modes)

DME indication has failed.

2 ADF Failure Flag (APP and VOR modes)

ADF has failed.

3 Heading Failure Flag (APP and VOR modes)

Heading information failed. Heading cannot be displayed.

4 ILS Localizer Failure Flag (APP modes)

ILS localizer indication has failed.

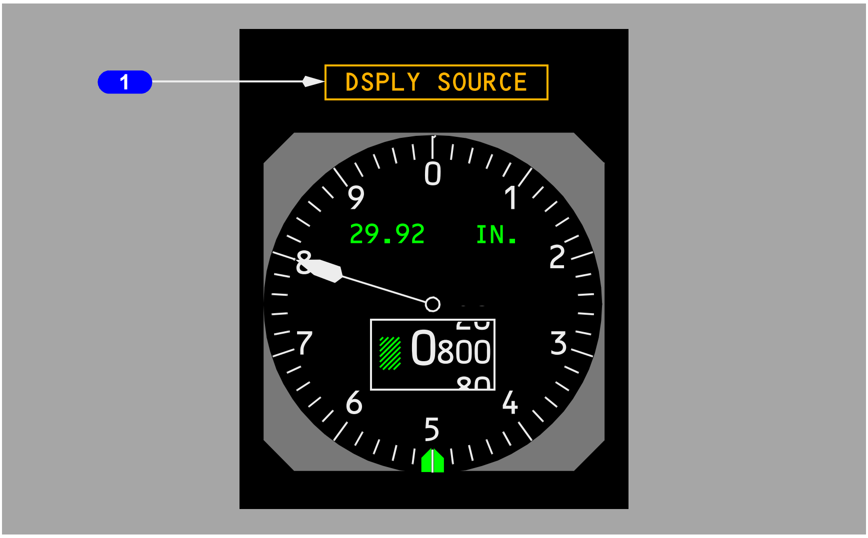
5 **VOR Failure Flag (VOR modes)**

VOR indication has failed.

6 **ILS Glideslope Failure Flag (APP modes)**

ILS glideslope indication has failed.

Additional Flags and Annunciations
Display System Annunciations



1 **Display System Annunciations**

When there is a problem with the DEU display system, one of the following annunciations will appear above the altimeter:

DSPLY SOURCE (amber) – A DEU has failed.

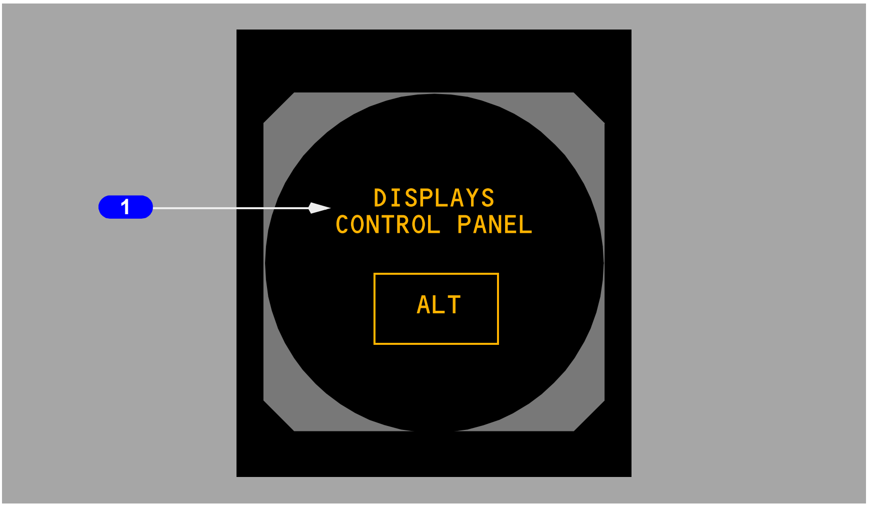
- If a DEU fails above FL220 –
  - the autopilot and flight directors are not affected
- If a DEU fails during climb or descent below FL220 with the failed side autopilot engaged –
  - the flight director pitch command bar is removed from both pilots' displays
  - the flight director pitch command bar reappears at ALT ACQ
  - the autopilot engages in CWS P
  - LVL CHG, VNAV, and V/S are not available with the failed side autopilot

- If a DEU fails during level flight below FL220 with the failed side autopilot engaged –
  - climb or descent to a new altitude is only possible in CWS P
- If a DEU fails in the approach mode above 400 feet with both flight directors on –
  - the flight director pitch and roll command bars are removed from the display on the failed side
- If a DEU fails prior to engaging the second autopilot for a dual autopilot approach –
  - engagement of the second autopilot is inhibited.

CDS MAINT (white) – A dispatchable CDS fault has occurred. Displayed on the ground only, prior to start of the second engine.

CDS FAULT (amber) – A non–dispatchable CDS fault has occurred. Displayed on the ground only, prior to start of the second engine.

Displays Control Panel Annunciation



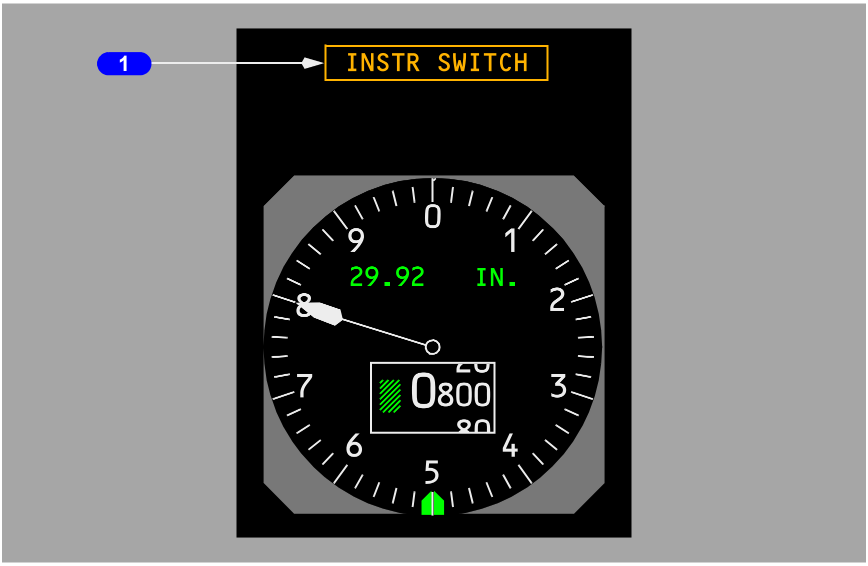
1 Displays Control Panel Annunciation (amber)

Indicates a failed EFIS control panel on the affected side. When DISPLAYS CONTROL PANEL appears, altitude information is removed.

With the CONTROL PANEL select switch on the overhead panel in:

- BOTH ON 1 – Both the Captain's and First Officer's CDS displays and baro are controlled from the left EFIS panel
- NORMAL – Left EFIS panel controls Captain's CDS displays and baro, Right EFIS panel controls First Officer's CDS displays and baro
- BOTH ON 2 – Both the Captain's and First Officer's CDS displays and baro are controlled from the right EFIS panel.

Instrument Switch Annunciation



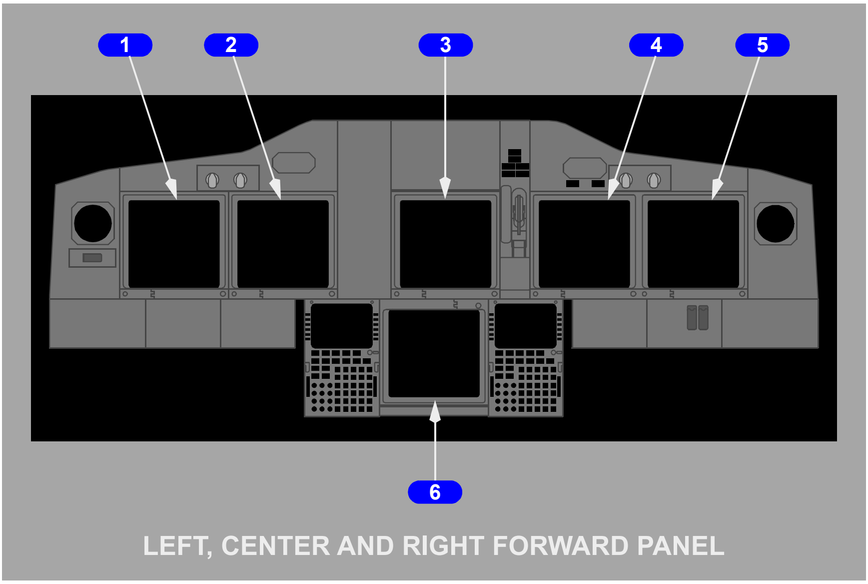
1 INSTR SWITCH Annunciation (amber)

Indicates both the Captain's and First Officer's displays are using the same source of IRU data. Displayed when the IRS switch on the overhead panel is not in the NORMAL position. See Chapter 11, Section 10 for Inertial Reference Transfer Switch information.

Intentionally
Blank

PFD/ND Display System – Overview

Display Units



1 Captain Outboard Display Unit

2 Captain Inboard Display Unit

3 Upper Display Unit

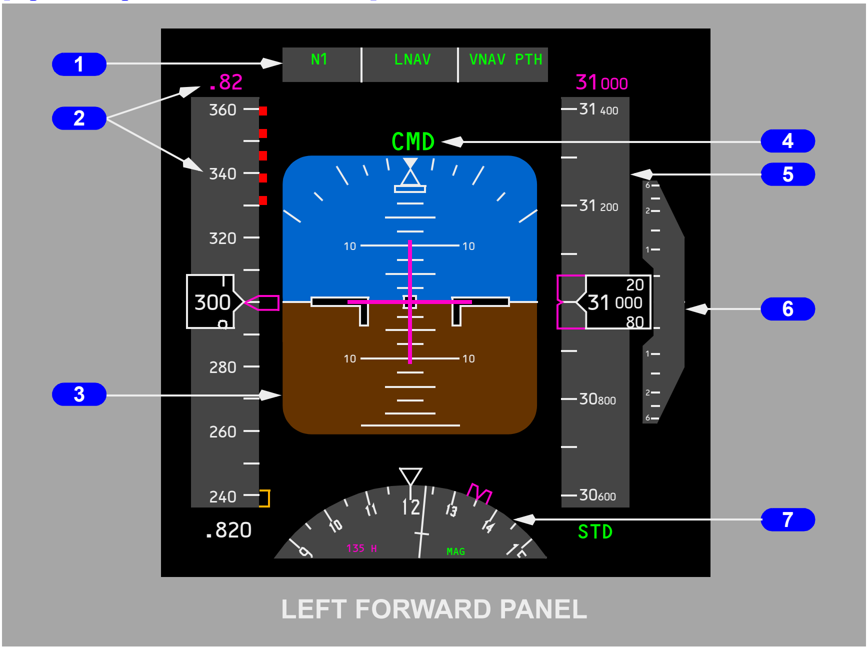
4 First Officer Inboard Display Unit

5 First Officer Outboard Display Unit

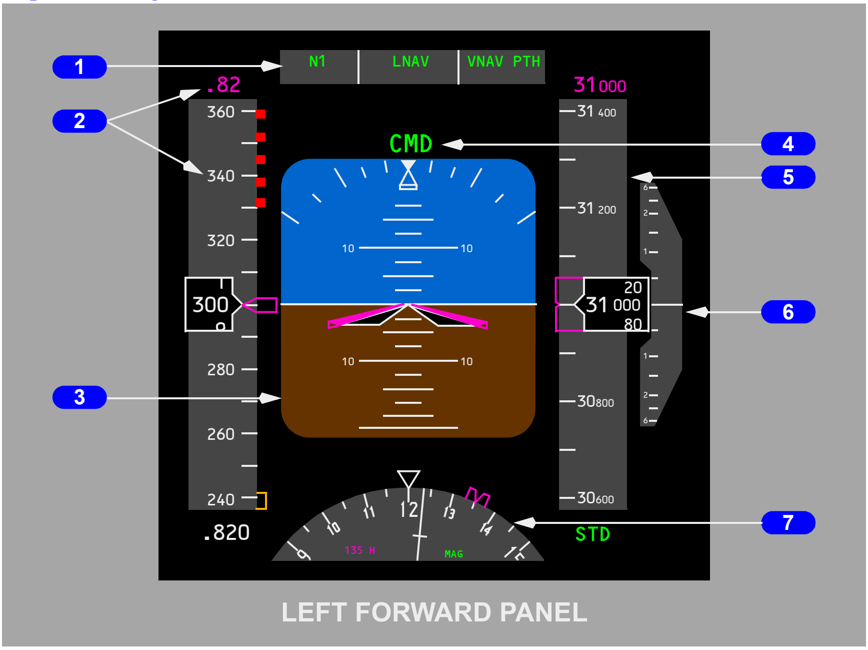
6 Lower Display Unit

Captain Outboard Display

[Option - Split axis command bars]



[Option - Integrated cue command bar]



1 **Flight Mode Annunciator**

Displays current flight modes; refer to Chapter 4, Automatic Flight.

2 **Airspeed/Mach Indications**

3 **Attitude Indications**

4 **Autopilot, Flight Director System Status**

5 **Altitude Indications**

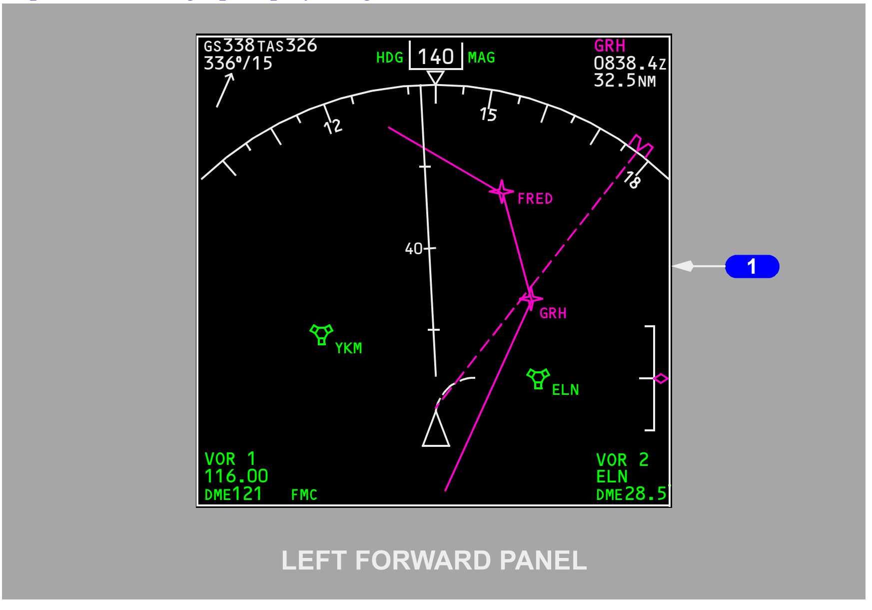
6 **Vertical Speed Indications**

7 **Heading/Track Indications**

Captain Inboard Display

[Option - Track-up display, dual FMC]

[Option - Heading-up display, single FMC]

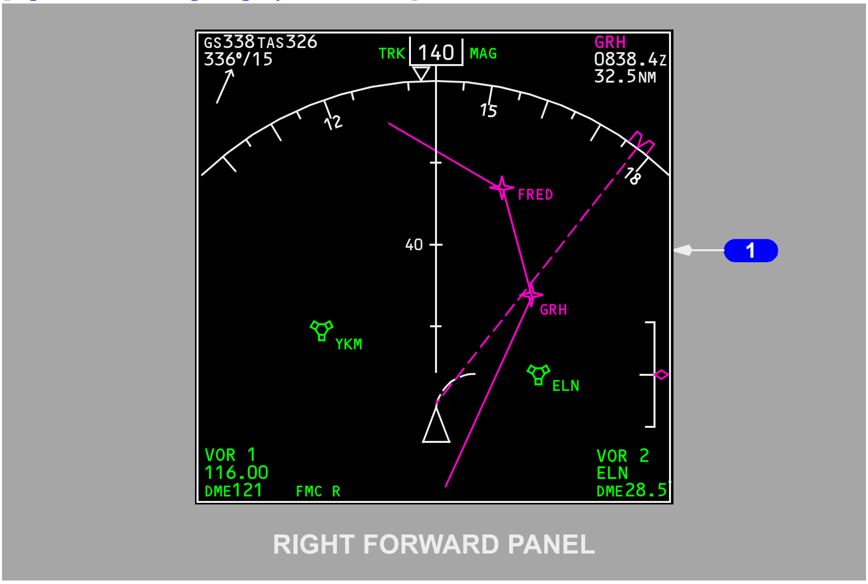


1 Navigation Display

Displays map, approach, VOR, or plan modes as selected on the EFIS control panel.

First Officer Inboard Display

[Option - Track-up display, dual FMC]



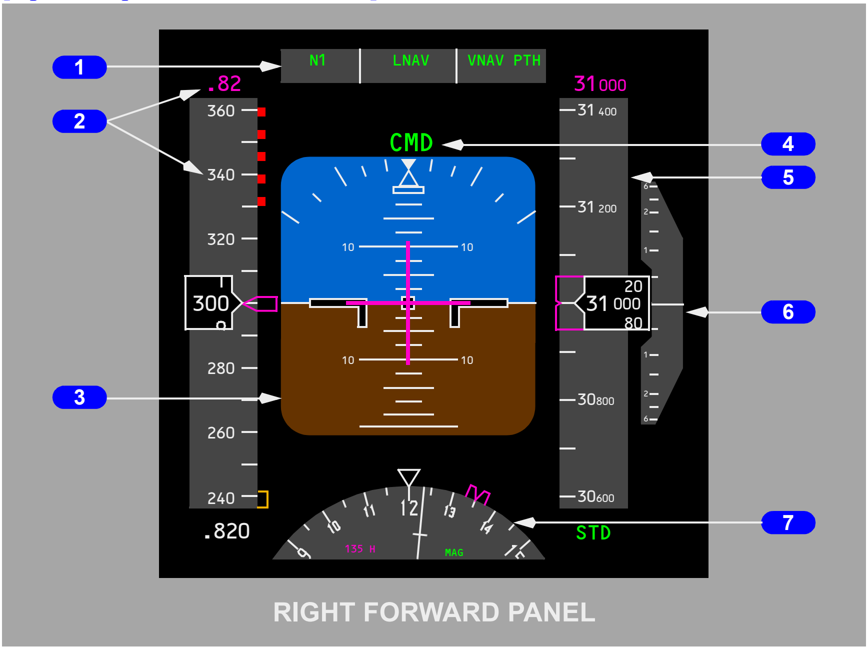
[Option - Heading-up display, single FMC]

1 Navigation Display

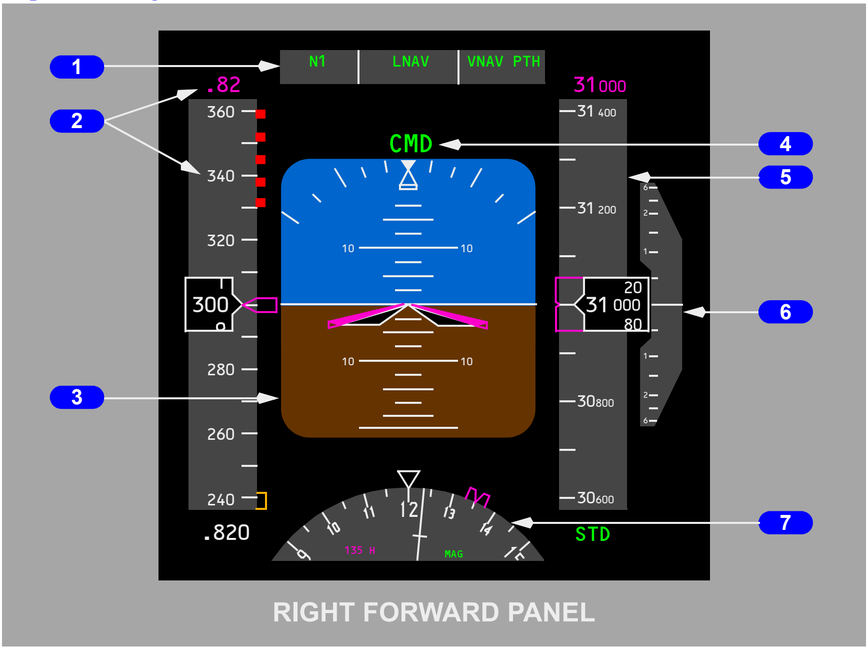
Displays map, approach, VOR, or plan modes as selected on the EFIS control panel.

First Officer Outboard Display

[Option - Split axis command bars]



[Option - Integrated cue command bar]



1 **Flight Mode Annunciator**

Displays current flight modes; refer to Chapter 4, Automatic Flight.

2 **Airspeed/Mach Indications**

3 **Attitude Indications**

4 **Autopilot, Flight Director System Status**

5 **Altitude Indications**

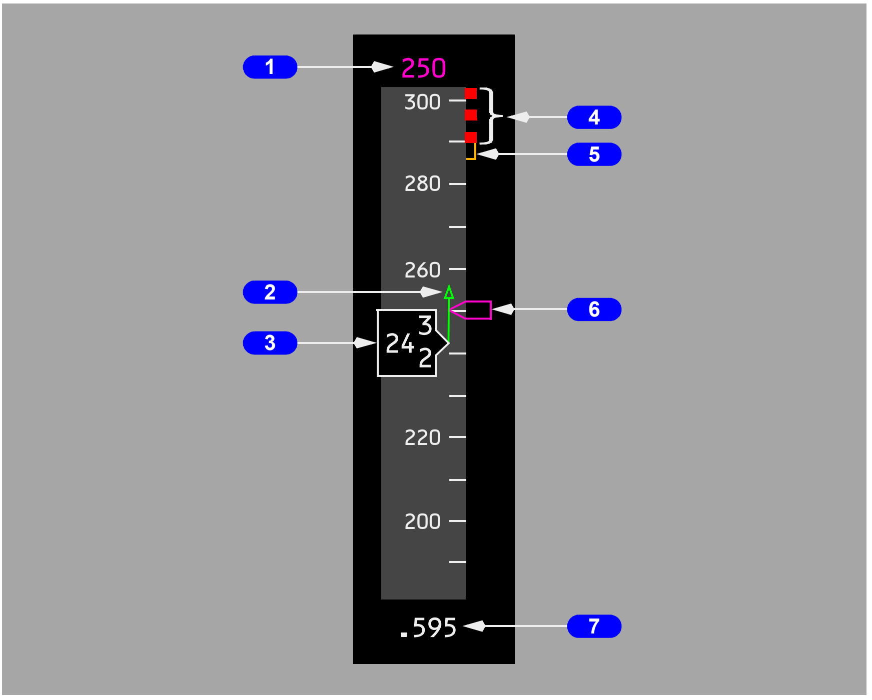
6 **Vertical Speed Indications**

7 **Heading/Track Indications**

PFD Airspeed Indications

Airspeed Indications – General

The PFD airspeed indication displays air data inertial reference system (ADIRS) airspeed and other airspeed related information.



1 Selected Speed (magenta)

Displays target airspeed:

- indicates the airspeed manually selected in the IAS/MACH window
- indicates the FMC computed airspeed when the IAS/MACH window is blank.

2 Speed Trend Vector (green)

Tip of arrow indicates predicted airspeed in the next 10 seconds based on the current airspeed and acceleration.

3 Current Airspeed (white)

Indicates current calibrated airspeed when above 45 knots.

[Option - Low airspeed alert]
When current airspeed decreases into the minimum maneuver speed amber bar:

- airspeed readout box turns amber and flashes for 10 seconds

[Option - Voice Airspeed Low Alert]
- voice alert annunciate “Airspeed Low, Airspeed Low” once
- box returns to white when airspeed is above minimum maneuver speed.

4 Maximum Operating Speed (red and black)

Bottom of the bar indicates the maximum speed as limited by the lowest of the following:

- Vmo/Mmo
- landing gear placard speed
- flap placard speed.

5 Maximum Maneuver Speed/High Speed Buffet (amber)

When flaps are up, the bottom of the amber bar indicates the maximum maneuver speed. This airspeed provides 1.3g maneuver capability to high speed buffet (or an alternative approved maneuver capability set in the FMC maintenance pages). The bar may be displayed when operating at high altitude at relatively high gross weights.

Note: 1.3g maneuver capability occurs at 40 degrees of bank in level flight.

6 Speed Bug (magenta)

Points to the airspeed:

- manually selected in the IAS/MACH window
- indicates the FMC computed airspeed when the IAS/MACH window is blank.

When the selected speed is off scale, the bug is parked at the top or bottom of the tape, with only one half bug visible.

[Option - Without groundspeed displayed]
7 Current Mach (white)

Indicates current Mach number:

- displays when airspeed is 0.40 Mach and above
- blanks when airspeed decreases below 0.40 Mach.

[Option - With groundspeed displayed]

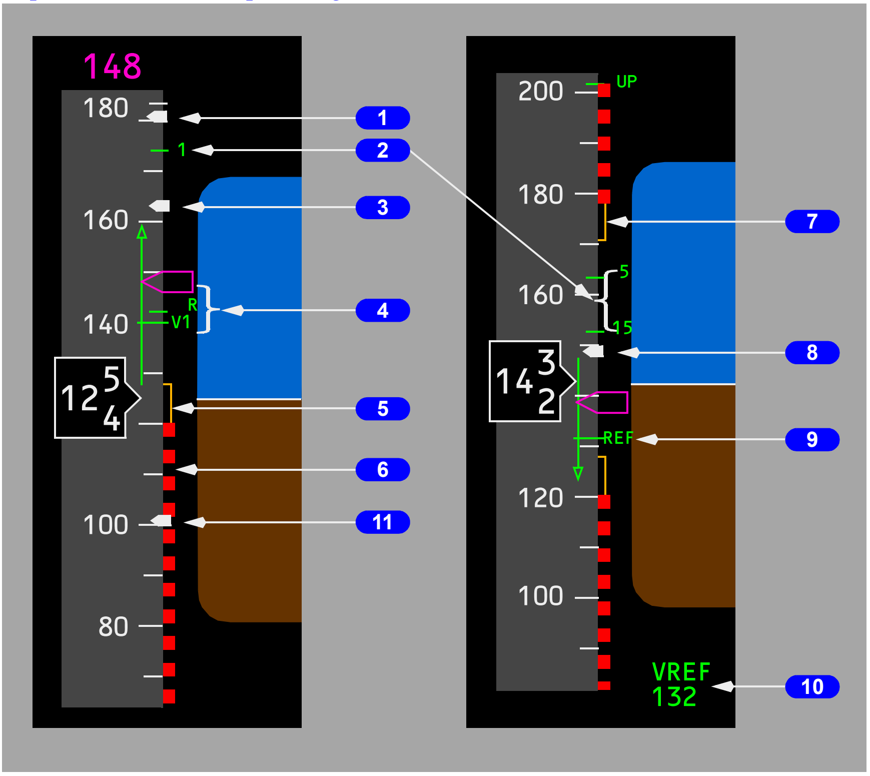
7 Current Mach/Groundspeed (white)

Indicates current Mach or groundspeed:

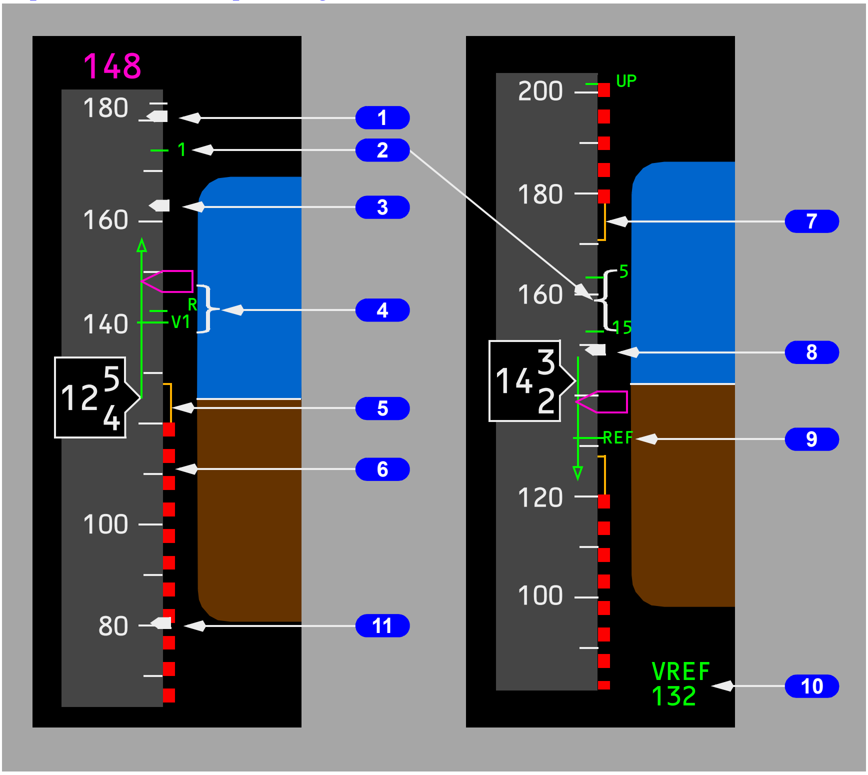
- displays Mach when airspeed is 0.40 Mach and above
- displays groundspeed when airspeed decreases below 0.40 Mach
- when transitioning from Mach to groundspeed or from groundspeed to Mach, a white box shows around the numeric value for 10 seconds.

Airspeed Indications – Takeoff and Approach

[Option - 100 knot airspeed bug]



[Option - 80 knot airspeed bug]



1 **Bug 5 (white)**

Displayed if speed reference selector on the engine display control panel is in the bug 5 position or SET position and a value greater than 60 knots has been selected. Not available if the speed reference selector is in the AUTO position.

2 **Flaps Maneuvering Speeds (green)**

Indicates flap maneuvering speed for the displayed flap position:

- displayed after gross weight is entered in the CDU or after takeoff gross weight is set with the speed reference selector
- when the V2+15 bug is displayed for takeoff, the flap maneuvering speed bug for the current flap setting is not displayed, except for flaps 1 takeoff
- numbered flap maneuvering speed bugs are removed when flap lever is moved to flaps 30 or 40
- flap bugs inhibited if less than VREF +4
- UP bug not displayed above approximately 20,000 feet altitude.

3 V2+15 (white)

Displayed for takeoff.

Removed when either of the following occurs:

- at first flap retraction
- when VREF is entered in the CDU.

4 Takeoff Reference Speeds (green)

Indicates V1 (decision speed “V1”) and VR (rotation speed “VR”) as selected on the CDU TAKEOFF REF page (refer to Chapter 11, Flight Management, Navigation) or as set with the SPD REF selector switch:

- amber NO VSPD is displayed on the ground if V1 and VR are not selected on the CDU or are not set with the SPD REF selector
- displayed for takeoff when speed is greater than 80 knots
- removed at lift–off
- V1 speed is displayed at the top of airspeed indication when selected and value is off scale

[Option - V1 aural alert]
- V1 is automatically called out by voice aural.

5 Minimum Maneuver Speed (amber)

The amber bar is displayed with the first flap retraction after takeoff or when a valid Vref is entered.

Top of amber bar indicates minimum maneuver speed. This airspeed provides

- 1.3g maneuver capability to stick shaker below approximately 20,000 ft.
- 1.3g maneuver capability to low speed buffet (or an alternative approved maneuver capability set in the FMC maintenance pages) above approximately 20,000 ft.

Note: 1.3g maneuver capability occurs at 40 degrees of bank in level flight.

CAUTION: Reduced maneuver capability exists when operating within the amber regions below the minimum maneuver speed or above the maximum maneuver speed. During non-normal conditions the target speed may be below the minimum maneuver speed.

6 Minimum Speed (red and black)

Top of bar indicates the speed at which stick shaker occurs.

7 Maximum Maneuver Speed/Next Flap Position Placard Speed (amber)

Shortly after takeoff the amber bar may be displayed until airspeed exceeds 160 knots or until first flap retraction.

[Option] - CDS Software Upgrade - BP02/04/06
When flaps are not up, the bottom of the amber bar indicates the placard speed for the next normal flap setting. The display logic is based on a normal flap setting sequence of 1, 5, 15, 30, 40. The bar is removed when the flap handle is moved to the landing flap setting selected on the APPROACH REF page or when the flap lever is moved to flaps 40. It is also removed with any flap retraction.

8 VREF+15 (white)

Displayed with selection of VREF.

8 VREF+20 (white)

Displayed with selection of VREF.

9 Landing Reference Speed (green)

Indicates REF (reference speed) as selected on the CDU APPROACH REF page (refer to Chapter 11, Flight Management, Navigation) or as set with the speed reference selector on the engine display control panel.

REF speed is displayed at the bottom of airspeed indication when selected and value is off scale.

10 Speed Reference Display (green)

Displayed if the airspeed and/or weight is entered via the speed reference selector on the engine display control panel:

- on the ground, V1, VR, and takeoff gross weight may be selected; if VREF is selected, INVALID ENTRY is displayed
- in flight, VREF and landing gross weight may be selected; if V1 or VR is selected, INVALID ENTRY is displayed
- removed when the speed reference selector is moved to the SET position.
- MAN SPD (white) indicates that the speed reference selector is in the SET position.

[Option - 100 knot airspeed bug]
11 100 Knot Airspeed Bug (white)

Indicates 100 knots:

- displayed automatically during preflight
- removed at first flap retraction or when VREF is entered.

[Option - 80 knot airspeed bug]

11 80 Knot Airspeed Bug (white)

Indicates 80 knots:

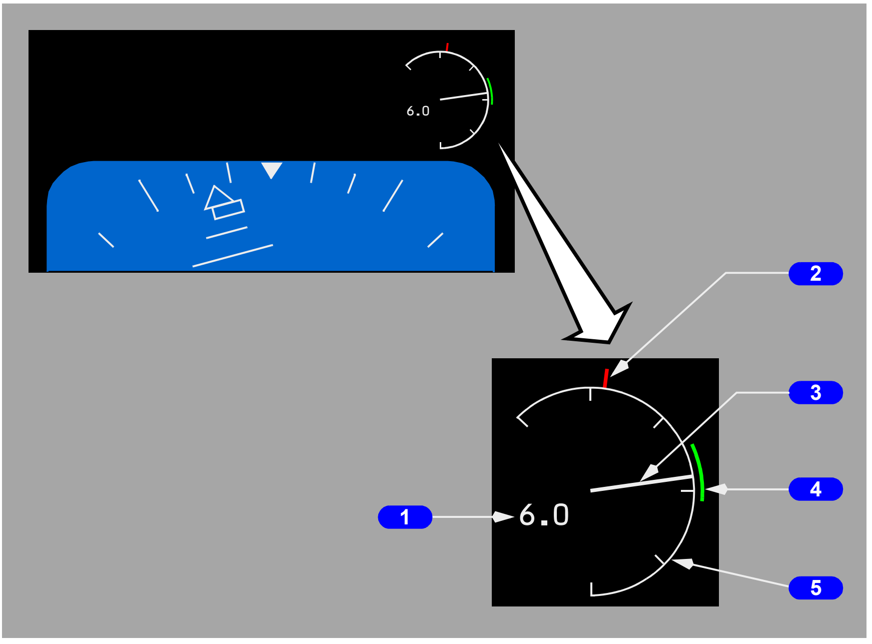
- displayed automatically during preflight
- removed at first flap retraction or when VREF is entered.

PFD Angle of Attack (AOA) Indications

[Option]

Angle of Attack Indications - General

The angle of attack indications display ADIRU aircraft body angle of attack.



1 Digital AOA Readout (white)

Indicates digital AOA value to the nearest 0.2 degrees. When on the ground and ground speed less than 80 knots, the readout is fixed at 0.0 degrees.

2 Stick Shaker Indicator (red)

Indicates point at which stick shaker activation occurs for existing flight conditions.

Blank if AOA signal is invalid.

3 Analog Needle (white)

Indicates analog AOA value.

- needle travel is limited to a range of – 6 degrees and +21 degrees
- fixed at 0.0 degrees when on the ground and ground speed is less than 80 knots.

4 Approach Reference Band (green)

Indicates appropriate range of approach AOA for a Vref(xx) + 5 approach.

- displayed when in normal or single engine landing flaps (15, 30, 40)
- moves with flap position
- inhibited on takeoff and initial climb.

5 Zero Degree Reference Line (white)

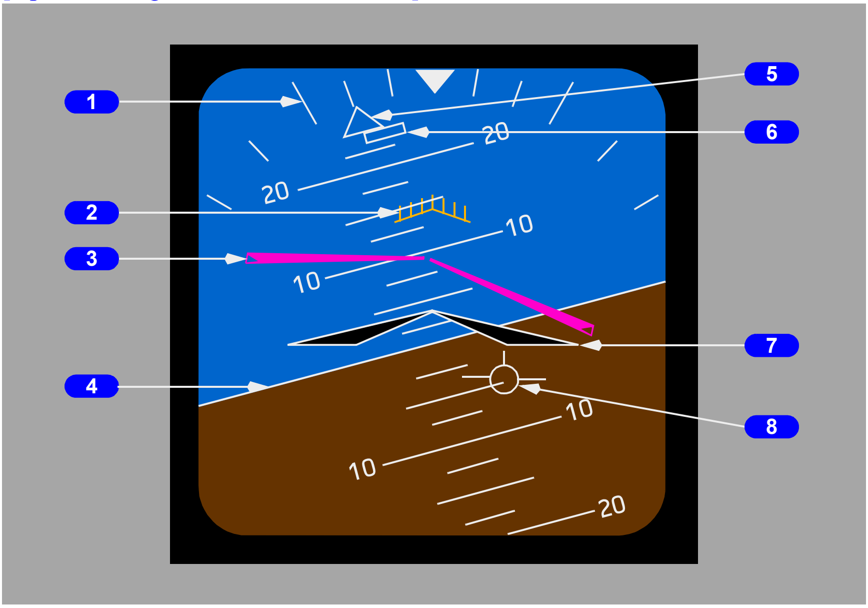
Indicates zero degrees angle of attack. Reference lines are displayed every 5 degrees from – 5 degrees to +20 degrees.

PFD – Attitude Indications

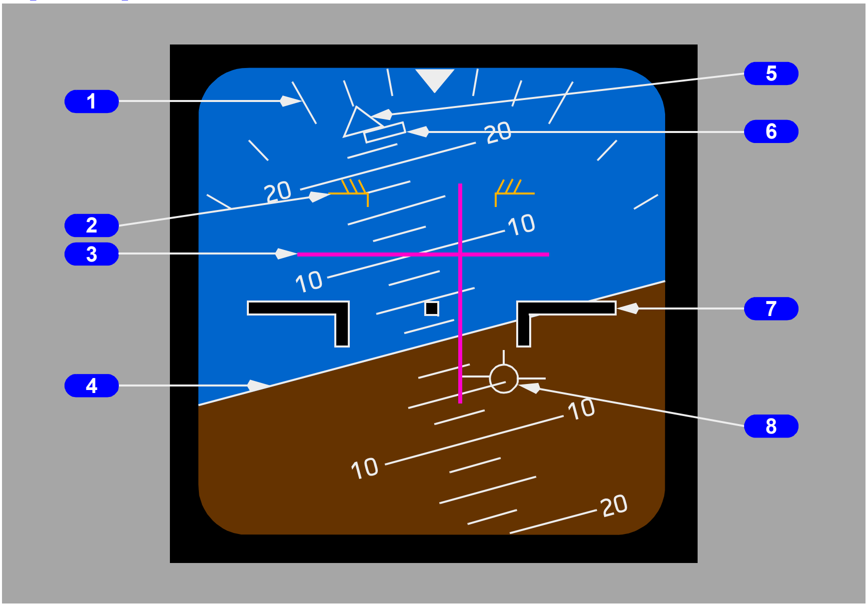
Attitude Indications – General

The attitude indication displays ADIRS attitude information.

[Option - Integrated cue command bar]



[Option - Split axis command bars]



1 **Bank Scale (white)**

Provides fixed reference for the bank pointer; scale marks are at 0, 10, 20, 30, 45, and 60 degrees.

2 **Pitch Limit Indication (amber)**

Indicates pitch limit (stick shaker activation for existing flight conditions).

- displayed when the flaps are not up.

[Option - PLI pop-up]

- displayed at slow speeds with the flaps up.

3 **Flight Director Bar (magenta)**

Indicates flight director steering commands. (Refer to Chapter 4, Automatic Flight).

4 **Horizon Line and Pitch Scale (white)**

Indicates the horizon relative to the airplane symbol; pitch scale is in 2.5 degree increments.

5 Bank Pointer

Indicates bank angle; fills and turns amber if bank angle is 35 degrees or more.

- indicates direction towards wings level.

6 Slip/Skid Indication

Displaces beneath the bank pointer to indicate slip or skid:

- fills white at full scale deflection
- turns amber if bank angle is 35 degrees or more; fills amber if the slip/skid indication is also at full scale deflection.

7 Airplane Symbol

Indicates airplane attitude relative to the horizon.

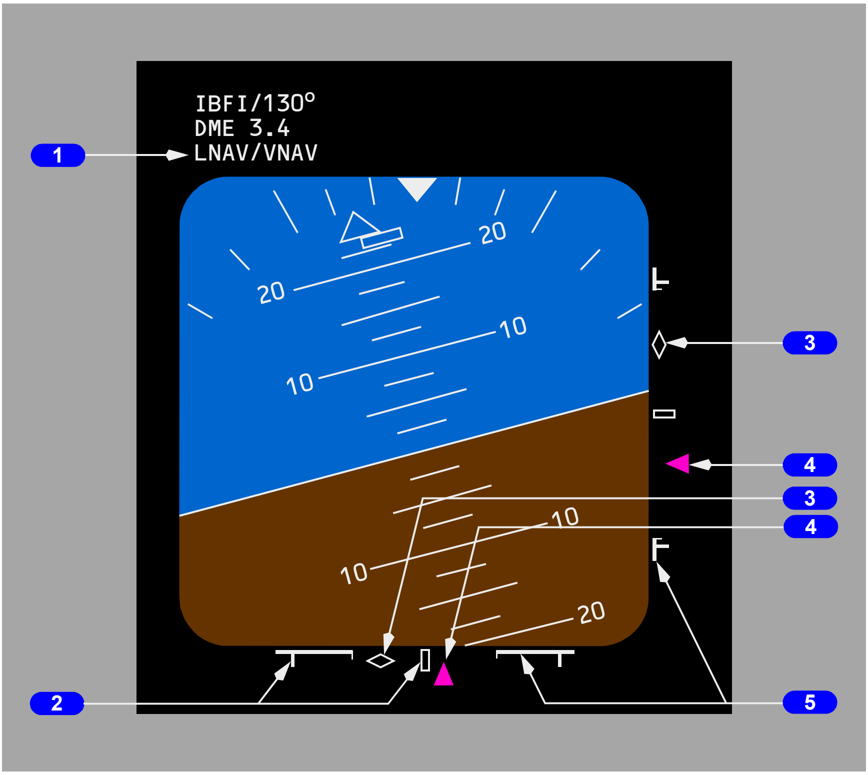
8 Flight Path Vector (FPV) Indication (white)

Displays flight path angle and drift when selected on the EFIS control panel:

- flight path angle is displayed relative to the horizon line
- drift angle is displayed relative to display center.

Navigation Performance Scales (NPS) Indications

[Option - NPS scale and pointer]



1 Scale ID Annunciation (white)

- displayed above the left corner of ADI
- indicates the source of displayed deviation for each scale
- displayed when LNAV, VNAV, HDG SEL, or TO/GA are engaged
- displayed when current aircraft position is laterally within 1nm or 2 x RNP of the flight plan route – will go out of NPS if lateral limits exceeded
- Possible annunciations include:
  - LNAV/VNAV – (LNAV and VNAV deviations)
  - LOC/VNAV – (ILS localizer course with VNAV deviation)
  - FAC/VNAV – (IAN final approach course with VNAV deviation)
  - LNAV/ G/S – (LNAV deviation with glideslope)
  - LNAV/ GP – (LNAV deviation with IAN glide path)
  - LOC/ GP – (ILS localizer course with IAN glide path)

- ILS – (ILS approach)
- FMC – (IAN approach)
- GLS – (GLS approach)

2 **NPS Deviation Scale**

- lateral NPS deviation scale represents current FMC lateral RNP
- vertical NPS deviation scale represents current FMC vertical RNP
- displayed if an approach mode is not engaged and either HDG SEL, TO/GA, LNAV or any VNAV mode is engaged.

3 **Anticipation Cues**

- displayed if valid approach course deviation information is being received while corresponding NPS deviation scale and pointer are displayed
- an unfilled white diamond symbol.

[Option - IAN]

- if engaged lateral mode subsequently transitions to LOC or IAN FAC, lateral NPS deviation indications will be removed, and normal ILS localizer or IAN FAC indications will be displayed
- when the aircraft passes beyond perpendicular (greater than 92 degrees) to the IAN final approach course, the lateral deviation indication swaps sides on the Primary Flight Display. This allows quick orientation to which way the aircraft should be turned to acquire the final approach course. This makes the navigation performance scale (NPS) display consistent with ILS.

[Option - IAN]

- if engaged vertical mode subsequently transitions to G/S or IAN GP, vertical NPS deviation indications will be removed, and normal ILS G/S or IAN GP indications will be displayed.

4 **NPS Pointer**

- a filled magenta symbol when it is not parked at deflection limit
- an unfilled pointer outline when at deflection limit
- indicates lateral/vertical paths relative to the airplane
- will flash for 10 seconds if deviation is within ANP bar limits for 5 continuous seconds.

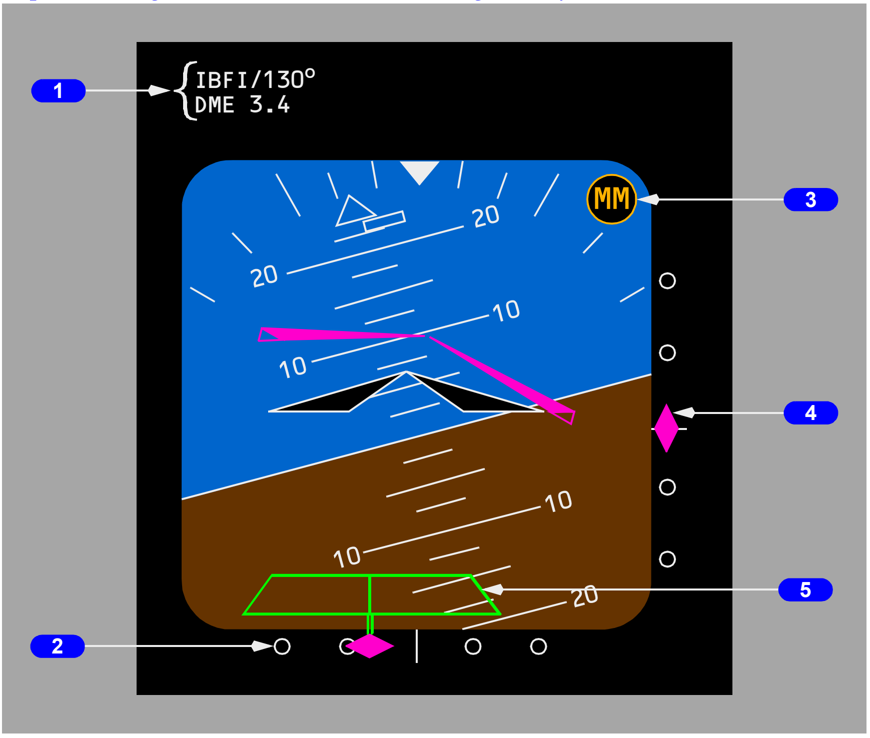
5 **Actual Navigation Performance (ANP) Bars**

- lateral/vertical indication of available flight technical error remaining based on total system error
- lateral ANP bars can be displayed in all phases of flight
- vertical ANP bars can be displayed only after reaching top-of-descent

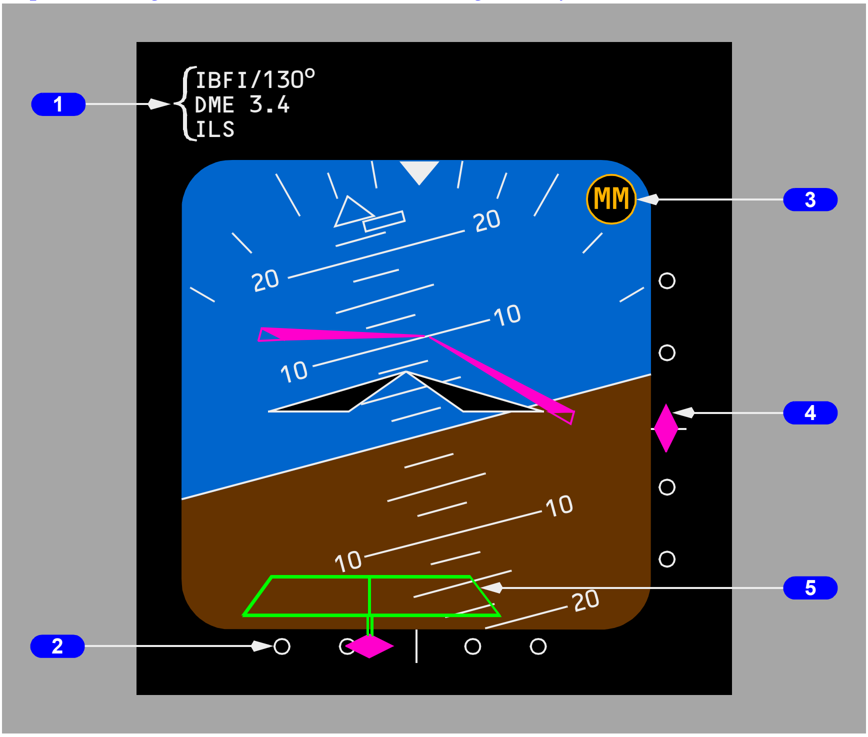
- originate from outer scale and expand inward as a function of increasing ANP relative to RNP
- will just touch at center of scale when ANP equals RNP
- turn from white to amber if current deviation is within the ANP bar limits for 5 continuous seconds.

Instrument Landing System Indications

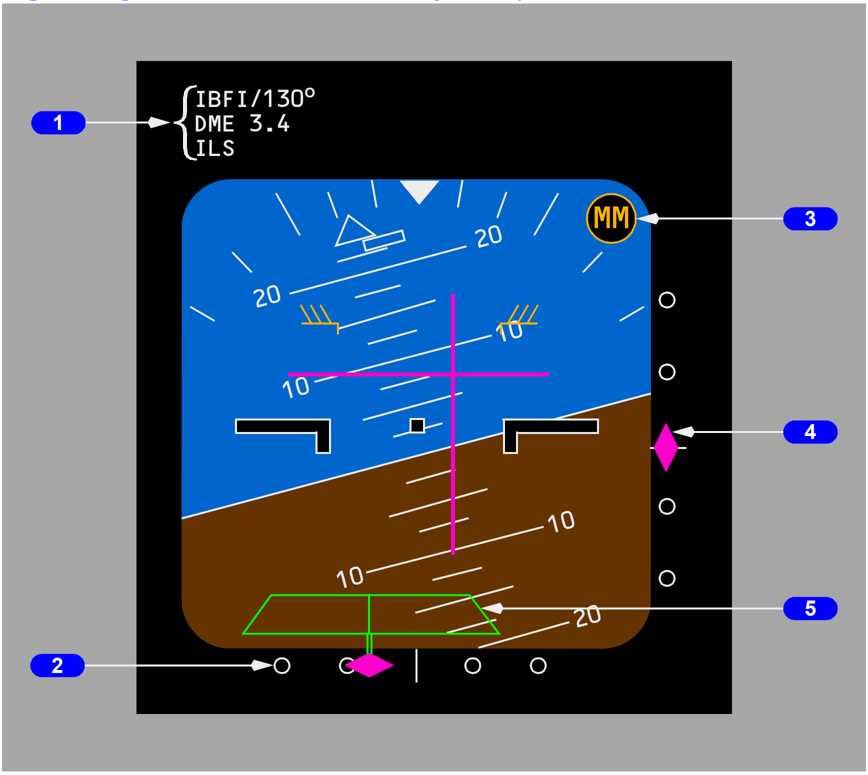
[Option - Integrated cue command bar, rising runway]



[Option - Integrated cue command bar, rising runway, IAN]



[Option - Split axis command bars, rising runway, IAN]



1 Approach Reference

Displays the selected ILS frequency or identifier, approach course, ILS/DME/FMC distance and source annunciation.

[Option - IAN]
Displays the selected ILS/IAN frequency or identifier, approach course, ILS/DME/FMC distance and source annunciation.

[Option - GLS]
Displays the selected GLS identifier, channel, selected course, GLS approach distance and source annunciation.

If the tuned ILS frequencies disagree (for longer than one minute of time), the frequency turns amber with an amber horizontal line until set identically.

If the approach courses entered in the MCP disagree (for longer than one minute of time), the course turns amber with an amber horizontal line through it.

If the Pilot's and First Officer's tuned GLS channels or approach courses disagree for more than one minute, the indication turns amber with an amber horizontal line until set identically.

2 Localizer Pointer and Deviation Scale

The pointer:

- indicates localizer position relative to the airplane
- in view when the localizer signal is received
- fills in solid magenta when within 2 ½ dots from center.

The scale:

- indicates deviation
- in view when the localizer frequency is tuned
- expands when the localizer is engaged and deviation is slightly more than ½ dot.

At low radio altitudes with autopilot engaged the scale turns amber and the pointer flashes to indicate excessive localizer deviation.

Below 1,000 feet AGL, with LNAV engaged and LOC armed, the localizer scale turns amber and the pointer flashes if the localizer is not captured.

Each pilot's deviation alerting system self-tests upon becoming armed at 1500 feet radio altitude. This self-test generates a two second LOC deviation alerting display on each attitude indicator.

[Option - IAN]

2 Localizer/FAC Pointer and Deviation Scale

The pointer:

- indicates localizer or FAC position relative to the airplane
- in view when the localizer signal is received or IAN approach selected
- fills in solid magenta when within 2 ½ dots from center.

The scale:

- indicates deviation
- in view when the localizer frequency is tuned or IAN approach selected
- expands when the localizer is engaged and deviation is slightly more than ½ dot.

At low radio altitudes with autopilot engaged the scale turns amber and the pointer flashes to indicate excessive localizer or FAC deviation.

Below 1,000 feet AGL, with LNAV engaged and LOC or FAC armed, the localizer/FAC scale turns amber and the pointer flashes if the localizer or FAC is not captured.

Each pilot's deviation alerting system self-tests upon becoming armed at 1500 feet radio altitude. This self-test generates a two second LOC or FAC deviation alerting display on each attitude indicator.

3 Marker Beacon symbol

Flashes (and audible) when over one of the marker beacons:

OM (cyan) – outer marker beacon (two dashes per second).

MM (amber) – middle marker beacon (alternate dot and dash).

IM (white) – inner marker beacon (only dots).

4 Glideslope Pointer and Deviation Scale

The pointer:

- indicates glideslope position
- in view when the glideslope signal is received
- fills in solid magenta when within 2 ½ dots from center.
- the pointer is not displayed when the track and the front course on the mode control panel differ by more than 90 degrees (backcourse).

The scale:

- indicates deviation
- in view when the localizer frequency is tuned.

At low radio altitudes with autopilot engaged the scale turns amber and the pointer flashes to indicate excessive glideslope deviation.

Each pilot's deviation alerting system self-tests upon becoming armed at 1500 feet radio altitude. This self-test generates a two second G/S deviation alerting display on each attitude indicator.

[Option - IAN]

4 Glideslope/Glide Path Pointer and Deviation Scale

The pointer:

- indicates glideslope/glide path position.
- in view when the glideslope signal is received or IAN approach is selected.
- fills in solid magenta when within 2 ½ dots from center.
- the pointer is not displayed when the track and the front course on the mode control panel differ by more than 90 degrees (backcourse).

The scale:

- indicates deviation
- in view when the localizer frequency is tuned or IAN approach is selected.

At low radio altitudes with autopilot engaged the scale turns amber and the pointer flashes to indicate excessive glideslope/glide path deviation.

Each pilot's deviation alerting system self-tests upon becoming armed at 1500 feet radio altitude. This self-test generates a two second G/S or GP deviation alerting display on each attitude indicator.

[Option - Rising runway]

5 Rising Runway (green with magenta stem)

Displayed when:

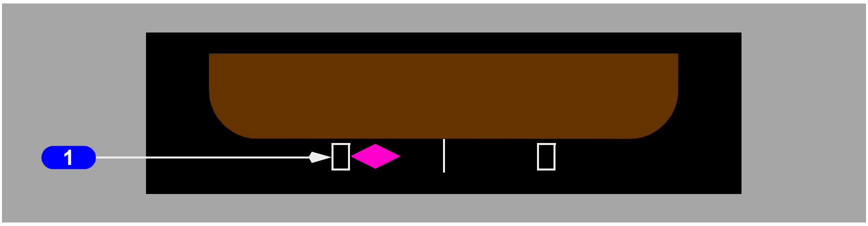
- localizer signal usable and pointer is in view.

[Option - IAN]

- localizer signal usable or IAN approach selected and pointer is in view
- radio altitude is less than 2500 feet.

Rises towards airplane symbol when radio altitude is below 200 feet.

Expanded Localizer Indications



1 Expanded Localizer Scale

Note: The Localizer Scale does not expand for IAN approaches.

[Option - Autopilot or flight director activation]

Displayed when the autopilot or flight director is in LOC mode, deviation is slightly more than ½ dot and track is within 5 degrees of the MCP selected course.

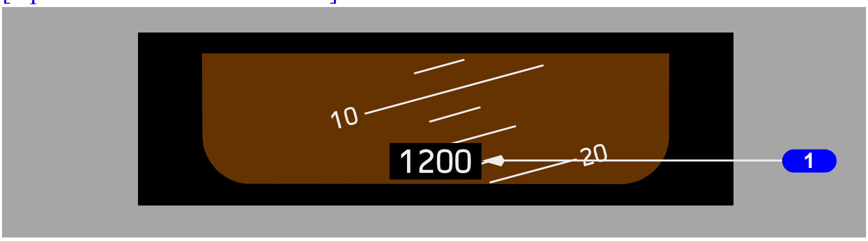
As deviation increases, the deviation pointer remains filled in solid magenta and parks at the limit of the expanded scale. Once the deviation reaches the equivalent of 2.4 dots from center on the standard scale, the pointer becomes unfilled.

Reverts to standard scale when out of LOC mode, and groundspeed is less than 30 knots or radio altitude is greater than 200 feet.

A rectangle equals ½ dot deviation.

Radio Altitude Indications

[Option - Radio altitude below]



[Option - Radio altitude above, round dial]

1 Radio Altitude

Displays current radio altitude:

- displayed below 2500 feet AGL
- box is highlighted in white for 10 seconds when descending through 2500 feet AGL
- turns amber when below radio altitude minimums.

[Option - Radio altitude above, round dial]

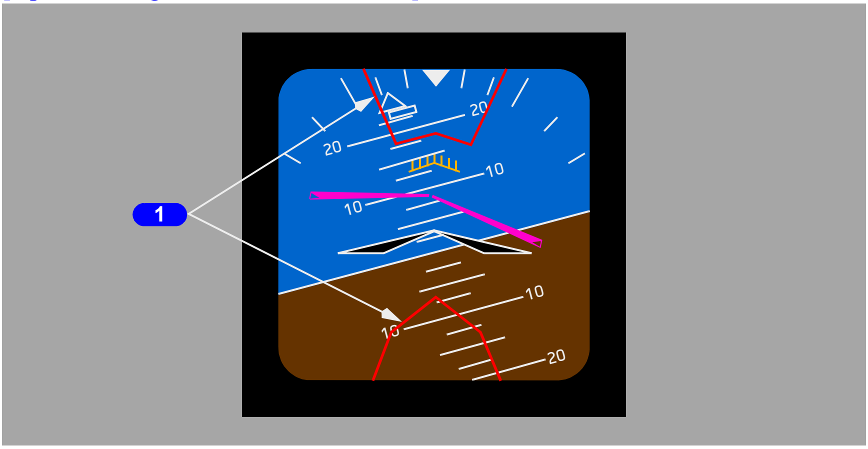
1 Radio Altitude – Round Dial

Displayed below 2500 feet AGL:

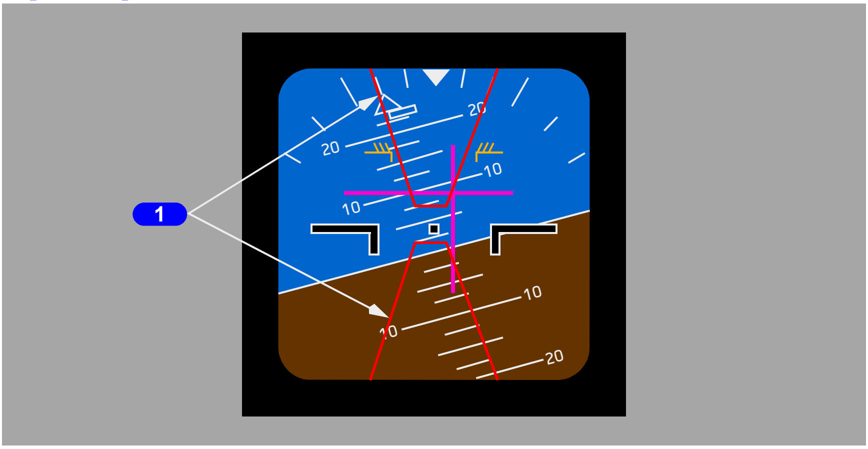
- digital display from 2500 to 1000 feet AGL
- box is highlighted in white for 10 seconds when descending through 2500 feet AGL
- round dial displays below 1000 feet AGL
- pointer indicates selected radio altitude minimums
- the circumference of the dial is added to, or taken away from, to depict the airplane's radio altitude
- the remaining perimeter and pointer turn amber and flash for 3 seconds when below radio altitude minimums, the numeric readout does not flash.

Traffic Alert and Collision Avoidance Indications

[Option - Integrated cue command bar]



[Option - Split axis command bars]

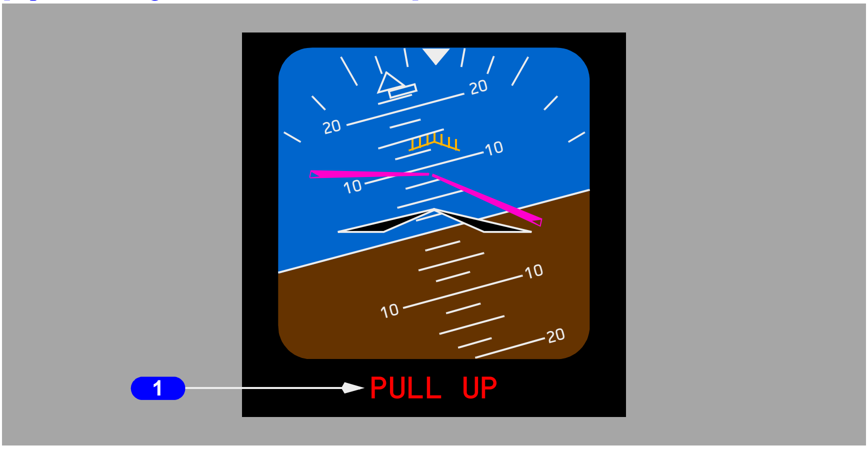


1 Traffic Alert and Collision Avoidance System Pitch Command (red)

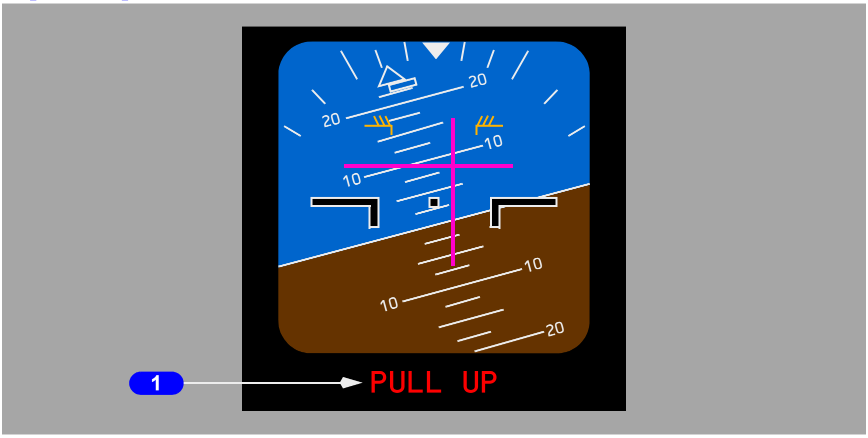
The area(s) inside the red lines indicate(s) the pitch region(s) to avoid in order to resolve the traffic conflict. The airplane symbol must be outside the TCAS pitch command area(s) to ensure traffic avoidance. Refer to Chapter 15, Warning Systems.

GPWS Annunciations

[Option - Integrated cue command bar]



[Option - Split axis command bars]



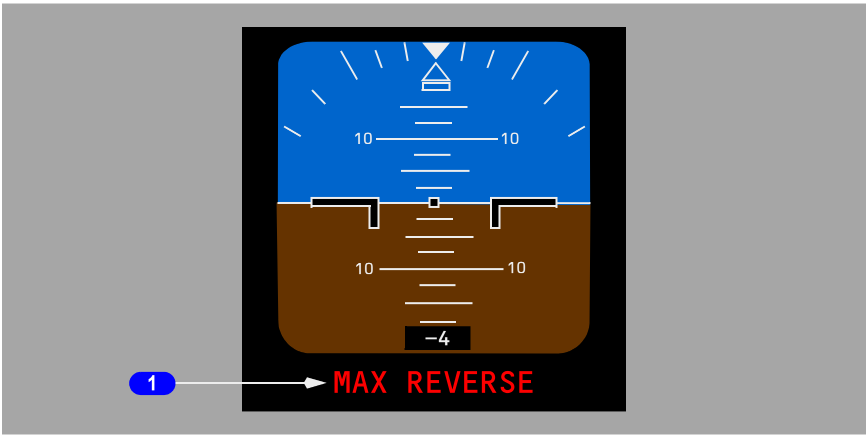
1 GPWS Annunciations (red)

Displays WINDSHEAR or Pull UP alert.

Refer to Chapter 15, Warning Systems.

On-Ground Overrun Warning

[Option - Overrun Warning (on-ground)]



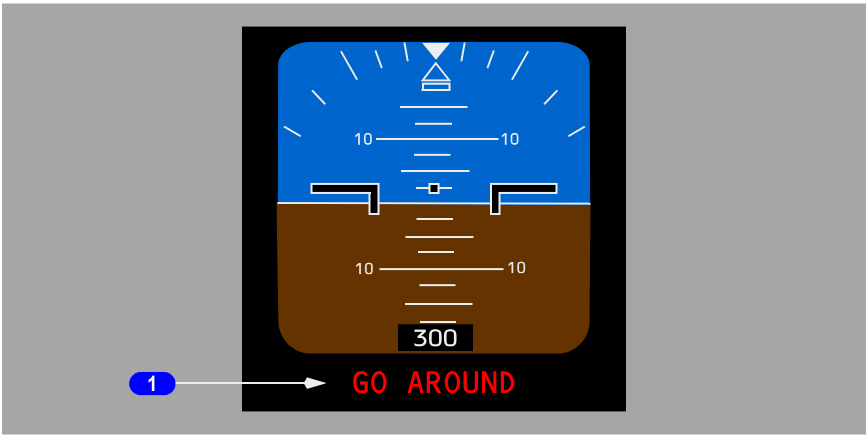
1 On-Ground Overrun Warning

The On-Ground Overrun Warning provides an alert when a runway overrun condition is likely to occur. The warning is armed from 3 seconds after touchdown until the airplane slows below 20 knots groundspeed or comes within 1000 feet of the end of the runway.

Refer to Chapter 15, Warning Systems.

In-Air Overrun Warning

[Option - Overrun Warning (in-flight)]



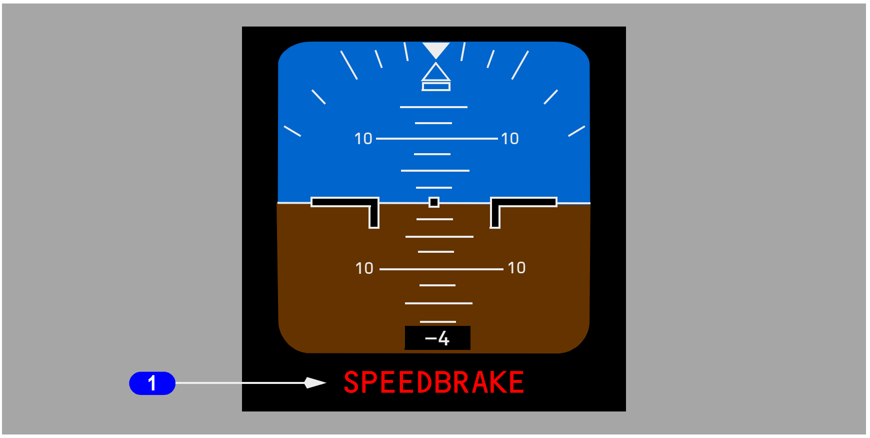
1 In-Air Overrun Warning

The In-Air Overrun Warning provides an alert when a runway overrun condition is likely to occur. The warning is armed from 500 feet above TDZE until touchdown.

Refer to Chapter 15, Warning Systems.

SPEEDBRAKE Warning

[Option - Speedbrake warning]



1 SPEEDBRAKE Warning (red)

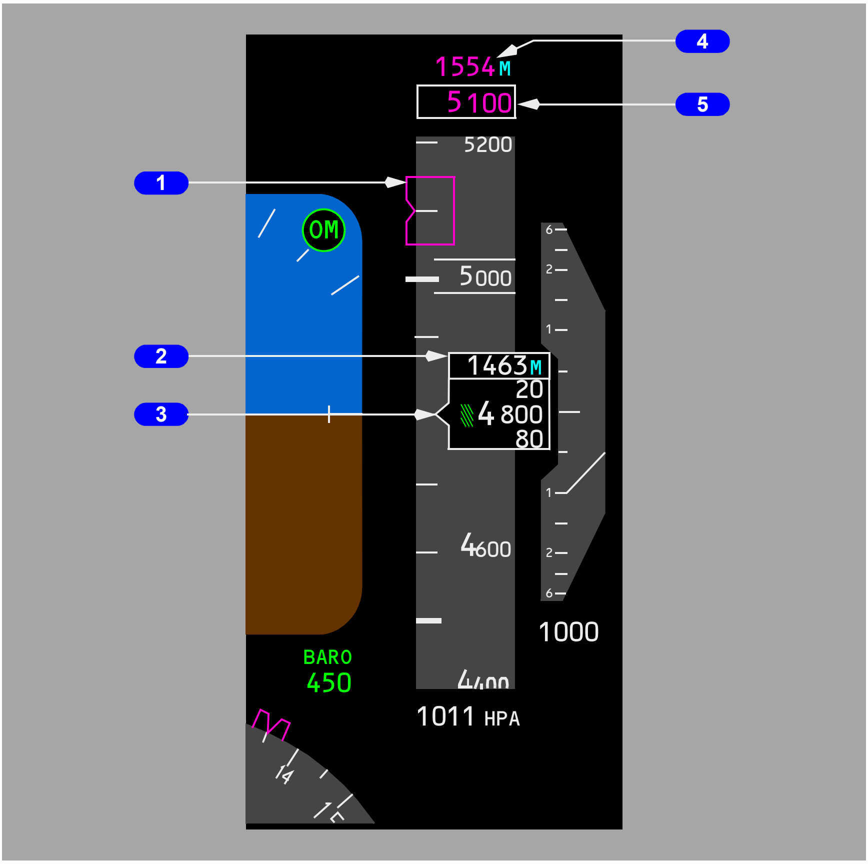
The SPEEDBRAKE warning provides an alert when speedbrakes are not deployed during a landing or rejected takeoff. The SPEEDBRAKE warning alert activates when spoiler panels 4 and 9 are less than halfway up 1.5 seconds after touchdown. In addition, SPEEDBRAKE warning alert activates when spoiler panels are less than halfway up 3 seconds after the initiation of a RTO above 80 knots.

Refer to Chapter 15, Warning Systems.

PFD – Altitude Indications

Altitude Indications– General

The altitude indication displays ADIRS altitude and other altitude related information.



1 Selected Altitude Bug (magenta)

Indicates the altitude set in the MCP altitude window.

When the selected altitude is off scale, the bug is parked at the top or bottom of the tape, with only one half the bug visible.

2 Metric Digital Readout (readout and box–white, metric symbol–cyan)

Displays current altitude in meters when MTRS is selected on the EFIS control panel.

3 Current Altitude

Displays current altitude in increments of thousands, hundreds and twenty feet:

- for positive values of altitude below 10,000 feet, a green crosshatch symbol is displayed
- a negative sign appears when altitude below zero feet is displayed
- readout box becomes bold to denote altitude acquisition
- readout box is highlighted in amber and flashes to denote altitude deviation (refer to Chapter 4, Automatic Flight and Chapter 15, Warning Systems).

4 Metric Selected Altitude Readout (readout–magenta, metric symbol–cyan)

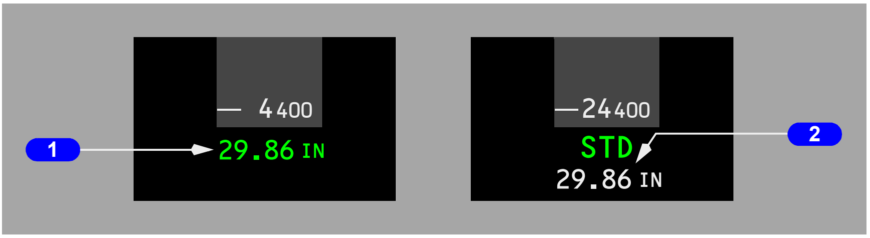
Displays MCP altitude in meters when MTRS is selected on the EFIS control panel.

5 Selected Altitude (magenta)

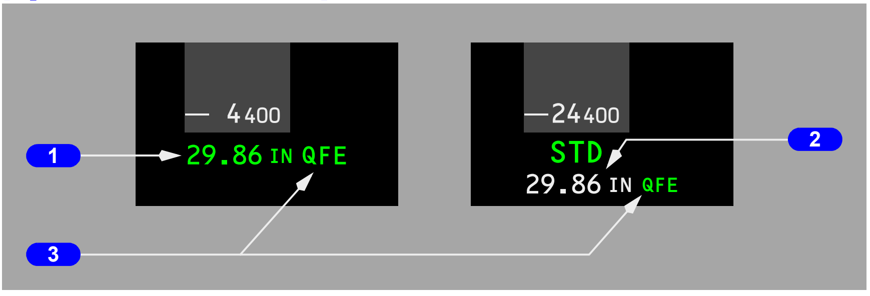
Displays the altitude set in the MCP altitude window.

The selected altitude box appears in white during an altitude alert. For more information, refer to Chapter 15, Warning Systems.

Barometric Indications



[Option - Altimeter with QFE]



1 Barometric Settings (green)

Indicates the barometric setting in either inches of mercury (IN) or hectopascals (HPA) as selected on the EFIS control panel.

Display is boxed amber if numeric is set and airplane is climbing above transition altitude, or if STD is set and descending below transition flight level.

2 Preselected Barometric Setting (white)

STD is displayed when the Barometric Standard (STD) switch is selected on the EFIS control panel.

When STD is displayed, a barometric setting can be preselected on the EFIS control panel barometric selector and is displayed in small white characters below STD.

[Option - Altimeter with QFE]

3 QFE Altitude Reference (green)

Indicates QFE altitude reference if selected on the CDU APPROACH REF Page or TAKEOFF REF Page 2/2.

When selected, QFE is boxed for 10 seconds.

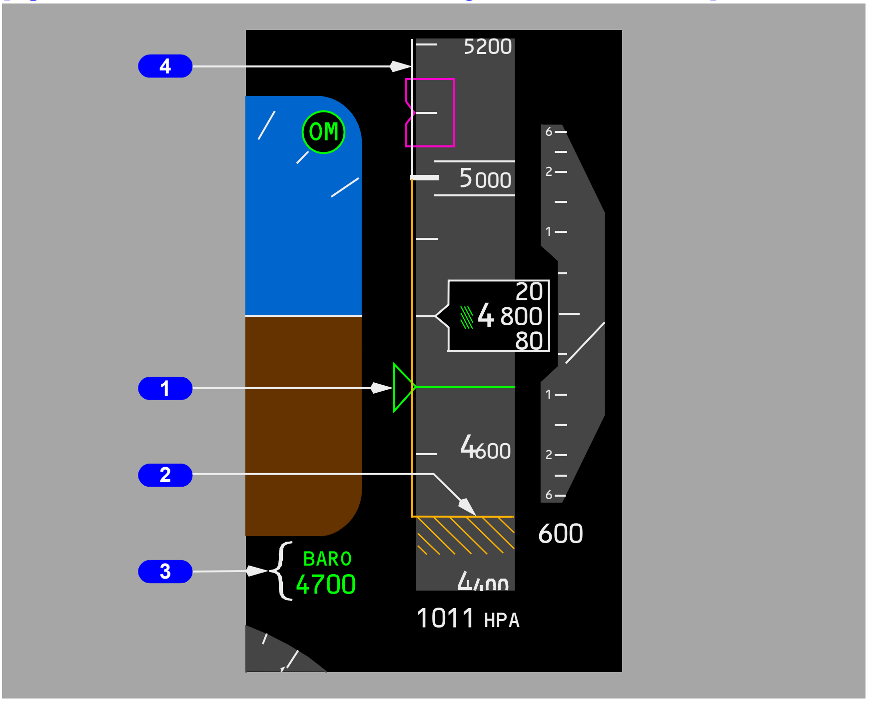
The altitude tape is shaded green during QFE operation.

When QNH is selected, the green shading is removed; QNH is displayed for 10 seconds, then blanks.

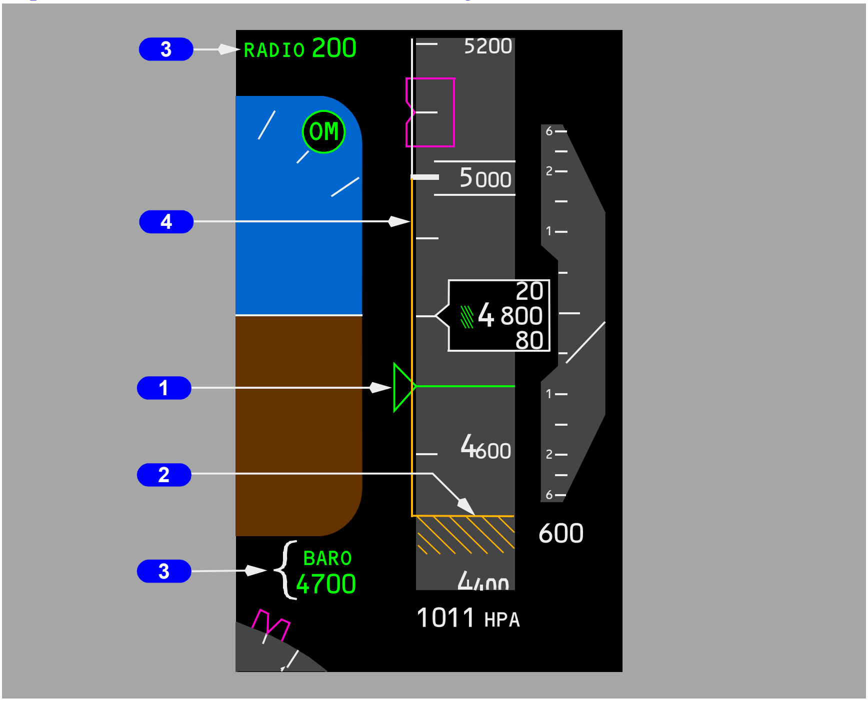
When STD is displayed, QFE in small white characters is displayed below STD, and a QFE altimeter setting can be preselected.

Landing Altitude/Minimums Indications

[Option - Radio altitude below ADI, landing altitude reference bar]



[Option - Radio altitude above ADI, landing altitude reference bar]



1 **BARO Minimums Pointer (green)**

Indicates the barometric minimums selected on the EFIS control panel:

- pointer and line turn amber when airplane descends below selected minimum altitude
- reset with the RST switch on the EFIS control panel.

2 **Landing Altitude Indication (amber)**

The crosshatched area indicates:

- the FMC landing altitude for the destination runway or airport, or
- the landing altitude for departure runway or airport until 400 NM from departure or one-half the distance to destination, whichever occurs first.

[Option - Radio altitude below ADI]

3 **Minimums Reference/Altitude (green)**

Displays approach minimum reference and altitude set by the MINS selector on the EFIS control panel:

BARO –

- displayed when selector is set to BARO, minimums are in feet MSL
- turns amber and flashes for 3 seconds when airplane descends below selected minimum altitude
- changes back to green:
  - when passing the selected minimum altitude plus 75 feet during go–around
  - at touchdown
  - after pressing the RST switch on the EFIS control panel.

RADIO –

- displayed when selector is set to RADIO, minimums are in feet AGL
- blank when an altitude less than 0 feet is selected
- turns amber and flashes for 3 seconds when airplane descends below selected minimum altitude
- changes back to green:
  - when passing the selected minimum altitude plus 75 feet during go–around
  - at touchdown
  - after pressing the RST switch on the EFIS control panel.

[Option - Radio altitude above ADI]

3 Minimums Reference/Altitude (green)

Displays approach minimum reference and altitude set by the MINS selector on the EFIS control panel:

BARO –

- displayed below ADI when selector is set to BARO, minimums are in feet MSL
- turns amber and flashes for 3 seconds when airplane descends below selected minimum altitude
- changes back to green:
  - when passing the selected minimum altitude plus 75 feet during go–around
  - at touchdown
  - after pressing the RST switch on the EFIS control panel.

RADIO –

- displayed above ADI when selector is set to RADIO, minimums are in feet AGL
- blank when an altitude less than 0 feet is selected
- turns amber and flashes for 3 seconds when airplane descends below selected minimum altitude

- changes back to green:
  - when passing the selected minimum altitude plus 75 feet during go–around
  - at touchdown
  - after pressing the RST switch on the EFIS control panel.

[Option]

4 Landing Altitude Reference Bar

Indicates height above touchdown:

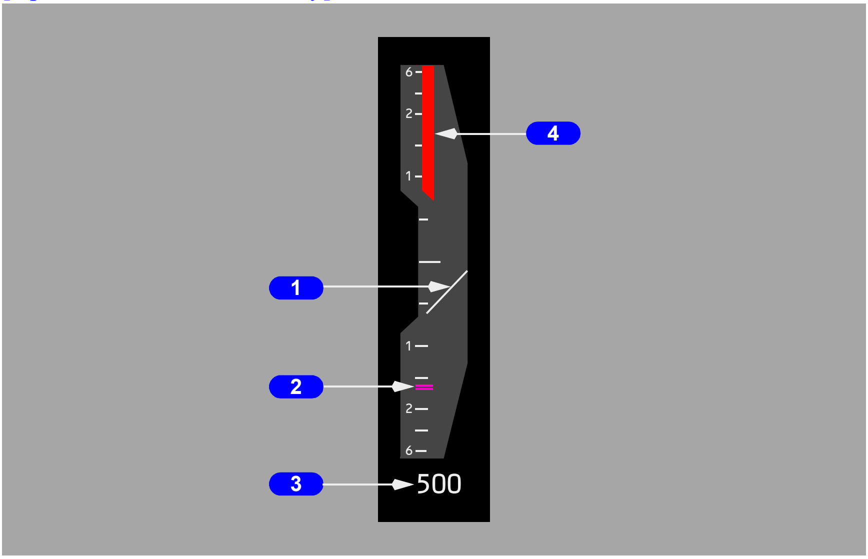
- White bar – 500 to 1000 feet above landing altitude
- Amber bar – 0 to 500 feet above landing altitude.

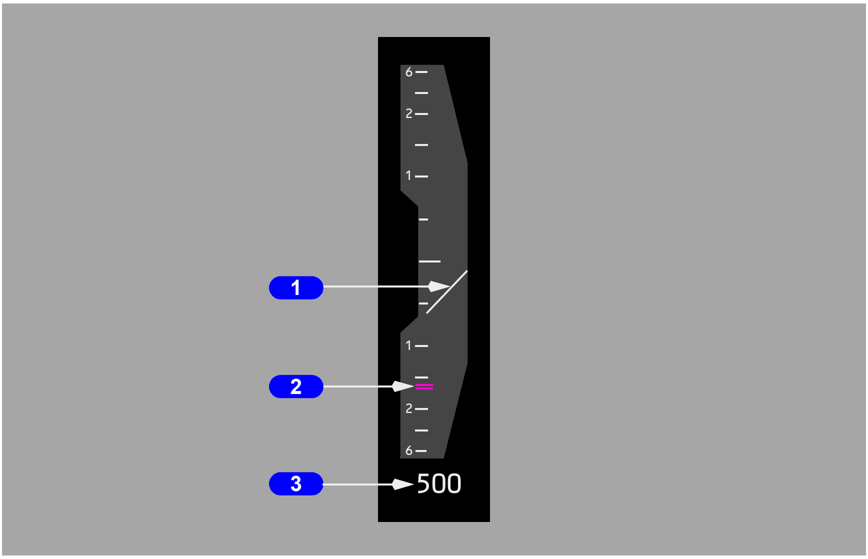
PFD – Vertical Speed Indications

Vertical Speed Indications – General

The vertical speed indication displays ADIRS instantaneous vertical speed.

[Option - VSI TCAS advisory]





1 **Vertical Speed Pointer (white)**

Indicates current vertical speed.

2 **Selected Vertical speed Bug (magenta)**

Indicates the speed selected in the MCP vertical speed window with V/S pitch mode engaged.

3 **Vertical speed (white)**

Displays vertical speed when greater than 400 feet per minute.

The display is located above the vertical speed indication when climbing and below when descending.

[Option - VSI TCAS advisory]
4 **TCAS Vertical Speed Tape (red)**

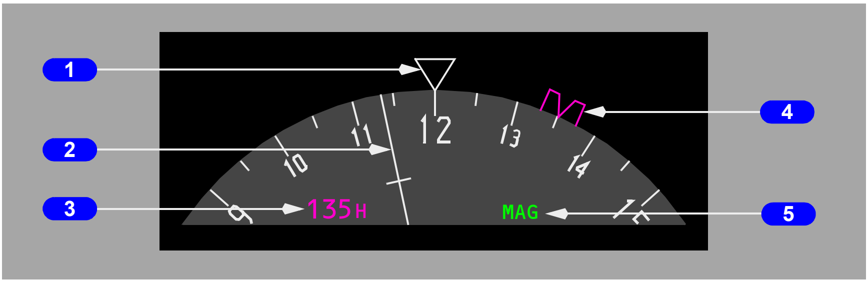
Tape turns red to indicate vertical speed values to avoid or exit during a TCAS resolution advisory.

Vertical speed pointer is red if it is within the vertical speed tape range.

Supplements TCAS resolution advisory pitch commands on the attitude indication.

PFD – Heading and Track Indications
Heading and Track Indications– General

The heading and track indications display current FMC/ADIRS heading, track and other information.



1 Current Heading Pointer (white)

Indicates current heading.

2 Track Pointer (white)

Indicates current track.

3 Selected Heading (magenta)

Digital display of the selected heading bug.

4 Selected Heading Bug (magenta)

Indicates the heading selected on the mode control panel. If the selected heading exceeds the display range, the bug parks on the side of the compass rose in the direction of the shorter turn to the heading.

5 Magnetic/True Heading Annunciation (green)

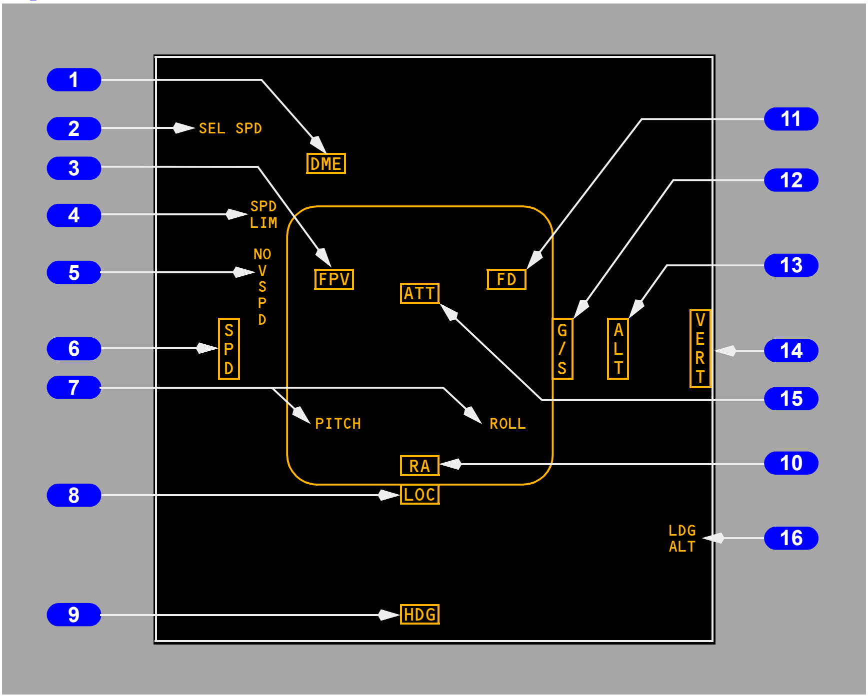
Displays selected heading reference:

- MAG indicates display is oriented relative to magnetic north
- TRU indicates display is oriented relative to true north; a white box is displayed continuously around TRU
- transition from TRU to MAG results in a green box around MAG for 10 seconds
- when TRU is displayed and the airplane descends more than 2000 feet at a descent rate greater than – 800 feet per minute, an amber box is drawn around TRU; the box flashes for 10 seconds, then turns steady amber.

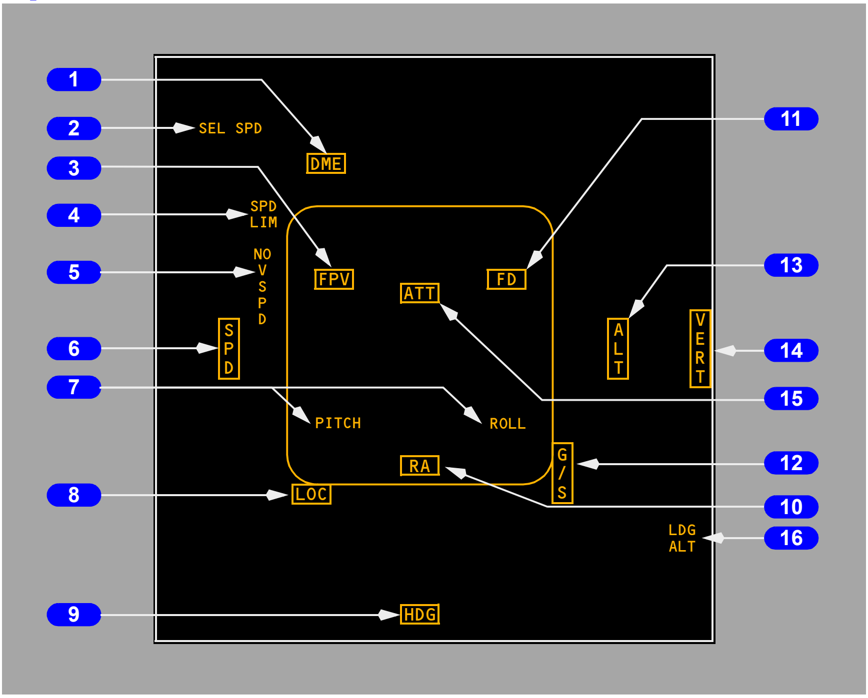
PFD Failure Flags

The flag replaces the appropriate display to indicate system failure.

[Option - Radio altitude below ADI]



[Option - Radio altitude below ADI]



1 Distance Measuring Equipment (amber)

The DME system has failed.

2 Selected Speed (amber)

The selected airspeed data is invalid.

3 Flight Path Vector Flag (amber)

FPV is selected on the EFIS control panel, but has failed. De–selection of FPV removes the flag.

4 Speed Limit Flag (amber)

Displays related with stick shaker or maximum operating speed has failed:

- if the stick shaker warning has failed, the red and black stick shaker speed bar is removed
- if the maximum operating speed has failed, the red and black maximum operating speed bar is removed.

5 No V Speeds Flag (amber)

Displayed when the aircraft is on the ground and both V1 (decision speed) and VR (rotation speed) are not valid or are set to less than 80 knots.

6 Speed Flag (amber)

Speed indication is inoperative.

7 Pitch/Roll Comparator Annunciation (amber)

PITCH displayed when Captain's and F/O's pitch angle displays differ by more than 5 degrees.

ROLL displayed when Captain's and F/O's roll angle displays differ by more than 5 degrees.

[Option - Attitude comparator flashing]
The flags flash for 10 seconds then remain steady.

8 Localizer Flag (amber)

An ILS frequency is tuned and localizer course indication has failed.

[Option - IAN]
8 Localizer/FAC Flag (amber)

An ILS frequency is tuned and localizer course indication has failed. An IAN approach is active and FAC indication has failed.

9 Heading Flag (amber)

Heading information failed. Heading cannot be displayed.

10 Radio Altitude Flag (amber)

Radio altitude indication has failed.

11 Flight Director Flag (amber)

The flight director has failed.

12 Glideslope Flag (amber)

An ILS frequency is tuned and glideslope indication has failed.

[Option - IAN]
12 Glideslope/Glide Path Flag (amber)

An ILS frequency is tuned and glideslope indication has failed. An IAN approach is active and glide path indication has failed.

13 **Altitude Flag (amber)**

The altitude display has failed.

14 **Vertical Speed Flag (amber)**

Vertical speed has failed.

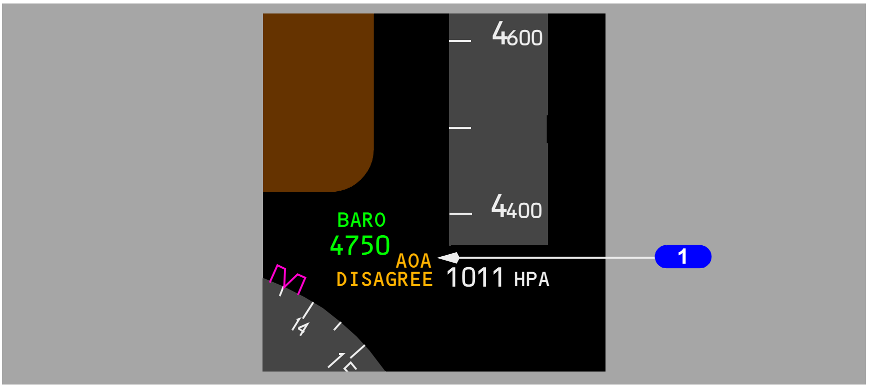
15 **Attitude Flag (amber)**

The attitude display has failed.

16 **Landing Altitude Flag (amber)**

The landing altitude input is not available or invalid.

PFD Annunciations and Alerts
Angle of Attack (AOA) Disagree Alert



1 **AOA DISAGREE Alert (amber)**

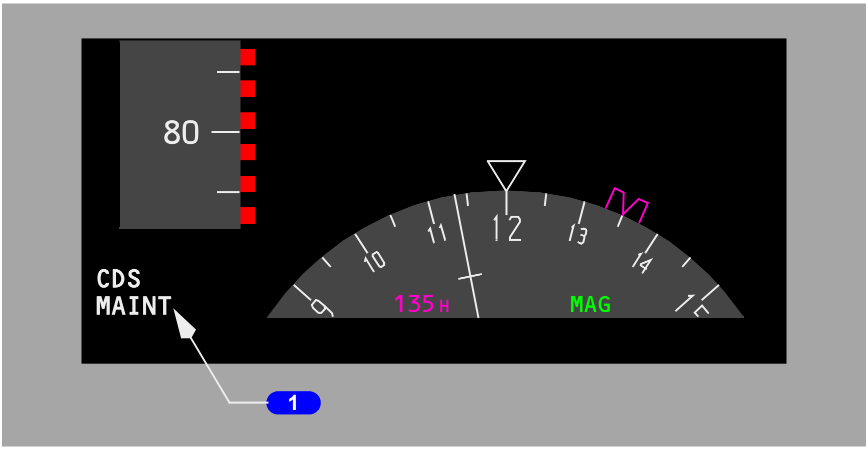
Indicates the Captain’s (left) and First Officer’s (right) AOA values disagree by greater than 10 degrees for more than 10 seconds. The alert is shown on both PFDs and does not indicate which AOA value is erroneous.

The AOA DISAGREE alert logic is active when the airplane is above 400 feet RA.

NOTE: If the AOA DISAGREE alert is shown when descending through 400 feet RA, the alert remains until landing.

[Option - AOA Indicator]
NOTE: The AOA DISAGREE alert is based on vane angle and the AOA indicator is based on body angle.

Display System Annunciations



1 Display System Annunciations

When there is a problem with the DEU display system, one of the following indications will appear in the lower left corner of the primary flight display:

CDS MAINT (white) – A dispatchable CDS fault has occurred. Displayed on the ground only, prior to start of the second engine.

CDS FAULT (amber) – A non-dispatchable CDS fault has occurred. Displayed on the ground only, prior to start of the second engine.

DSPLY SOURCE (amber) – A DEU has failed.

DSPLY SOURCE 1 or 2 (amber) – DEU 1 has failed or DEU 2 has failed.

Split axis flight director –

- If a DEU fails above FL220 –
  - the autopilot and flight directors are not affected
- If a DEU fails during climb or descent below FL220 with the failed side autopilot engaged –
  - the flight director pitch command bar is removed from both pilot's displays
  - the flight director pitch command bars reappears at ALT ACQ
  - the autopilot engages in CWS P
  - LVL CHG, VNAV, and V/S are not available with the failed side autopilot

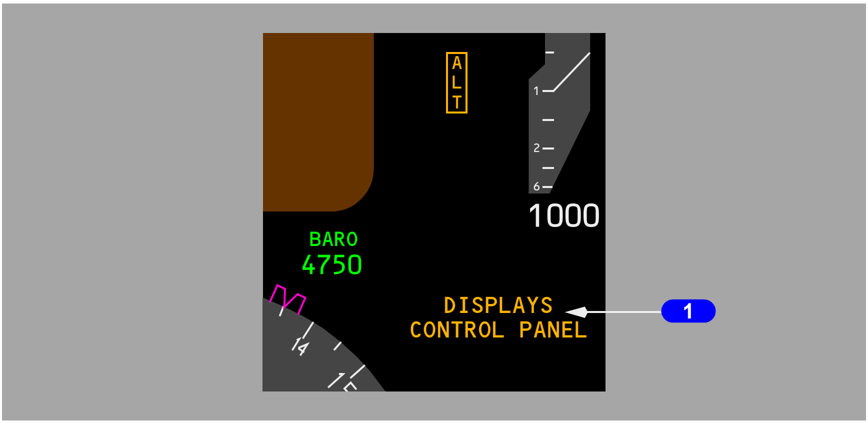
- If a DEU fails during level flight below FL220 with the failed side autopilot engaged –
  - climb or descent to a new altitude is only possible in CWS P
  - initial climb or descent to a new MCP altitude is not possible in LVL CHG, VNAV or V/S modes with the autopilot engaged
- If the DEU fails on the opposite side as the engaged autopilot or while in manual F/D mode during climb or descent–
  - the flight director pitch command bar is removed from the pilot's display on the failed side until ALT ACQ
  - climb or descent is possible in LVL CHG, VNAV or V/S modes with the autopilot engaged.
- If a DEU fails in the approach mode above 400 feet with both flight directors on –
  - the flight director pitch and roll command bars are removed from the display on the failed side
- If a DEU fails prior to engaging the second autopilot for a dual autopilot approach –
  - engagement of the second autopilot is inhibited.

Integrated cue flight director –

- If a DEU fails above FL220 –
  - the autopilot and flight directors are not affected
- If a DEU fails during climb or descent below FL220 with the failed side autopilot engaged –
  - the flight directors are removed from both pilot's displays
  - the flight directors reappear at ALT ACQ
  - the autopilot engages in CWS P
  - LVL CHG, VNAV, and V/S are not available with the failed side autopilot
- If a DEU fails during level flight below FL220 with the failed side autopilot engaged –
  - climb or descent to a new altitude is only possible in CWS P
  - initial climb or descent to a new MCP altitude is not possible in LVL CHG, VNAV or V/S modes with the autopilot engaged
- If the DEU fails on the opposite side as the engaged autopilot or while in manual F/D mode during climb or descent–
  - the flight director is removed from the pilot's display on the failed side until ALT ACQ
  - climb or descent is possible in LVL CHG, VNAV or V/S modes with the autopilot engaged.
- If a DEU fails in the approach mode above 400 feet with both flight directors on –
  - the flight director is removed from the display on the failed side

- If a DEU fails prior to engaging the second autopilot for a dual autopilot approach –
  - engagement of the second autopilot is inhibited.

Displays Control Panel Annunciation (EFIS CP)



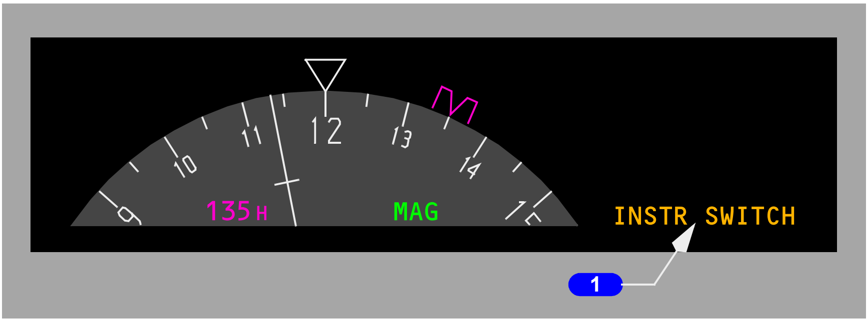
1 Displays Control Panel Annunciation (amber)

Indicates a failed EFIS control panel on the affected side. When DISPLAYS CONTROL PANEL appears in the lower right hand corner of the display, altitude information is removed.

With the CONTROL PANEL select switch on the overhead panel in:

- BOTH ON 1 – Both the Captain’s and First Officer’s CDS displays and baro are controlled from the left EFIS panel
- NORMAL – Left EFIS panel controls Captain’s CDS displays and baro, Right EFIS panel controls First Officer’s CDS displays and baro
- BOTH ON 2 – Both the Captain’s and First Officer’s CDS displays and baro are controlled from the right EFIS panel.

Instrument Switch Annunciation

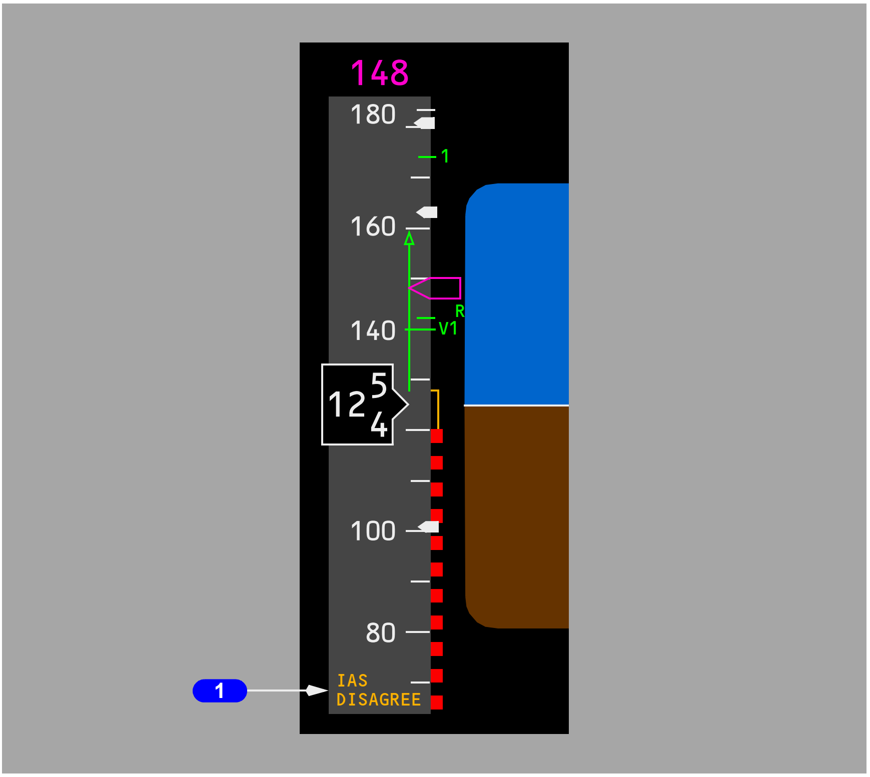


1 INSTR SWITCH Annunciation (amber)

Indicates both the Captain's and First Officer's displays are using the same source of IRU data.

Displayed when the IRS switch on the overhead panel is not in the NORMAL position. See Chapter 11, Section 10, for Inertial Reference System Transfer Switch information.

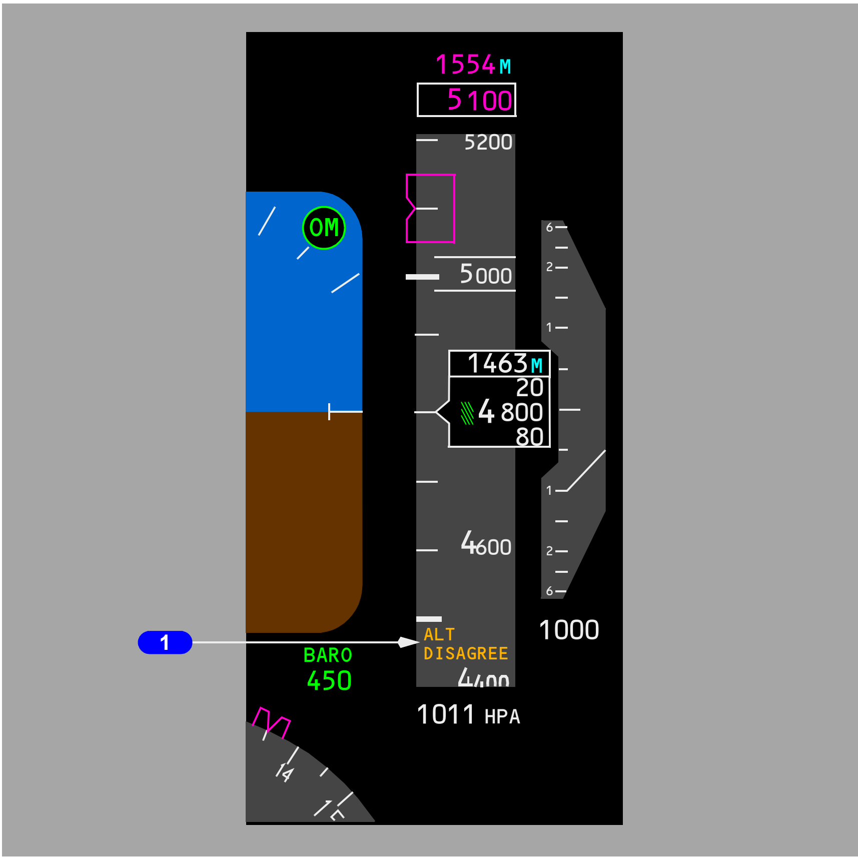
Airspeed Disagree Alert



1 Airspeed Disagree Alert (amber)

Indicates the Captain's and F/O's airspeed indications disagree by more than 5 knots for 5 continuous seconds.

Altitude Disagree Alert

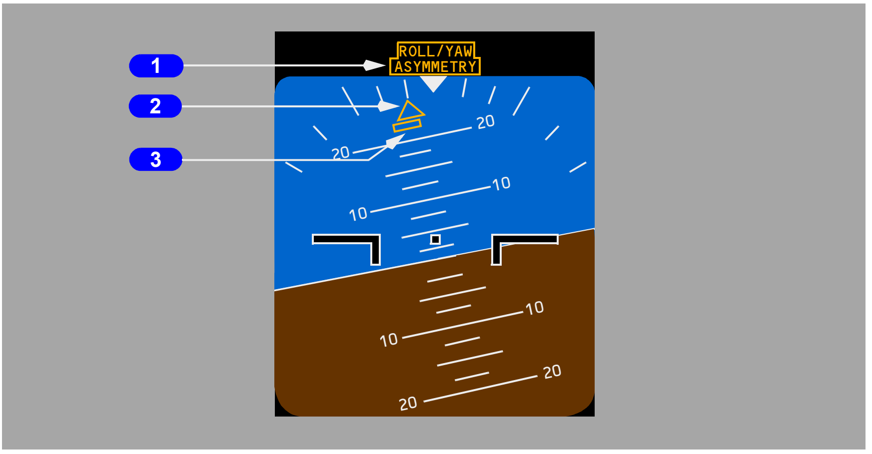


1 Altitude Disagree Alert (amber)

Indicates the Captain’s and F/O’s altitude indications disagree by more than 200 feet for more than 5 continuous seconds.

Roll Alerting

Roll/Yaw Asymmetry Alert



1 Roll/Yaw Asymmetry Alert (amber)

Autopilot is engaged in single channel and requires more than 75% of the autopilot roll authority due to unusual asymmetric forces acting on the airplane's longitudinal axis.

The ROLL/YAW ASYMMETRY alert:

- replaces the active autopilot status annunciation.
- is replaced with ROLL AUTHORITY when 100% of the autopilot roll authority is required.
- is replaced by the active autopilot status annunciation when less than 50% of the autopilot roll authority is required.

2 Bank Pointer (amber)

With ROLL/YAW ASYMMETRY or ROLL AUTHORITY alert active:

- bank pointer outline will turn amber.

With ROLL AUTHORITY alert active:

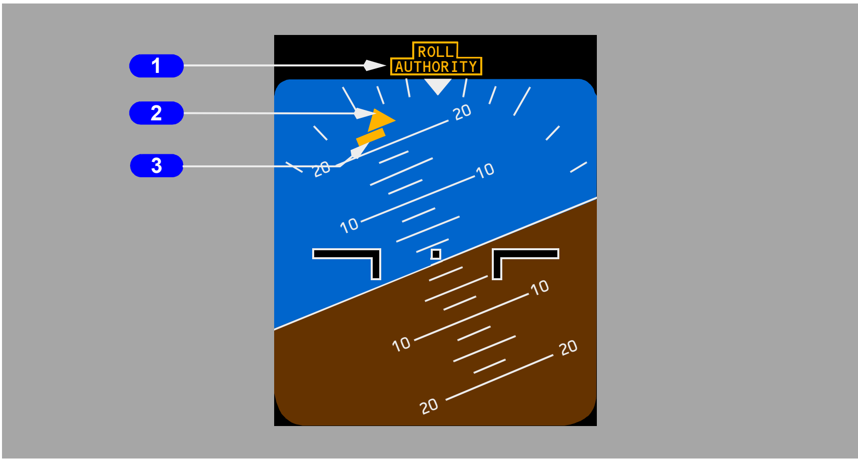
- bank pointer will fill amber if bank angle exceeds 15 degrees.

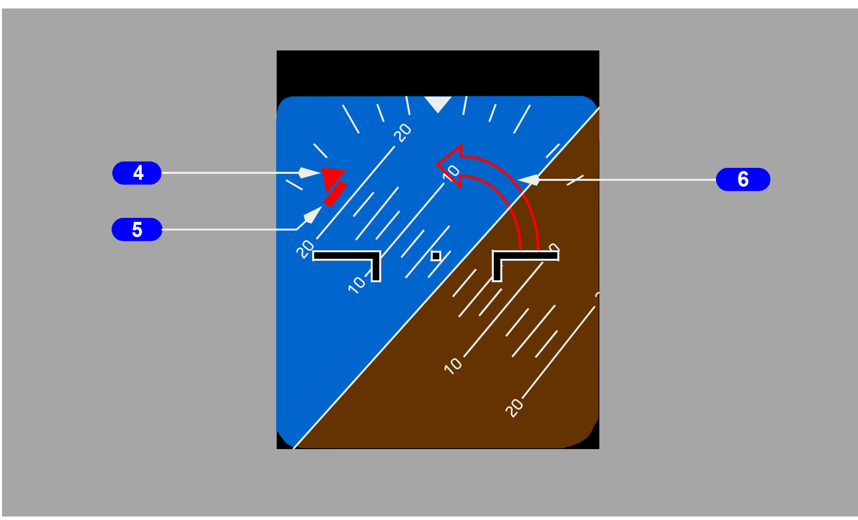
3 Slip/Skid Indication (amber)

With ROLL/YAW ASYMMETRY or ROLL AUTHORITY alert active:

- slip/skid indication outline will turn amber.
- slip/skid indication will fill amber if deflected greater than 25% of its width,

Roll Authority Alert





1 Roll Authority Alert (amber)

Autopilot is engaged in single channel and requires 100% of the autopilot roll authority due to unusual asymmetric forces acting on the airplane's longitudinal axis.

The ROLL AUTHORITY alert:

- replaces the active autopilot status annunciation.
- is replaced by the active autopilot status annunciation when less than 100% of the autopilot roll authority is required.

2 Bank Pointer (amber)

With ROLL/YAW ASYMMETRY or ROLL AUTHORITY alert active:

- bank pointer outline will turn amber.

With ROLL AUTHORITY alert active:

- bank pointer will fill amber if bank angle exceeds 15 degrees.

3 Slip/Skid Indication (amber)

With ROLL/YAW ASYMMETRY or ROLL AUTHORITY alert active:

- slip/skid indication outline will turn amber.
- slip/skid indication will fill amber if deflected greater than 25% of its width,

4 Bank Pointer (red)

When roll command arrow shown:

- bank pointer fills red.

5 Slip/Skid Indication (red)

When roll command arrow shown:

- slip/skid indication outline will turn red.
- slip/skid indication will fill red if it is deflected greater than 25% of its width.

6 Roll Command Arrow (red)

The roll command arrow points in the shortest direction to wings level. If the bank angle passes 180 degrees, the roll command arrow points in the new shortest direction to wings level. The roll command arrow is displayed with or without the autopilot engaged.

The roll command arrow is shown when bank angle exceeds:

- 45 degrees if the pitch attitude is 25 degrees or less.
- 65 degrees if the pitch attitude is greater than 25 degrees.

The roll command arrow is removed:

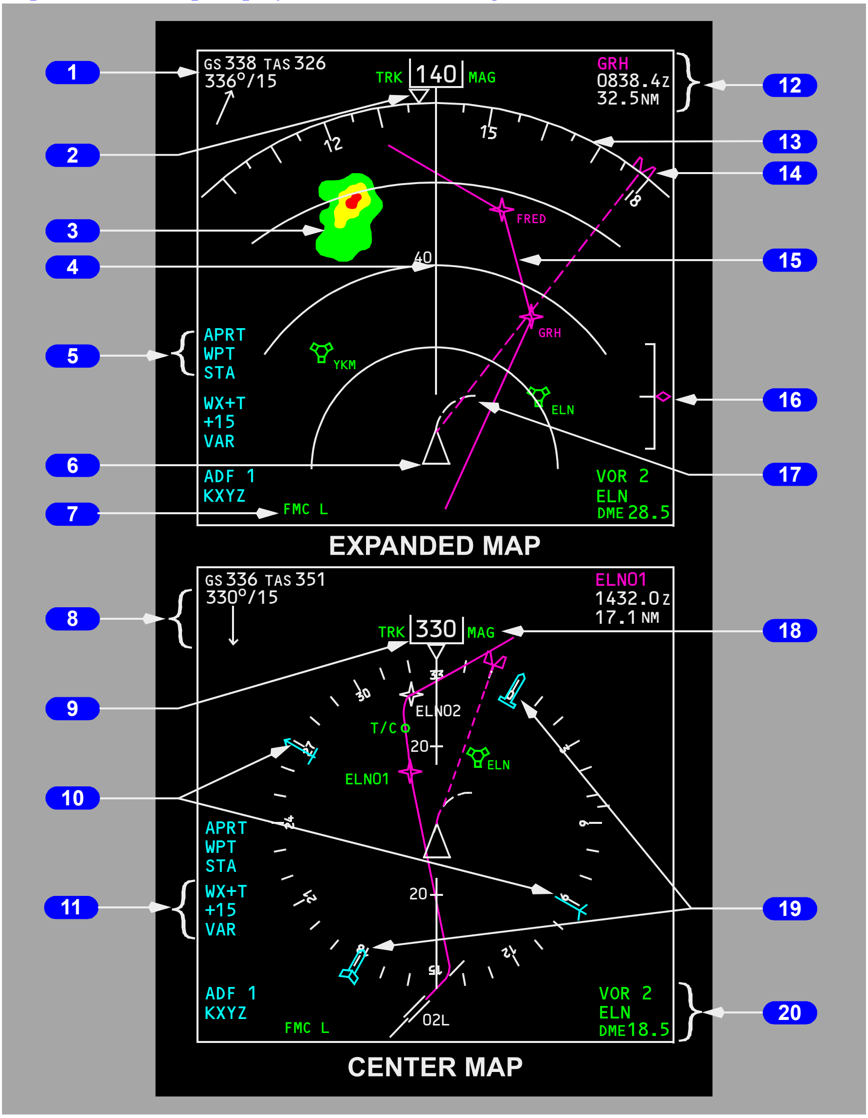
- when the bank angle is less than 35 degrees for 2 seconds, or;
- immediately if the bank angle is less than 10 degrees.

Navigation Displays – MAP Mode

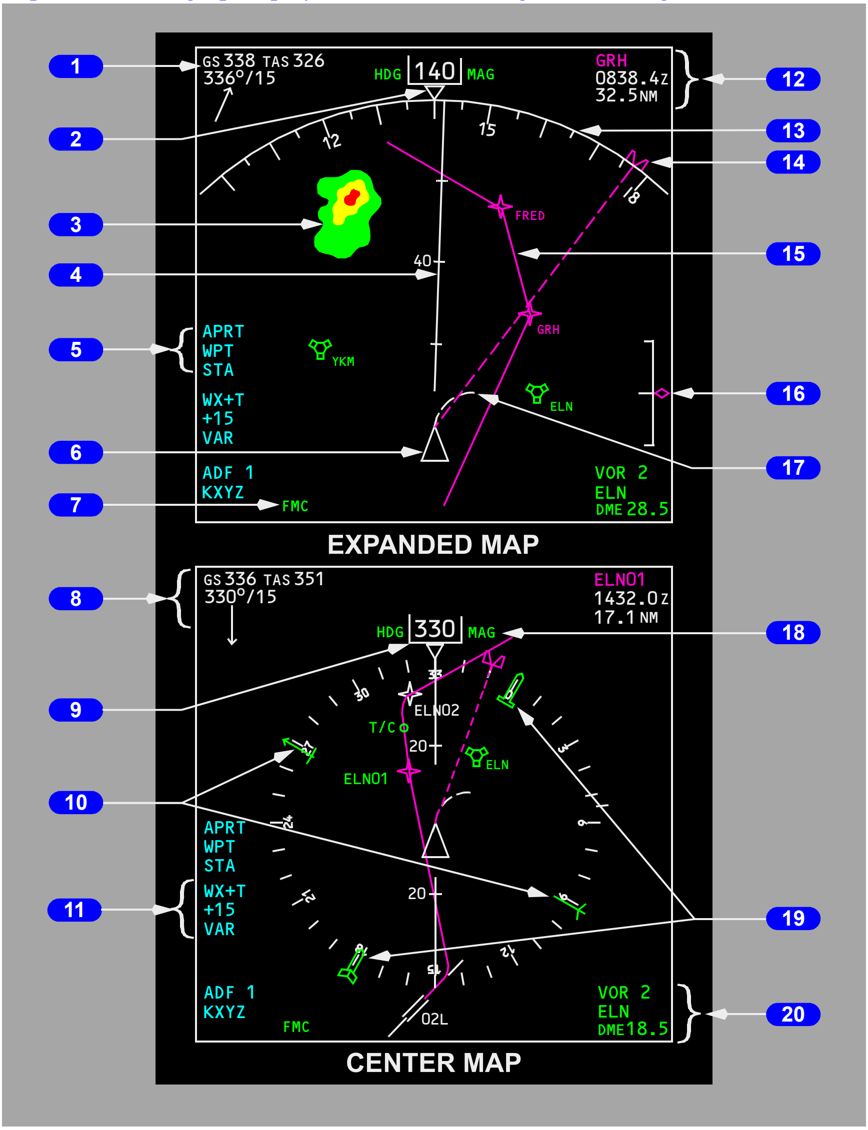
Note: Refer to Section 41 of this chapter for a detailed explanation of the navigation symbology shown on the following pages.

Expanded and Center MAP Modes

[Option - Track-up display, weather radar range arcs, dual FMC, ADF]



[Option - Heading-up display, weather radar range marks, single FMC, ADF]



1 **Groundspeed/True Airspeed**

2 **Heading Pointer**

3 **Weather Radar Returns**

4 **Track Line and Range Scale**

5 **Map Options**

6 **Airplane Symbol**

7 **Map Source Annunciation**

8 **Wind Direction/Speed/Arrow**

[Option - Heading-up display]
9 **Current Heading**

[Option - Track-up display]
9 **Current Track**

[Option - ADF]
10 **Number 1 VOR/ADF Pointer**

11 **Weather Radar Annunciations**

12 **Active Waypoint/ETA/Distance–To–Go**

13 **Compass Rose**

14 **Selected Heading Bug**

15 **Active LNAV Route**

16 **Vertical Deviation Scale and Pointer**

17 **Position Trend Vector**

18 **Magnetic/True Reference**

[Option - 2 ADF receivers]
19 **Number 2 VOR/ADF Pointer**

[Option - 2 ADF receivers]
20 **VOR/ADF Selection, Ident/Frequency, VOR DME**

Vertical Situation Display (VSD)

[Option VSD]

The VSD represents a profile view of the airplane and its environment along the current track. Information shown within the cyan dashed lines (enroute corridor) on the ND is shown in profile on the VSD.

Vertical Situation Display (VSD) - Reference Scales

1 **Enroute Swath**

Indicates area mapped by the VSD.

2 **Altitude Reference Scale**

Displays altitude in reference to the vertical position of the airplane symbol, terrain, and other objects in the VSD background display.

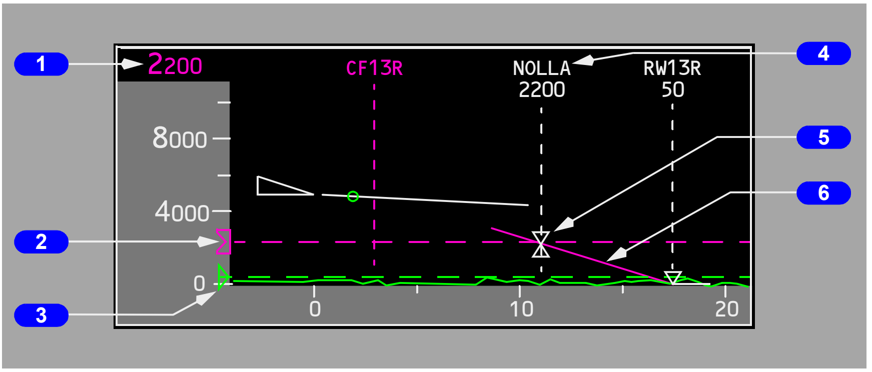
3 **Airplane Symbol**

Indicates current airplane altitude (bottom of the triangle) and lateral position (point of the triangle) relative to terrain.

4 Horizontal Reference Scale

Displays range in nautical miles. Actual range shown on VSD is one half the range selected on the EFIS control panel.

Vertical Situation Display (VSD) - General Background



1 MCP Selected Altitude Readout

Displays the altitude set in the MCP altitude window.

2 Selected Altitude Bug

Indicates the altitude set in the MCP altitude window.

When the selected altitude is off scale, the bug is parked at the top or bottom, with only one half the bug visible. The dashed line does not park.

3 BARO Minimums Pointer

Indicates the barometric minimums selected on the EFIS control panel:

- pointer and dashed line turn amber when airplane descends below selected minimum altitude
- reset with the RST switch on the EFIS control panel.

4 Waypoint ID and Anchor Line

Displayed with any altitude constraint directly beneath. Dashed vertical line depicts lateral position.

5 Altitude Constraint Symbol

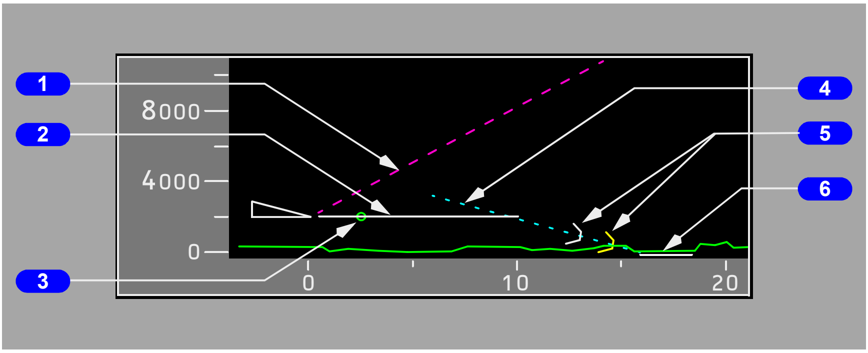
Displayed as triangle(s) on waypoint anchor line.

6 FMC Approach Glide Path Angle Line

Displayed for approaches that include a designated approach angle.

- extends 10 NM for situational awareness
- anchored to the missed approach waypoint, not the runway.
- manual altitude corrections do not change the displayed Navigation Database defined glidepath.

Vertical Situation Display (VSD) - Flight Path Background



1 MCP Selected Vertical Speed (V/S)

Displays the selected vertical speed as a dashed target angle line when the MCP V/S mode is selected.

2 Vertical Flight Path Vector

Indicates current flight path angle as a function of vertical speed and ground speed. The length of the vector is fixed at one half of the VSD range.

3 Range to Target Speed Dot (RTSD)

Indicates where the airplane will achieve the FMC or MCP target speed.

- dot is blanked within 5 knots of target speed
- dot reappears if speed increases 10 knots or more faster than target speed
- replaced with an unfilled dot at vector end if target speed will not be achieved within length of the vertical flight path vector line.

4 3-Degree Reference Line

Displayed for approaches that do not have a designated approach angle.

- dashed line extends 10 NM for situational awareness
- anchored to the runway threshold
- for reference only, line may intersect terrain.

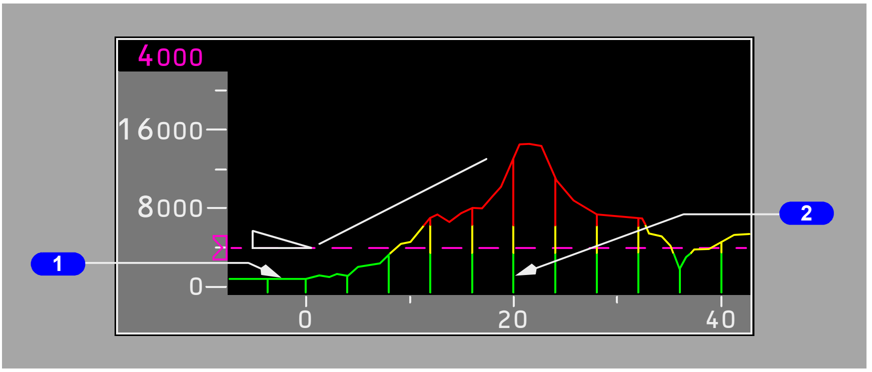
5 Decision Gates

Displayed on the FMC approach glide path angle line or 3 degree reference line at 500 feet and 1000 feet above field elevation.

6 Runway

Represents the selected runway.

Vertical Situation Display (VSD) - Terrain Background



1 Terrain Profile Line

Represents the highest terrain within the enroute swath.

- highest points of the terrain below and ahead of the airplane
- terrain is depicted so the true altitude separation between the airplane and terrain is shown
- terrain behind the airplane is drawn equal to the terrain at the current position
- VSD terrain uses the same color coding that is used to depict EGPWS terrain on the lateral map –
- green: terrain is more than 500 feet (250 feet gear down) below the airplane
- amber: terrain ranges from 500 feet below (250 feet gear down) to 2000 feet above the airplane
- red: terrain is 2000 feet above the airplane.

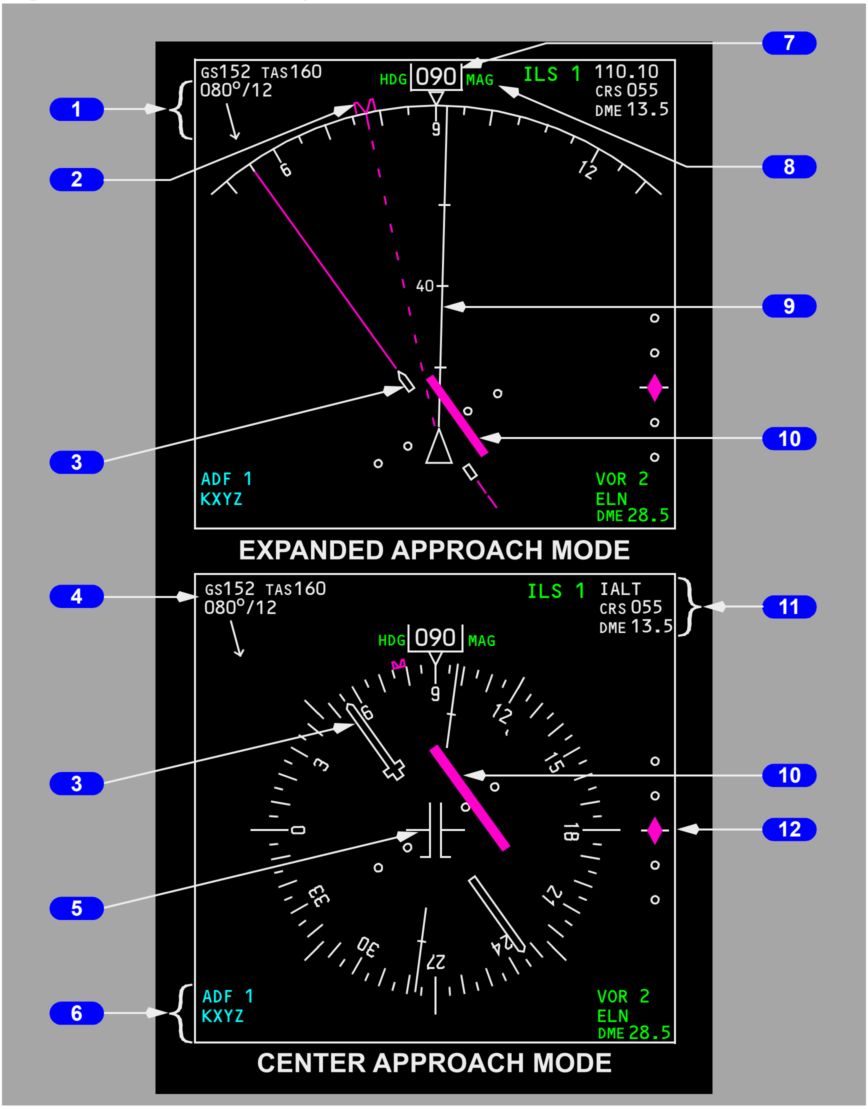
Note: See Chapter 15, Section 10, for Terrain Warnings.

2 Vertical Support Lines

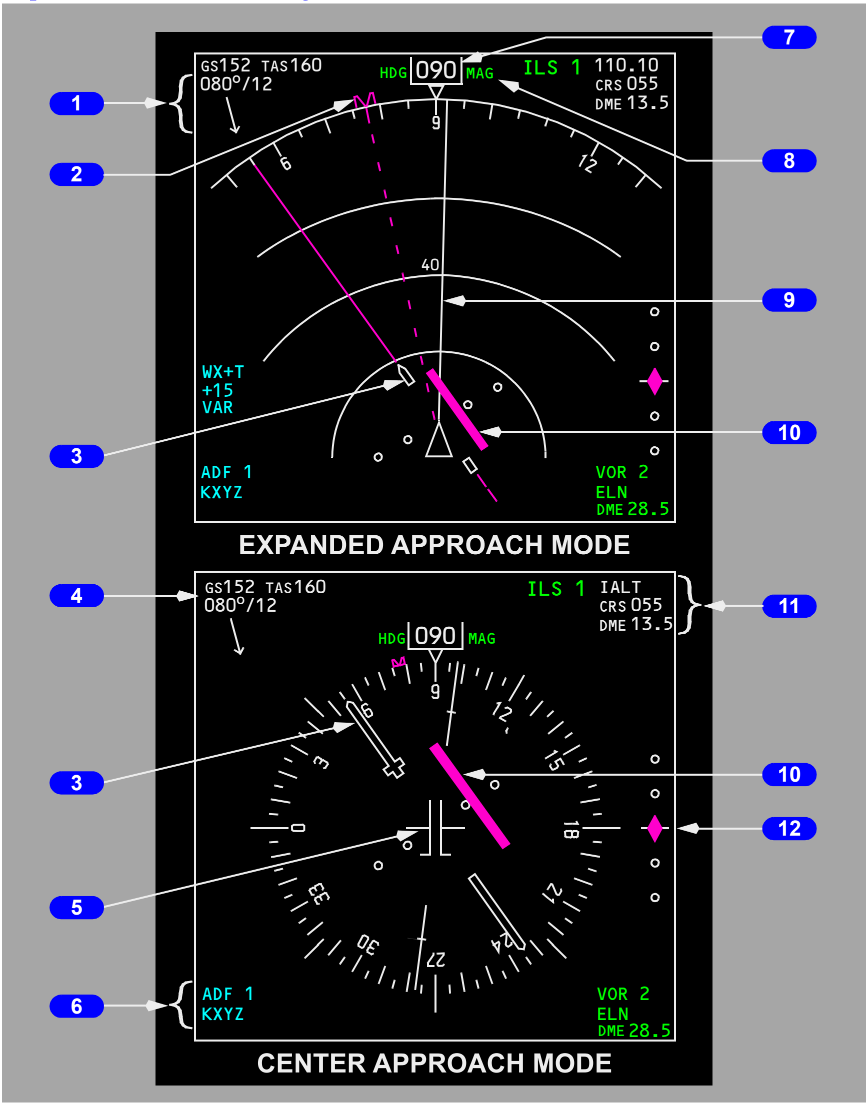
Vertical terrain vectors placed at constant intervals along the terrain profile line.

Navigation Displays – Approach Mode
Expanded and Center Approach Modes

[Option - Weather radar range marks, ADF]



[Option - Weather radar range arcs, ADF]



1 **Wind Direction/Speed/Arrow**

2 **Selected Heading Bug**

3 **Selected Course Pointer**

4 **Groundspeed/True Airspeed**

5 **Airplane symbol**

[Option - ADF}

6 **VOR/ADF Selection/Ident or Frequency/VOR DME**

7 **Current Heading**

8 **Magnetic/True Reference**

9 **Track Line**

10 **Localizer Deviation Indication and Scale**

[Option - IAN]

10 **ILS Localizer/IAN FAC Deviation Indication and Scale**

11 **Reference ILS Frequency or Ident/Course/DME**

[Option - IAN]

11 **Reference ILS Frequency or Ident/Course/DME/Distance and Source Annunciation**

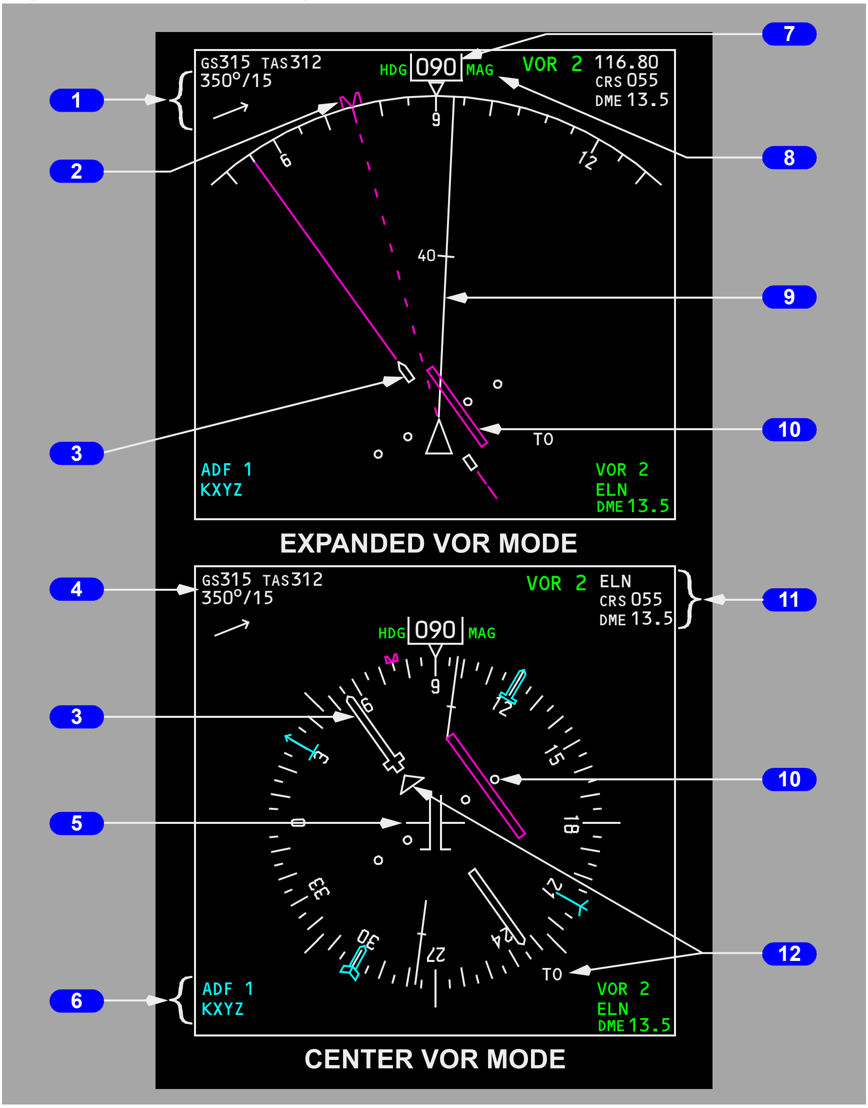
12 **Glideslope Pointer and Scale**

[Option - IAN]

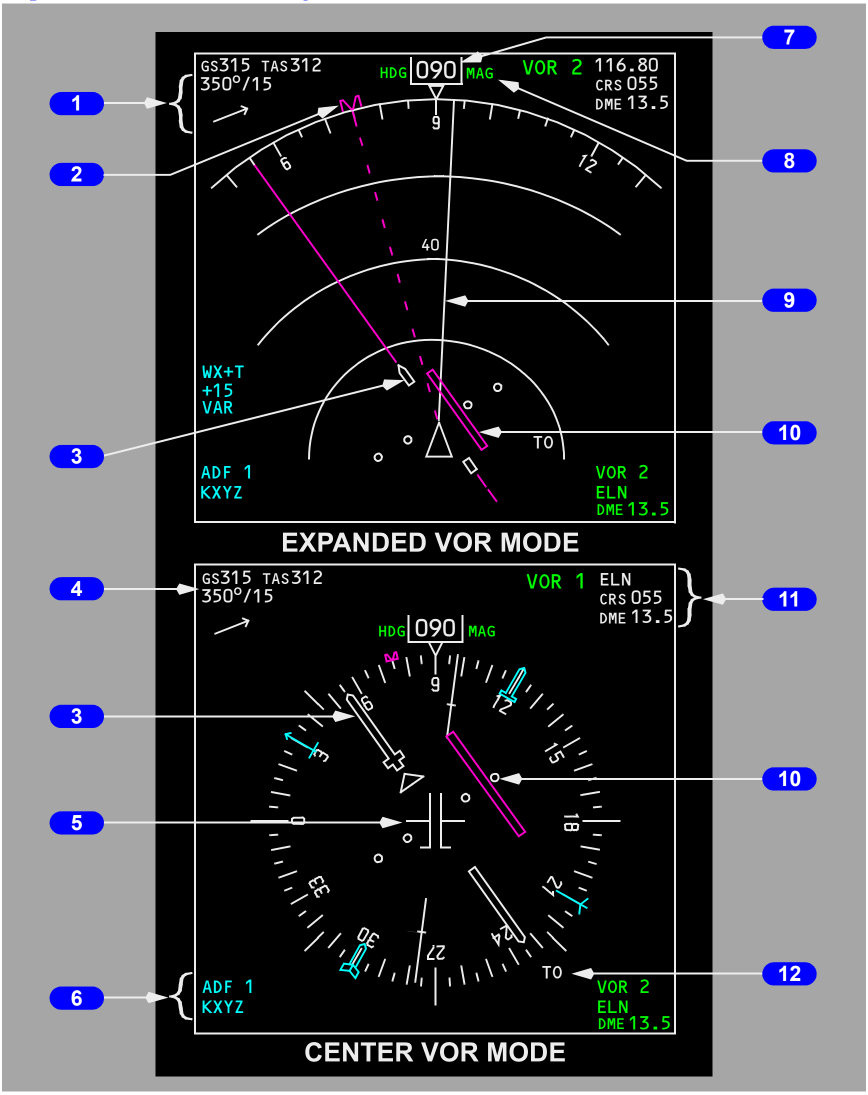
12 **ILS Glideslope/IAN Glide Path Pointer and Scale**

Navigation Displays – VOR Mode
Expanded and Center VOR Modes

[Option - Weather radar range marks, ADF]



[Option - Weather radar range arcs, ADF]



1 **Wind Direction/Speed/Arrow**

2 **Selected Heading Bug**

3 **Selected Course Pointer**

4 **Groundspeed/True Airspeed**

5 **Airplane symbol**

[Option - ADF]
6 **VOR/ADF Selection/Ident or Frequency/VOR DME**

7 **Current Heading**

8 **Magnetic/True Reference**

9 **Track Line**

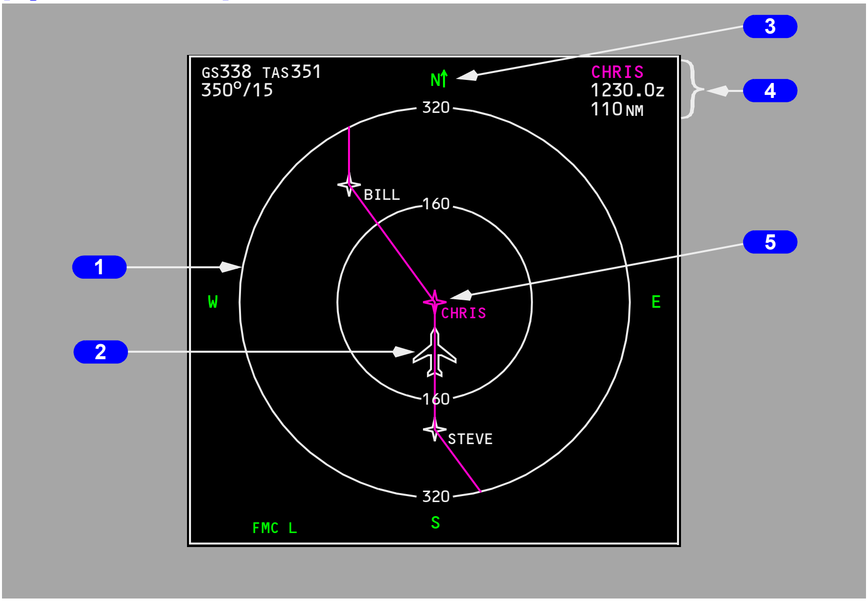
10 **Course Deviation Indication and Scale**

11 **Reference VOR Receiver/Frequency or Ident/Course/DME**

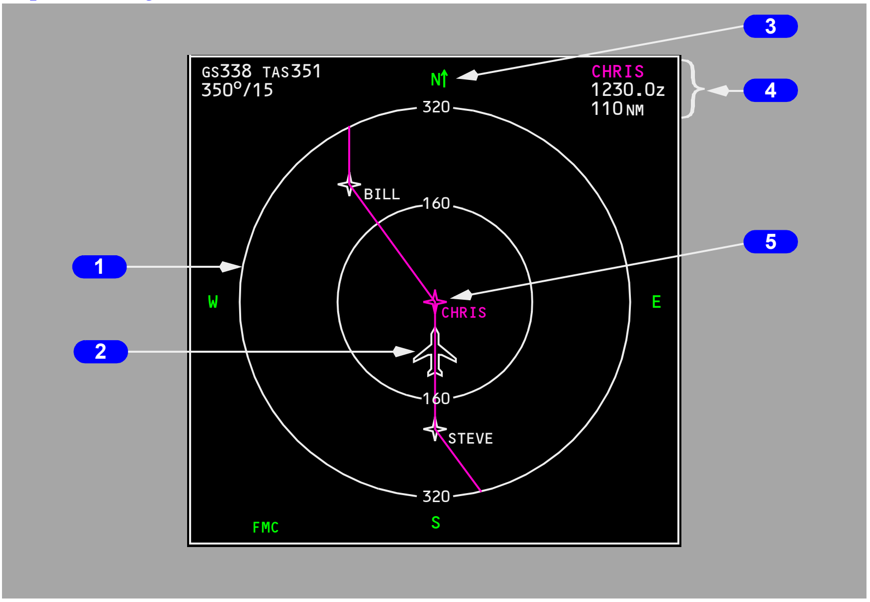
12 **TO/FROM Indication and TO pointer**

Navigation Displays – Plan Mode
Plan Mode

[Option - Dual FMC]



[Option - Single FMC]



1 Range Circle

2 Airplane Symbol

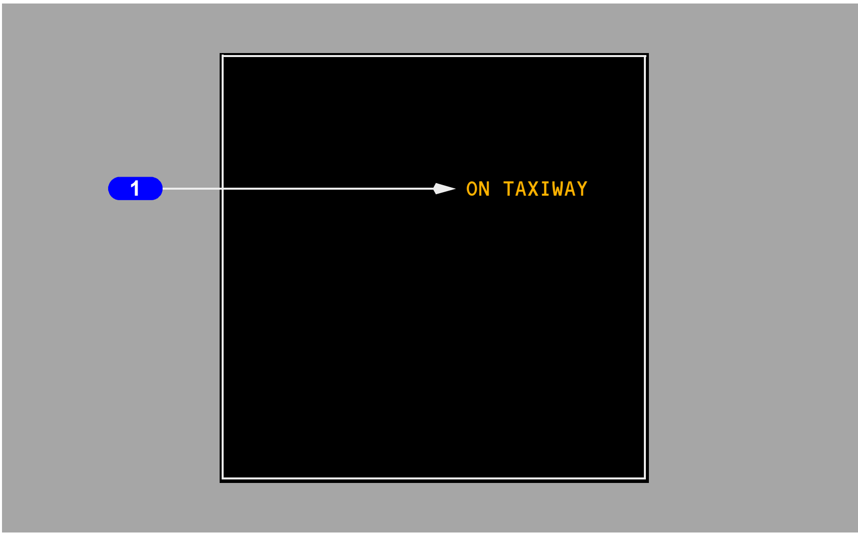
3 True North Up Arrow

4 Active Waypoint Information

5 Center Waypoint

The waypoint located at the display center is identified as CTR on the CDU RTE LEGS page.

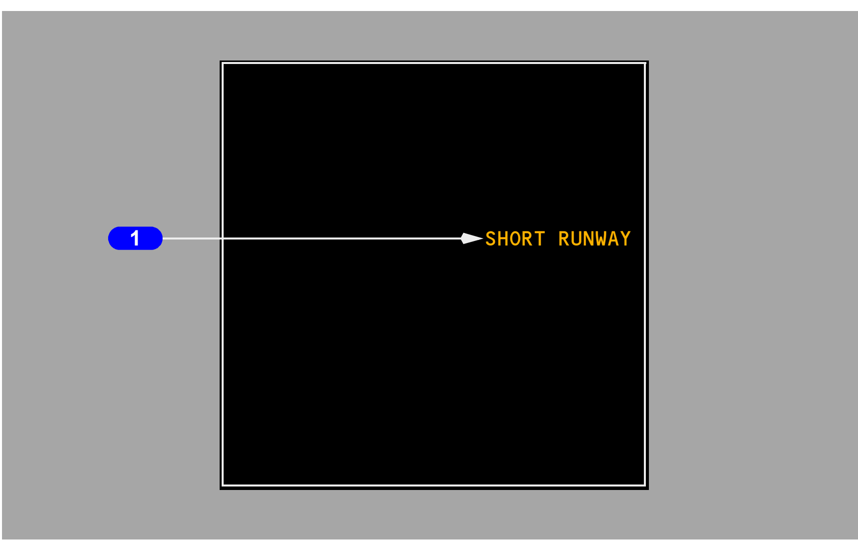
Navigation Displays – Alerts
Runway Awareness and Advisory System Alerts (RAAS)



1 ON TAXIWAY (amber)

[Option - Taxiway T/O ALERT]
Appears each time the airplane:

- is on a surface other than a runway, and
- ground speed is greater than 40 knots

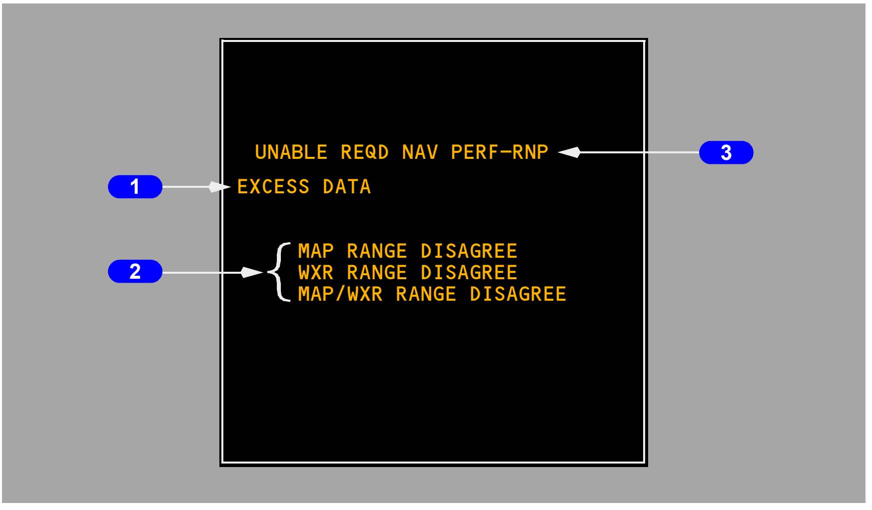


1 SHORT RUNWAY (amber)

[Option - Insufficient Rwy Length T/O ALERT]
Appears each time the airplane:

- is on a runway with available runway length for takeoff less than the defined length required, and
- heading is within 20 degrees of the runway heading, and
- ground speed is greater than 40 knots.

Navigation Displays – Advisory Messages
Navigation Advisory Messages



1 Excess Data Annunciation (amber)

The amount of map information sent to the primary display system is too great to display. When this occurs, the system removes some information from the display.

The message can be cleared by:

- decluttering - removing unnecessary navigation information.
- reducing the display range.
- deselecting one or more of the EFIS MAP switches (STA, WPT, ARPT, DATA, POS).

2 Range Disagreement Annunciations (amber)

MAP RANGE DISAGREE – Indicates selected range on the EFIS control panel is different than the MAP display range.

WXR RANGE DISAGREE – Indicates selected range on the EFIS control panel is different than the WXR display range.

MAP/WXR RANGE DISAGREE – Indicates selected range on the EFIS control panel is different than the MAP and WXR display ranges.

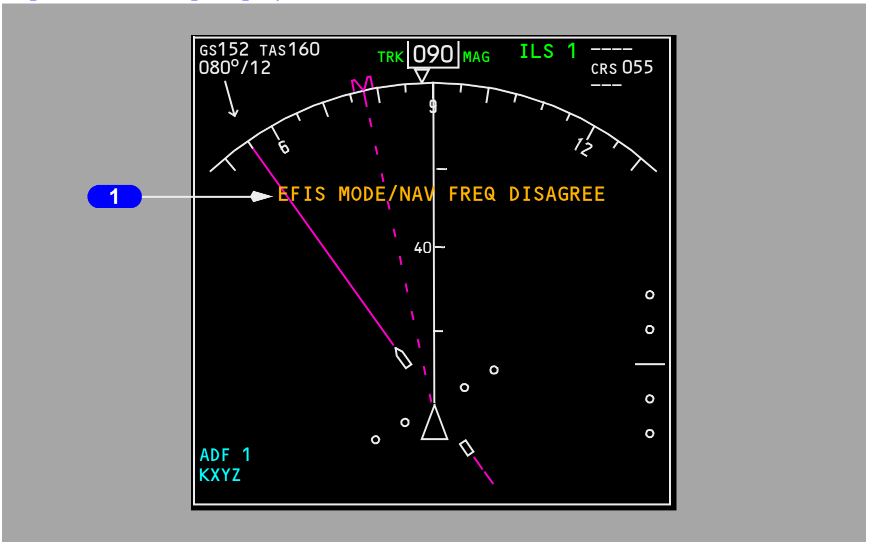
3 **Nav Advisory Message (amber)**

UNABLE REQD NAV PERF– RNP – Displayed in MAP modes when FMC actual navigation performance is not sufficient for the displayed RNP. Refer to Chapter 11, Section 60, FMC Messages.

Mode/Frequency Disagree Annunciation

[Option - Heading-up display, ADF]

[Option - Track-up display, ADF]



1 EFIS MODE/NAV FREQ DISAGREE (amber)

The ILS or VOR source annunciation corresponds to the position selected on the EFIS control panel and the tuned VOR/ILS frequency.

The annunciation is displayed:

- if APP is selected with a VOR frequency tuned
- if VOR is selected with an ILS frequency tuned.

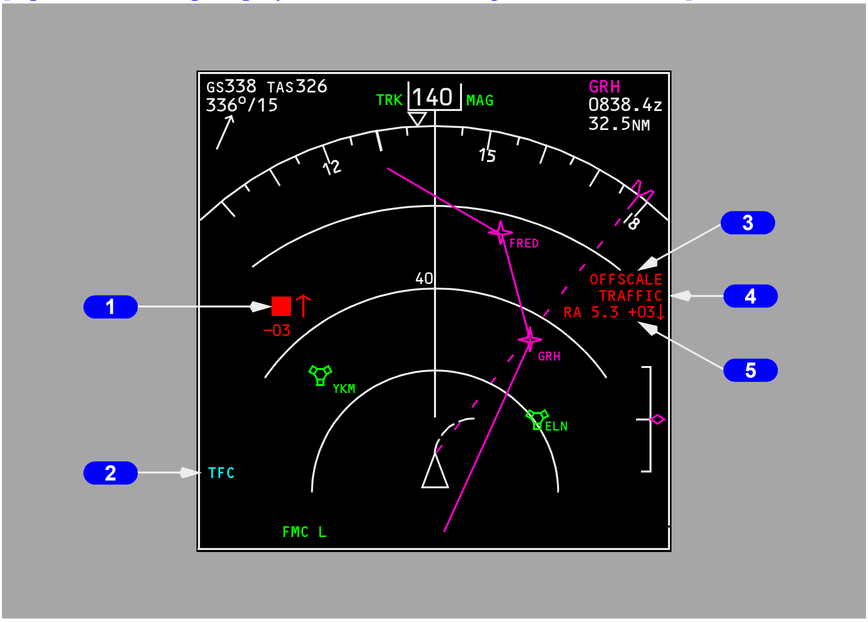
The DME display and ILS/VOR frequency at the upper right corner display dashes.

The localizer deviation bar, VOR course deviation bar and glideslope pointer are not displayed.

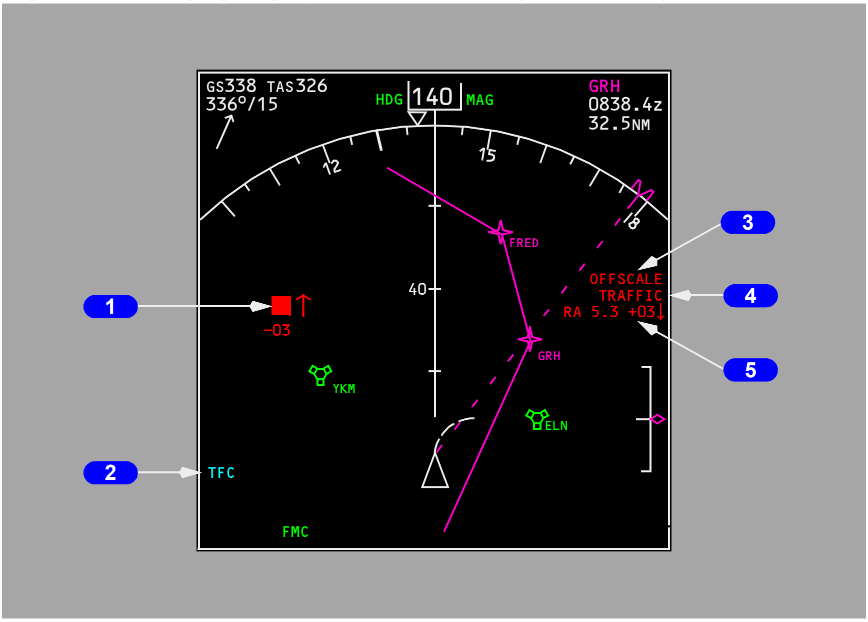
The annunciation is displayed in the expanded APP, center APP, expanded VOR and center VOR modes.

TCAS Messages

[Option - Track-up display, weather radar range arcs, dual FMC]



[Option - Heading-up display, weather radar range marks, single FMC]



1 TCAS Traffic Symbols

Note: Refer to Section 41 of this chapter for a detailed explanation of the traffic symbology.

Indicates position of traffic targets.

Displayed in expanded MAP, center MAP, expanded APP and expanded VOR modes and TFC is selected on the EFIS control panel.

2 TCAS Annunciations

TFC (cyan) – Indicates TFC selected on EFIS control panel in expanded MAP, center MAP, expanded APP and expanded VOR.

TCAS TEST (cyan) – TCAS in test mode.

TA ONLY (cyan) – TCAS TA mode only.

TCAS OFF (amber) – TCAS off.

3 Offscale (red or amber)

TA (amber) or RA (red) is beyond the selected display range and TFC is selected on the EFIS control panel.

4 Traffic (red or amber)

Displayed during a TA (amber) or RA (red) condition whether or not TFC is selected on the EFIS control panel.

5 No–Bearing Messages (red or amber)

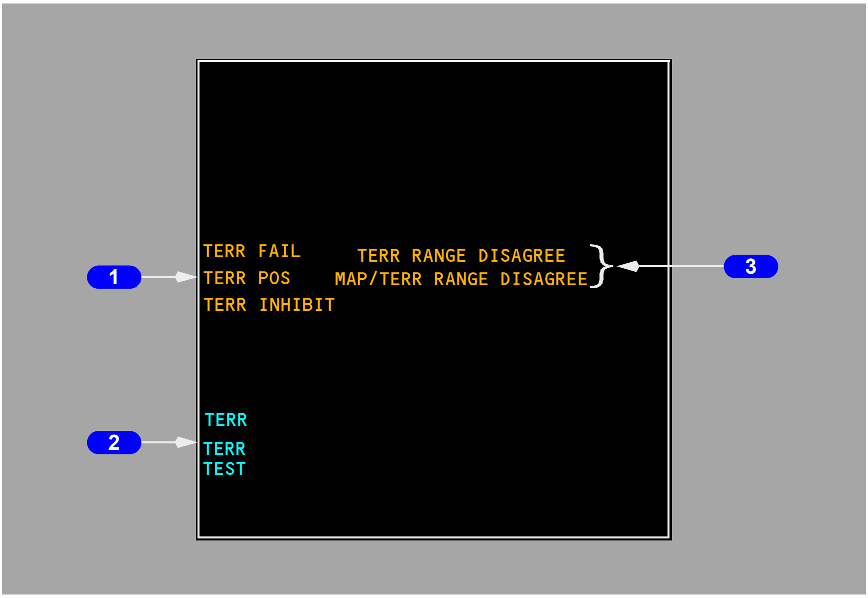
Textual description of TA (amber) or RA (red) traffic with no associated bearing.

Message provides traffic type, range in NM, altitude and a vertical motion arrow.

A maximum of two messages can be displayed simultaneously.

TFC selected on the EFIS control panel.

Look-Ahead Terrain Messages (GPWS)



1 Terrain Status Annunciation (amber)

TERR FAIL – Look-ahead terrain alerting and display have failed.

TERR POS – Look-ahead terrain alerting and display unavailable due to position uncertainty.

TERR INHIBIT – GPWS terrain inhibit switch in TERR INHIBIT position.

2 Terrain Mode Annunciation (cyan)

TERR – Terrain display enabled (manual or automatic display).

TERR TEST – GPWS is operating in self-test mode.

3 Terrain Range Status Annunciation (amber)

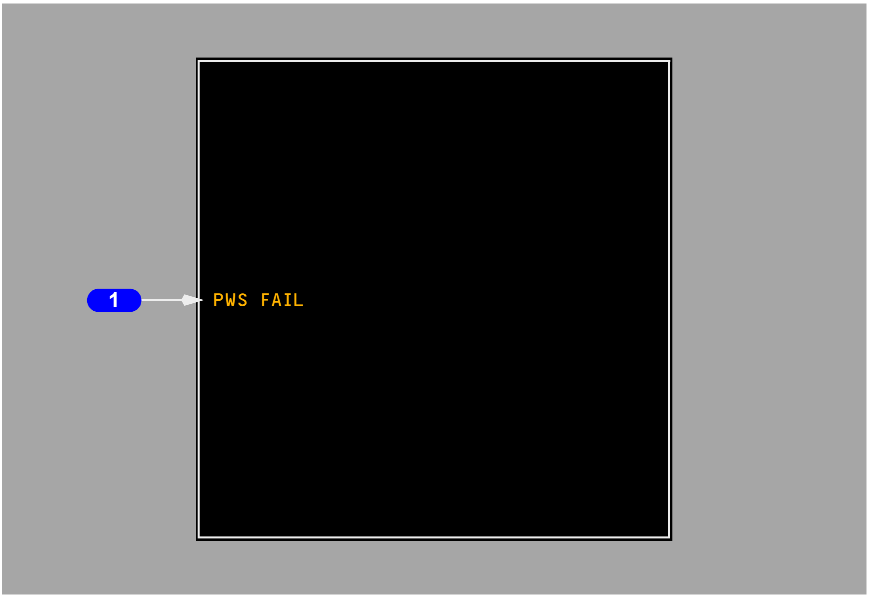
TERR RANGE DISAGREE –

- terrain display enabled, and
- terrain output range disagrees with selected EFIS control panel range.

MAP/TERR RANGE DISAGREE –

- terrain display enabled, and
- terrain output range disagrees with selected EFIS control panel range, and
- map display output range disagrees with selected EFIS control panel range.

Predictive Windshear System (PWS) Message



1 PWS FAIL Annunciation (amber)

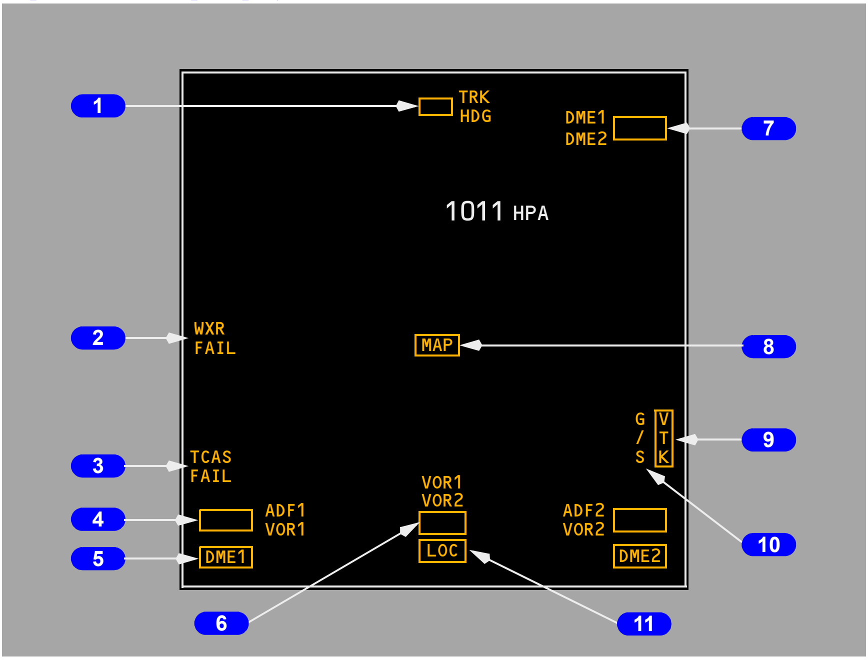
Predictive windshear alerting and display have failed.

Navigation Displays – Failure Indications and Flags

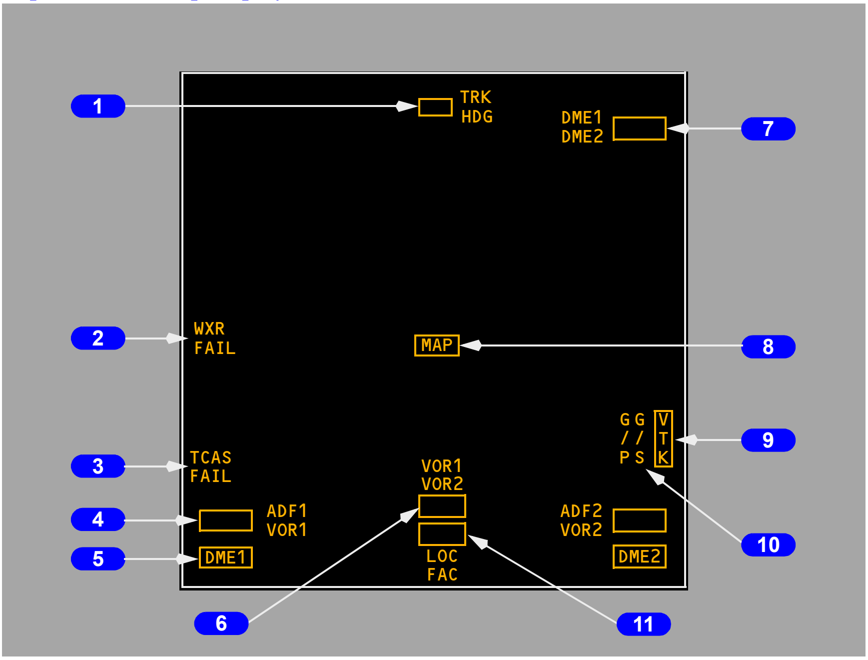
Dashes replace numbers if there is no computed information. Failure flags replace symbols or failure messages are displayed, as appropriate.

Center MAP, Expanded MAP, APP, & VOR Modes

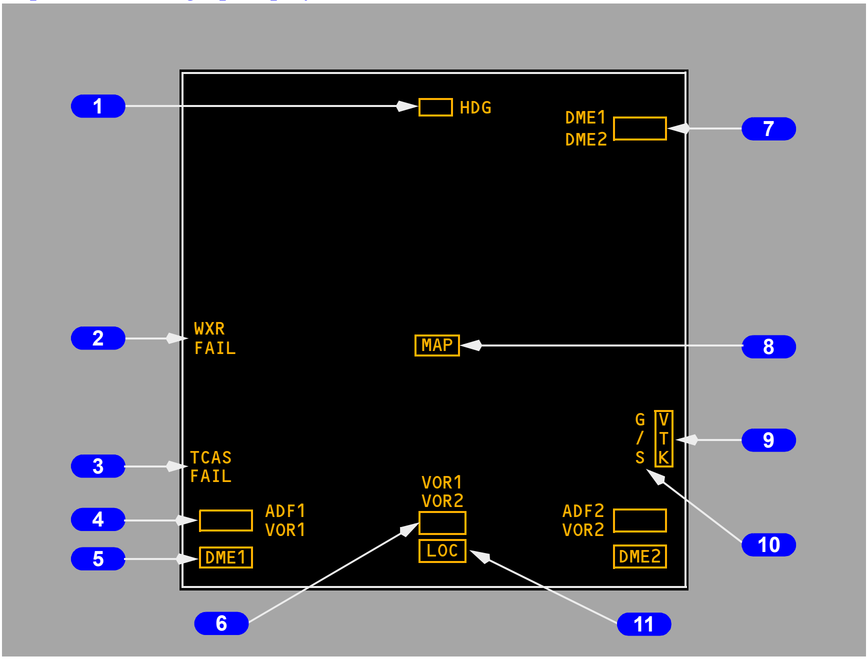
[Option - Track-up display, dual ADF]



[Option - Track-up display, dual ADF, IAN]



[Option - Heading-up display, dual ADF]



[Option - Track-up display]

1 Track Failure Flag (expanded and center MAP modes)

Track information failed. Track cannot be displayed.

[Option - Heading-up display]

1 Heading Failure Flag (expanded and center MAP, expanded APP and expanded VOR modes)

Heading information failed. Heading cannot be displayed.

2 Weather Radar Annunciations (expanded and center MAP, expanded APP, expanded VOR modes)

WXR FAIL – Weather radar has failed. No weather data are displayed.

WXR WEAK – Weather radar calibration fault.

WXR ATT – Attitude stabilization for antenna has been lost.

WXR STAB – Antenna stabilization is off.

WXR DSP – Range data input has failed. Only displayed in WXR TEST

3 TCAS Failure Flag (expanded and center MAP, expanded VOR, expanded APP, PLAN modes)

TCAS has failed.

[Option - Dual ADF]
4 ADF 1 and ADF 2 or VOR 1 and VOR 2 Failure Flag (expanded and center MAP, expanded APP, expanded VOR modes)

ADF or VOR has failed.

5 DME 1 and DME 2 Failure Flag (expanded and center MAP, expanded APP, expanded VOR modes)

Selected VOR DME has failed.

6 VOR 1, 2 Failure Flag (expanded VOR mode)

VOR has failed.

7 Reference VOR DME (expanded VOR mode) and Reference ILS DME (expanded APP mode)

Reference VOR or ILS DME has failed.

8 MAP Failure Flag (expanded and center MAP, PLAN modes)

The related FMC generated map display has failed.

9 Vertical Track Failure Flag (expanded and center MAP modes)

FMC vertical track data is invalid.

10 ILS Glideslope Failure Flag (expanded APP mode)

ILS glideslope has failed.

[Option - IAN]
10 ILS Glideslope/IAN Glide Path Failure Flag (expanded APP mode)

ILS glideslope or IAN glide path has failed.

11 ILS Localizer Failure Flag (expanded APP mode)

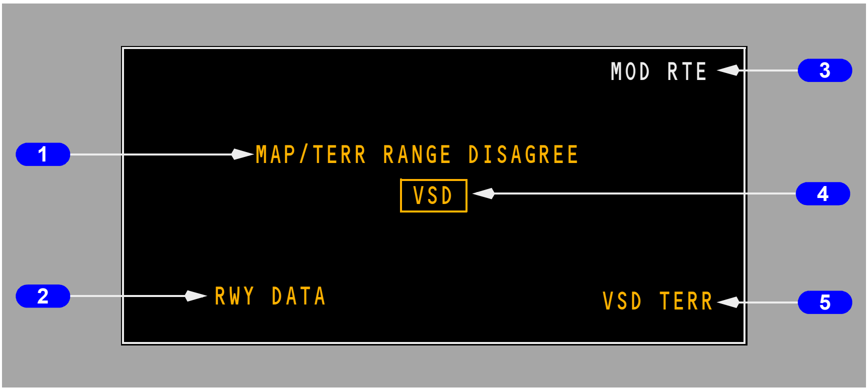
ILS localizer course indication has failed.

[Option - IAN]
11 ILS Localizer/IAN FAC Failure Flag (expanded APP mode)

ILS localizer course indication or IAN FAC has failed.

Vertical Situation Display (VSD)

[Option VSD]



1 Range Disagreement Annunciations (amber)

MAP RANGE DISAGREE – Indicates selected range on the EFIS control panel is different than the MAP display range.

TERR RANGE DISAGREE – Indicates selected range on the EFIS control panel is different than the Terrain display range.

MAP/TERR RANGE DISAGREE – Indicates selected range on the EFIS control panel is different than the MAP and Terrain display ranges.

2 Runway Data Annunciation (amber)

FMC runway data is not available.

3 Route Waypoints Modification Annunciation (white)

FMC active route is being modified. Only active waypoint is displayed.

4 VSD Failure Flag (amber)

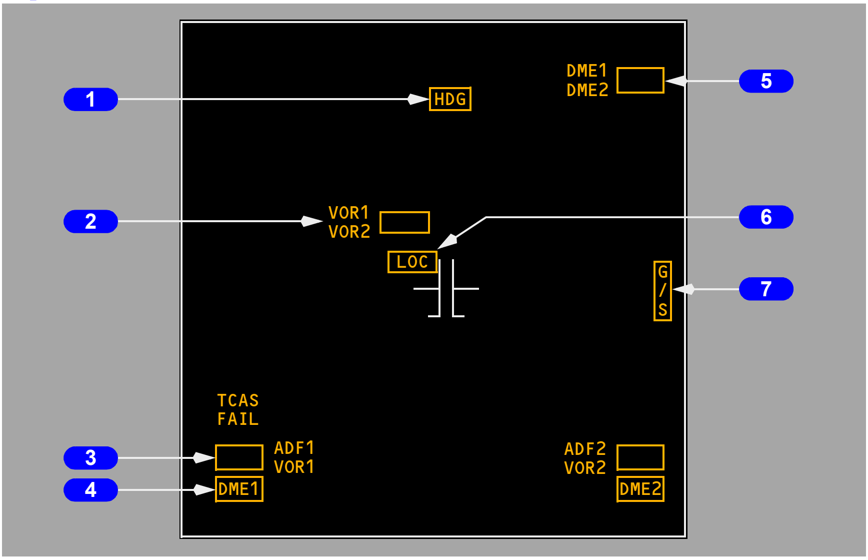
VSD cannot be displayed.

5 Terrain Data Failure Annunciation (amber)

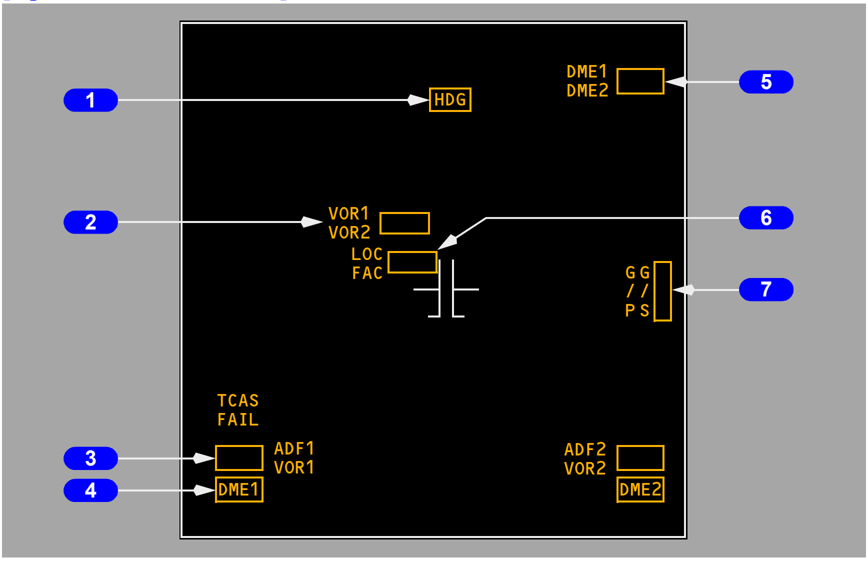
EGPWS terrain data is not available. Annunciation is replaced with VSD TERR INHIBIT when GPWS control panel TERR INHIBIT switch is in the inhibit position.

Center APP and Center VOR Modes

[Option - Dual ADF]



[Option - Dual ADF, IAN]



1 Heading Failure Flag (center APP, center VOR modes)

Heading indication failed. Heading cannot be displayed.

2 VOR Failure Flag (center VOR mode)

VOR has failed.

[Option - Dual ADF]
3 ADF 1 and ADF 2 or VOR 1 and VOR 2 Failure Flag (center APP, center VOR modes)

VOR or ADF has failed.

4 DME 1 and DME 2 Failure Flag (center APP, center VOR modes)

Selected VOR DME has failed.

5 Reference VOR DME (center VOR mode) and Reference ILS DME (center APP mode)

Reference VOR or ILS DME has failed.

6 ILS Localizer Failure Flag (center APP mode)

ILS localizer course indication has failed.

[Option - IAN]
6 ILS Localizer/IAN FAC Failure Flag (center APP mode)

ILS localizer course indication or IAN FAC has failed.

7 ILS Glideslope Failure Flag (center APP mode)

ILS glideslope has failed.

[Option - IAN]
7 ILS Glideslope/IAN Glide Path Failure Flag (center APP mode)

ILS glideslope or IAN glide path has failed.

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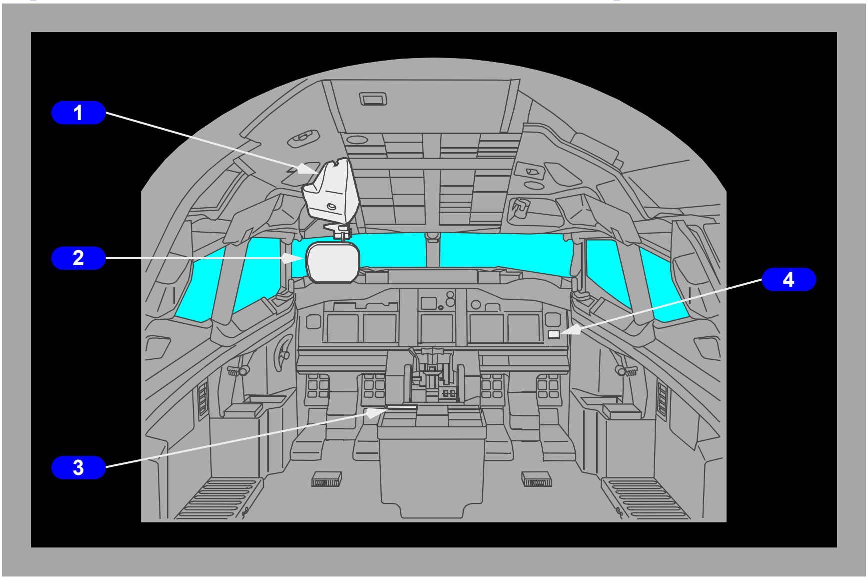
Flight Instruments, Displays — Chapter 10
Head-Up Display System - Displays — Section 12

System Components

[Option - Model 4000 with standard location first officer panel]



1 Overhead Unit

Contains the CRT and projection optics to display the symbolic image on the combiner.

2 Combiner

Combines displayed flight symbology with the pilot's view through window No. 1.

3 Control Panel

Used for data entry and to select modes of operation.

4 Annunciator

Provides system status and warning annunciations during a CAT III approach.

Combiner Display

The combiner displays symbology and fault indications for the HUD system. Display modes of operation include:

- Primary (PRI)
- AIII approach
- Instrument Meteorological Conditions (IMC) approach
- Visual Meteorological Conditions (VMC) approach.

Typical display modes are shown below.

Note: Not all symbols are represented in this section. Refer to Section 10-42, Head-Up Display System, Symbology, for a complete listing of HUD system symbology.

Primary (PRI) Mode Display

[Option - Model 4000]

The primary mode can be used for all phases of flight from takeoff to landing including low visibility takeoff and landing rollout operations.

PRI (IN FLIGHT) MODE

PRI (TAKEOFF) MODE

1 **Bank Scale and Pointer**

2 **Flight Mode Annunciations (FMAs)**

Refer to Chapter 4, Automatic Flight.

3 **Airspeed Indications**

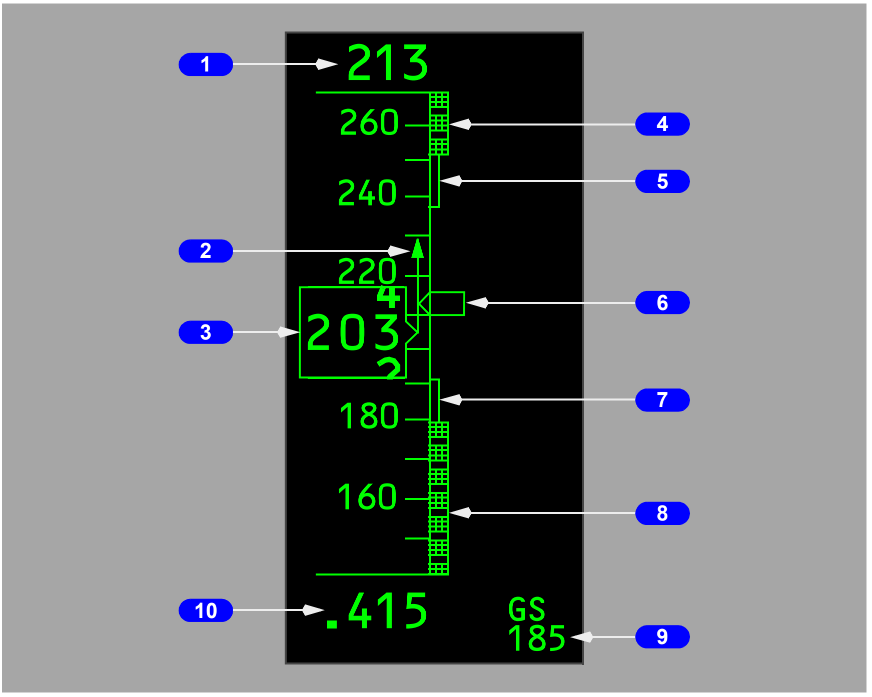
4 **Navigation Indications**

5 **Attitude Indications**

6 **Altitude Indications**

7 **Ground Localizer Line**

Airspeed Indications - General



1 Selected Speed (all modes)

Displays target airspeed:

- manually selected in the IAS/MACH window
- indicates the FMC computed airspeed when the IAS/MACH window is blank.

2 Speed Trend Vector (PRI in flight, PRI ground modes)

Tip of arrow indicates predicted airspeed in the next 10 seconds based on the current airspeed and acceleration.

3 Computed Airspeed (PRI in flight, PRI ground modes)

Indicates current computed airspeed in knots.

Displayed relative to a vertical scale along the edge of the tape and as a digital value.

4 Maximum Speed (PRI in flight mode)

Bottom of bar indicates the maximum speed as limited by the lowest of the following:

- Vmo/Mmo
- landing gear placard speed
- flap placard speed.

Inhibited on the ground.

5 Maximum Maneuver Speed (PRI in flight mode)

When flaps are up, the bottom of the bar indicates the maximum maneuver speed. This airspeed provides 1.3g maneuver capability to high speed buffet (or an alternative approved maneuver capability set in the FMC maintenance pages). The bar may be displayed when operating at high altitude at relatively high gross weights.

Note: 1.3g maneuver capability occurs at 40 degrees of bank in level flight.

[Option] - CDS Software Upgrade - BP02/04/06
When flaps are not up, the bottom of the bar indicates the placard speed for the next normal flap setting. The display logic is based on a normal flap setting sequence of 1, 5, 15, 30, 40. The bar is removed when the flap handle is moved to the landing flap setting selected on the APPROACH REF page or when the flap lever is moved to flaps 40. It is also removed with any flap retraction.

6 Speed Bug (PRI in flight, PRI ground modes)

Points to the airspeed:

- manually selected in the IAS/MACH window
- indicates the FMC computed airspeed when the IAS/MACH window is blank.

When the selected speed is off scale, the bug is parked at the top or bottom of the tape, with only one half bug visible.

7 Minimum Maneuver Speed (PRI in flight, PRI ground modes)

Top of the bar indicates minimum maneuver speed. This airspeed provides

- 1.3g maneuver capability to stick shaker below approximately 20,000 ft.
- 1.3g maneuver capability to low speed buffet (or an alternative approved maneuver capability set in the FMC maintenance pages) above approximately 20,000 ft.

Note: 1.3g maneuver capability occurs at 40 degrees of bank in level flight.

CAUTION: Reduced maneuver capability exists when operating within the regions below the minimum maneuver speed or above the maximum maneuver speed. During non-normal conditions the target speed may be below the minimum maneuver speed.

8 Minimum Speed (PRI in flight mode)

Top of bar indicates the speed at which stick shaker occurs.

Inhibited on the ground.

9 Ground Speed (all modes)

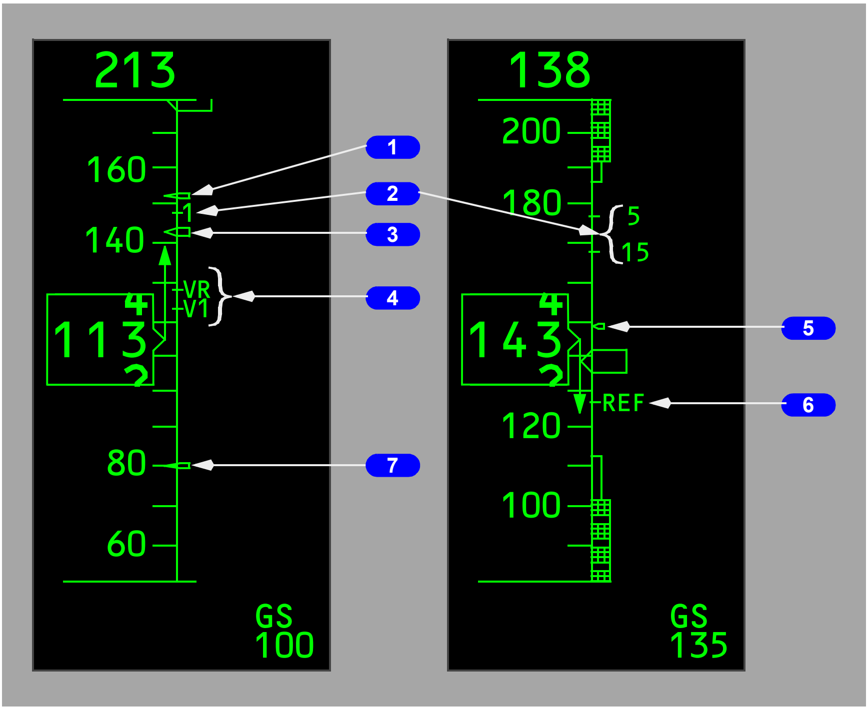
Indicates current ground speed in one knot increments.

10 Mach Speed (PRI in flight)

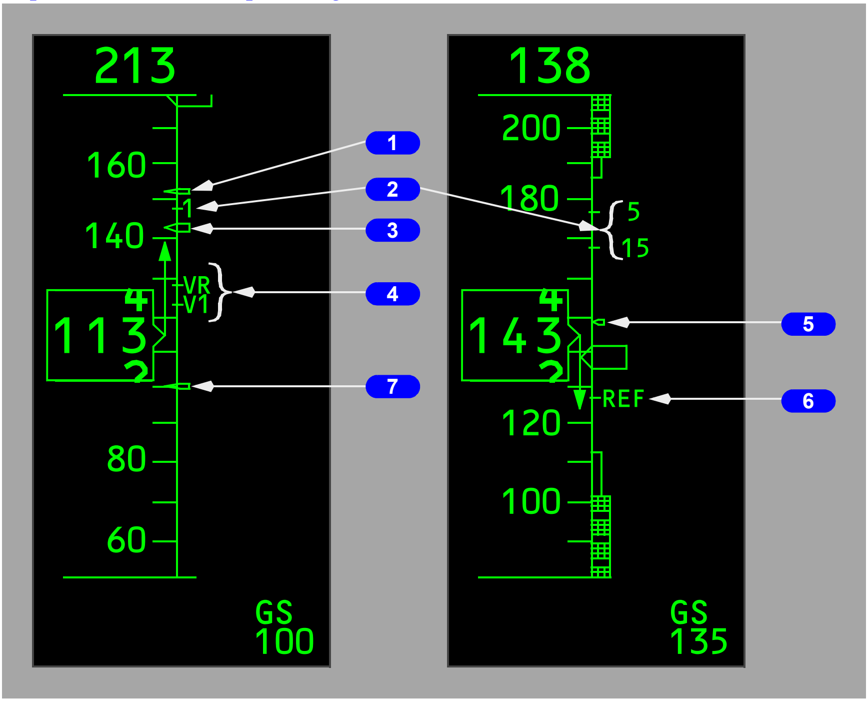
Indicates current mach speed when mach increases above .400 and removed when mach decreases below .380.

Note: In other than the PRI mode, the airspeed scale and associated symbols are replaced with a digital readout. The readout is positioned relative to the flight path vector. If the flight path vector is not displayed, the readout is positioned relative to the airplane reference symbol.

Airspeed Indications - Takeoff and Approach



[Option - 100 knot airspeed bug]



1 **Bug 5 (PRI in flight, PRI ground modes)**

Displayed if speed reference selector on the engine display control panel is in the bug 5 position or SET position and a value greater than 60 knots has been selected. Not available if the speed reference selector is in the AUTO position.

2 **Flaps Maneuvering Speeds (PRI in flight mode)**

Indicates flap maneuvering speed for the displayed flap position.

3 **V2+15 (PRI in flight mode)**

Displayed for takeoff.

Removed when either of the following occurs:

- at first flap retraction
- when VREF is entered in the CDU.

4 **Takeoff Reference Speeds (PRI ground mode)**

Indicates V1 (decision speed) and VR (rotation speed) as selected on the CDU TAKEOFF REF page (refer to Chapter 11, Flight Management, Navigation) or as set with the speed reference selector on the engine display control panel.

5 **VREF+15 (PRI in flight, PRI ground modes)**

Displayed after selection of VREF.

5 **VREF+20 (PRI in flight, PRI ground modes)**

Displayed after selection of VREF.

6 **Landing Reference Speed (PRI in flight, PRI ground modes)**

Indicates REF (reference speed) as selected on the CDU APPROACH REF page (refer to Chapter 11, Flight Management, Navigation) or as set with the speed reference selector on the engine display control panel. Replaced by a digital readout when off-scale at the bottom of the airspeed tape.

7 **80 Knot Airspeed Bug (PRI in flight, PRI ground modes)**

Indicates 80 knots:

- displayed automatically during preflight
- removed at first flap retraction or when VREF is entered.

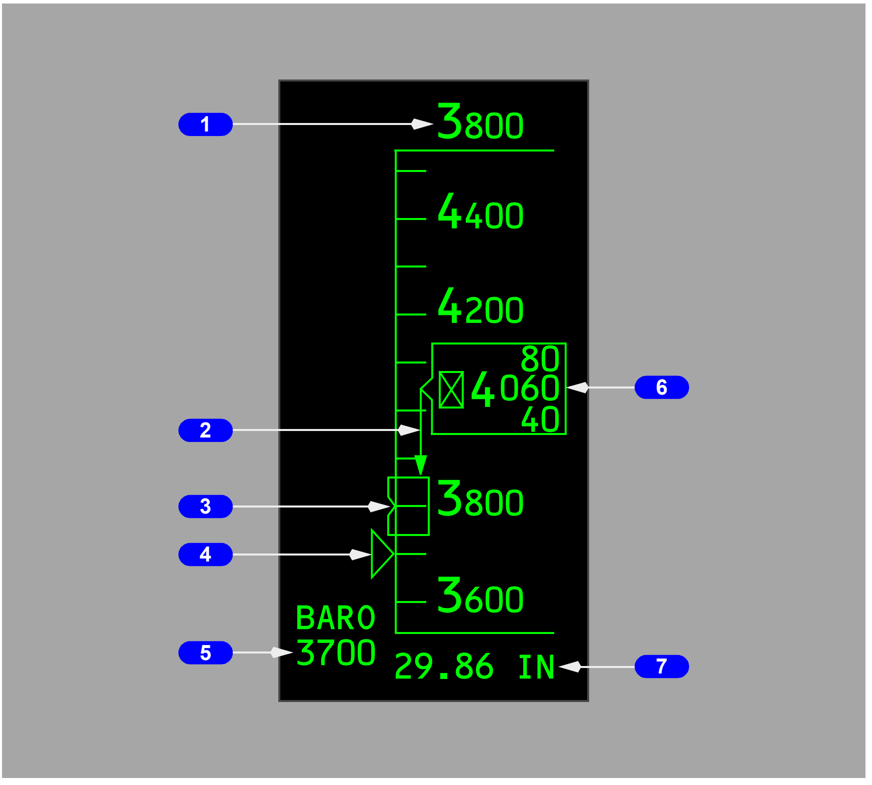
[Option - 100 knot airspeed bug]

7 **100 Knot Airspeed Bug (PRI in flight, PRI ground modes)**

Indicates 100 knots:

- displayed automatically during preflight
- removed at first flap retraction or when VREF is entered.

Altitude Indications



1 Selected Altitude (PRI in flight, PRI ground modes)

Displays the altitude set in the MCP altitude window.

2 Altitude Trend Vector (PRI in flight mode)

Tip of arrow indicates predicted altitude in the next 6 seconds based on the current vertical speed.

3 Selected Altitude Bug (PRI in flight, PRI ground modes)

Points to the altitude set in the MCP altitude window.

When the selected altitude is off scale, the bug is parked at the top or bottom of the tape, with only one half bug visible.

4 BARO Minimums Pointer (PRI in flight, PRI ground modes)

Displays the barometric minimums selected on the EFIS control panel.

5 Minimums Reference/Altitude (PRI in flight, PRI ground modes)

Displays approach minimum reference and altitude set by the MINS selector on the EFIS control panel.

6 Current Altitude (PRI in flight, PRI ground modes)

Displays current altitude in increments of thousands, hundreds and twenty feet.

For positive values of altitude below 10,000 feet, an “X” symbol is displayed.

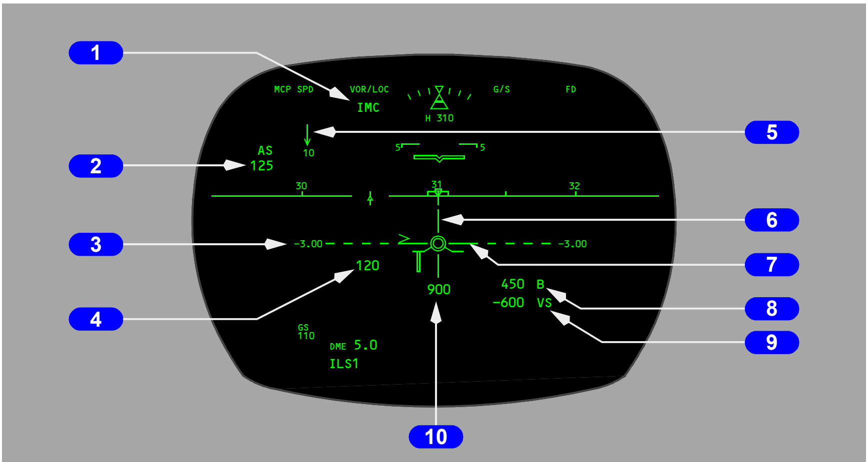
7 Barometric Setting (PRI in flight, PRI ground modes)

Displays the barometric setting in either inches of mercury (IN) or hectopascals (HPA) as selected on the EFIS control panel.

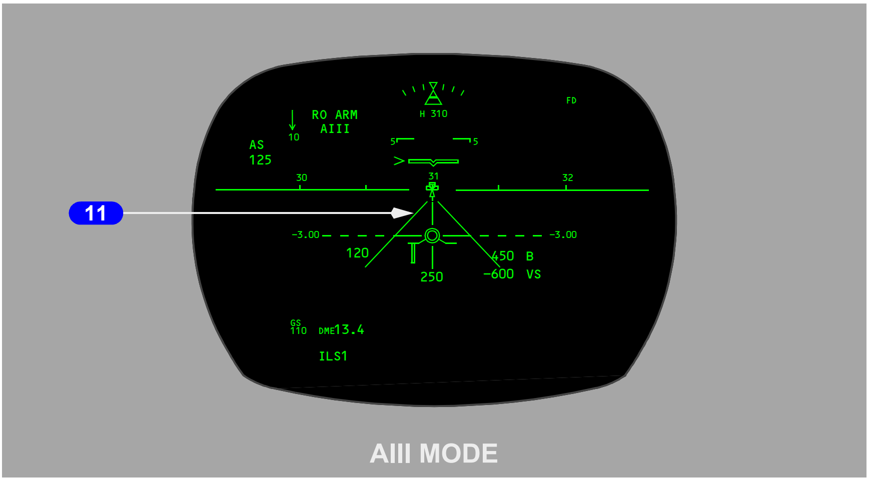
Note: In other than the PRI mode, the altitude scale and associated symbols are replaced with a digital readout. The readout is positioned relative to the flight path vector. If the flight path vector is not displayed, the readout is positioned relative to the airplane reference symbol.

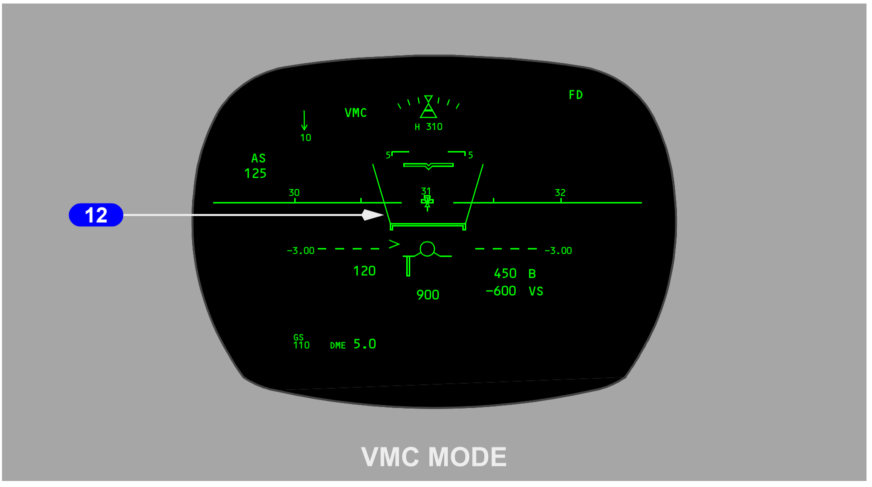
Approach Mode Displays

[Option - Model 4000]
Refer to section 42 for symbology descriptions.



IMC MODE





1 **Mode/Status**

2 **Digital Selected Airspeed**

3 **Glideslope Reference Line**

4 **Digital Airspeed**

5 **Wind Indications**

6 **Lateral Deviation Line**

7 Glideslope Deviation Line

8 Digital Barometric Altitude

9 Digital Vertical Speed

10 Radio Altitude

11 Runway Edge Lines

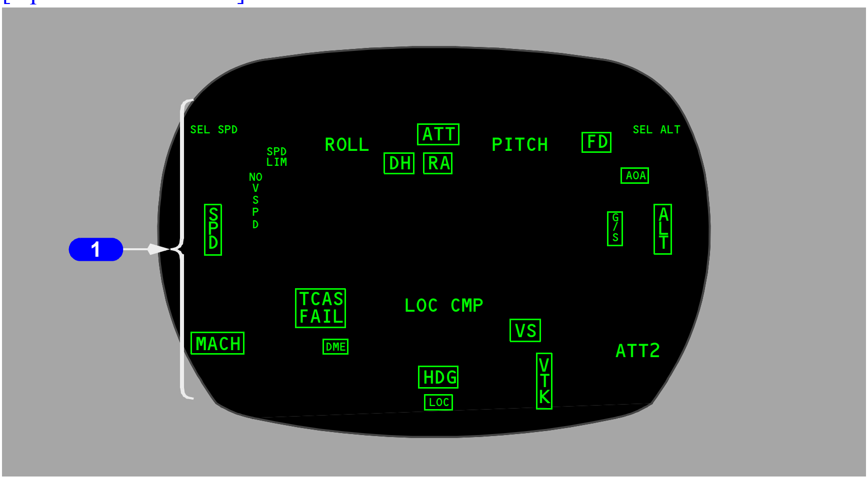
12 TCAS Resolution Advisory

Failure Indications and Flags

Dashes replace numbers if there is no computed information. Failure flags replace symbols or failure messages are displayed, as appropriate.

Data source flags are provided in a few cases to annunciate the source of displayed data when other than normal.

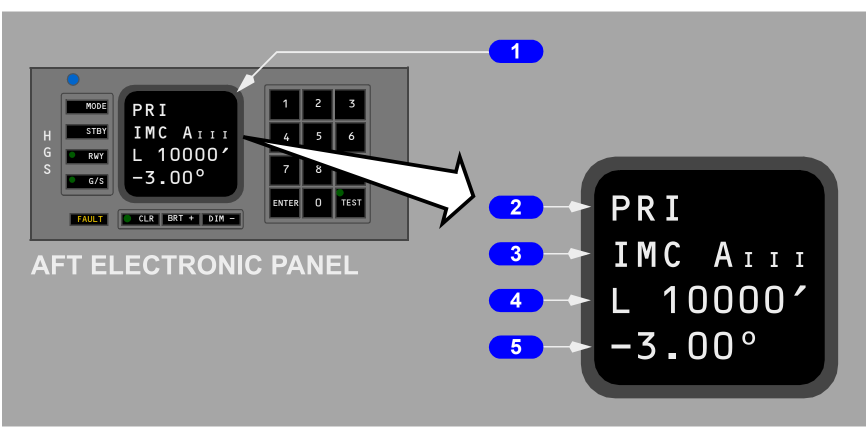
[Option - Model 4000]



1 HUD System Failure Indications and Flags

See section 42 for detailed information on the HUD system failure indications and flags.

Control Panel Display



1 Control Panel Display Window

Displays selected modes, entered values, system test and system status.

2 Mode Display Line

Displays current mode:

- PRI - primary flight mode
- AIII - Cat III approach mode
- IMC - instrument meteorological conditions approach mode
- VMC - visual meteorological conditions approach mode
- NO AIII - AIII capability lost
- CLR - combiner display cleared.

3 Standby Mode Display Line

Displays standby mode:

- PRI - primary flight mode
- AIII - Cat III approach mode
- IMC - instrument meteorological conditions approach
- VMC - visual meteorological conditions approach.

[Option - Model 4000]
Automatic AIII arming is indicated by “AIII ARM” displayed as the standby mode. Once all requirements are satisfied for an AIII mode approach, AIII mode is automatically activated. Refer to Section 10-22, Head-Up Display System Description, for AIII mode arming requirements.

4 Runway Length/Elevation Line

Displays runway length or elevation:

- L XXXXX - valid entry is 0 to 99999 feet, however, entries between 7500 and 13500 feet are required to display ground roll guidance for low visibility takeoff operations
- E XXXXX - valid entry is –9999 to 99999 feet.

5 Reference Glideslope Line

Displays runway glideslope:

- valid entry is 0.00° to –9.99°
- entered values are required to be between –2.51° and –3.00° for AIII approach operations.

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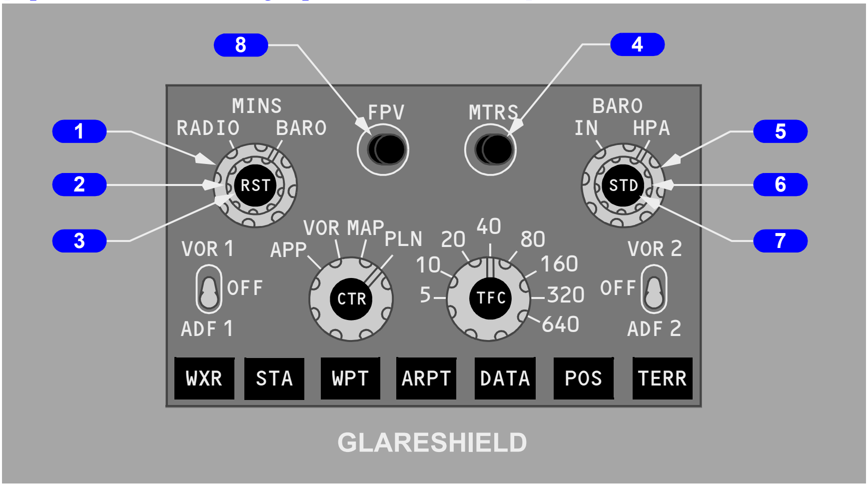
EFIS Control Panel (EFIS/Map Display)

The left EFIS control panel controls the Captain outboard and inboard display units. The right EFIS control panel controls the First Officer outboard and inboard display units.

EFIS Control Panel Controls – Flight Instrument Displays

[Option - Dual ADF, Flight path vector, EGPWS]



1 Minimums (MINS) Reference Selector (outer) (two position)

RADIO – selects radio altitude as the minimums reference.

BARO – selects barometric altitude as the minimums reference.

2 Minimums (MINS) Selector (middle) (slew)

ROTATE – adjusts the radio or baro minimums altitude.

3 Minimums (MINS) Reset (RST) Switch (inner) (momentary action)

PUSH –

- blanks radio height ALT alert
- resets the radio altitude minimums alert display on the attitude indicator
- blanks the reference altitude marker on the altimeter if displayed; sets the reference altitude marker to zero if not previously displayed.

4 Meters (MTRS) Switch (momentary action)

PUSH – displays altitude indications in meters. Not available in compact display format.

5 Barometric (BARO) Reference Selector (outer) (two position)

IN – selects inches of mercury as the barometric altitude reference.

HPA – selects hectopascals as the barometric altitude reference.

6 Barometric (BARO) Selector (middle) (slew)

ROTATE – adjusts the barometric altitude setting on the altimeter.

7 Barometric (BARO) Standard (STD) Switch (inner) (momentary action)

PUSH – selects the standard barometric setting (29.92 inches Hg/1013 HPA) for barometric altitude reference.

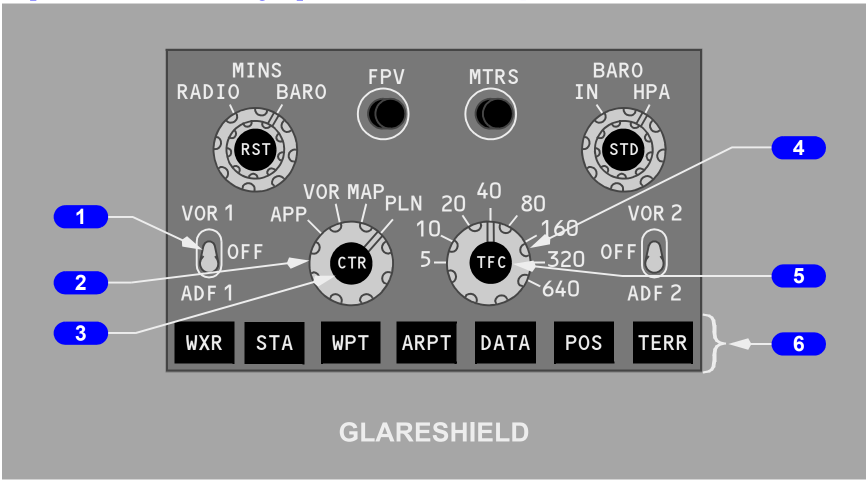
[Option - Flight path vector]

8 Flight Path Vector (FPV) Switch (momentary action)

PUSH – displays flight path vector on the attitude indicator.

EFIS Control Panel Controls – Navigation Displays

[Option - Dual ADF, flight path vector, EGPWS]



1 VOR/ADF Switch (three position)

Displays VOR or ADF information on the respective RDMI.

VOR – displays the selected VOR bearing pointer and VOR bearing pointer source indicator.

OFF – removes the VOR or ADF displays and displays “OFF” in place of the bearing pointer source indicators.

ADF – displays the selected ADF pointer and ADF bearing pointer source indicator.

2 Mode Selector (outer)

Selects the desired display.

APP –

- displays localizer and glideslope information in heading–up format
- displays reference ILS receiver, ILS frequency, course and DME.
- displays reference GLS receiver, GLS channel/course and GLS distance
- weather radar, TCAS, and TERRAIN are not displayed in center APP mode.

VOR –

- displays VOR navigation information in heading–up format
- displays reference VOR receiver, VOR frequency, course, DME and TO/FROM information
- weather radar, TCAS, and TERRAIN are not displayed in center VOR mode.

MAP –

[Option - Heading-up display]

- displays FMC generated route and MAP information, airplane position, heading and track, in a heading–up format
- displays waypoints, including the active waypoint, within the selected range
- displays VNAV path deviation.

PLN –

- displays a non–moving, true north up, route depiction
- the airplane symbol represents actual airplane position
- allows route step–through using the CDU LEGS page
- weather radar, TCAS, and TERRAIN are not displayed.

3 Center (CTR) Switch (inner)

PUSH –

- displays the full compass rose (center) for APP, VOR and MAP modes

[Option - VSD]

- subsequent pushes alternate between center with VSD, expanded and center without VSD.

4 Range Selector (outer)

Selects desired display range in nautical miles for APP, VOR, MAP or PLN mode.

5 Traffic (TFC) Switch (inner)

PUSH – displays TCAS information (refer to Chapter 15, Warning Systems).

6 MAP Switches (momentary action)

The MAP switches:

- add background data/symbols to MAP and center MAP modes
- displays can be selected simultaneously
- second push removes the information.

WXR (weather radar) – energizes weather radar transmitter and displays weather radar returns in MAP, center MAP, expanded VOR and expanded APP modes. When the 640 nm range is selected, weather radar returns are limited to 320 nm (refer to Chapter 11, Flight Management, Navigation).

STA (station) –

- displays all FMC data base navigation aids if on map scales 5, 10, 20 or 40 nm.
- displays FMC data base high altitude navigation aids on map scales 80, 160, 320 or 640 nm.

WPT (waypoint) – displays the waypoints in the FMC data base which are not in the flight plan route if the selected range is 40 nm or less.

ARPT (airport) – displays all airports which are stored in the FMC data base and which are within the viewable map area.

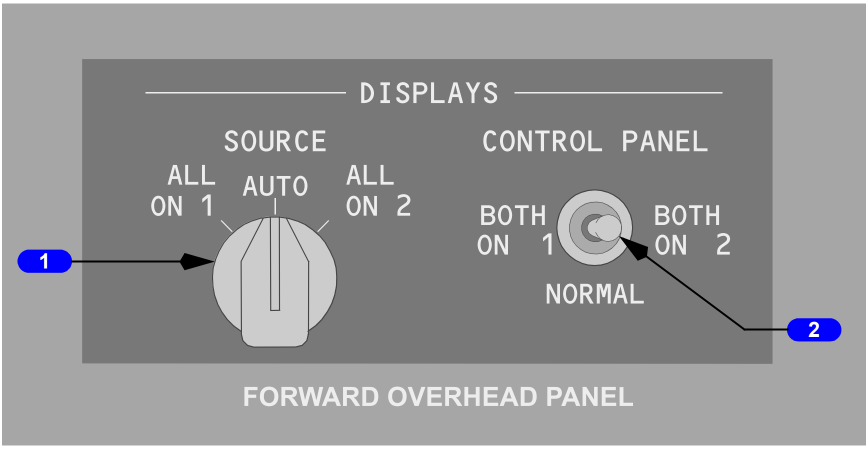
DATA – displays altitude constraint, if applicable, estimated time of arrival and down track RNP for each active route waypoint.

POS (position) – displays VOR and ADF bearing vectors extended from the nose of the airplane symbol to the stations.

TERR (terrain) – displays GPWS generated terrain data in MAP, center MAP, VOR, and APP modes (refer to Chapter 15, Warning Systems).

Displays Source Control Panel

Both a display source Display Electronics Unit (DEU) selector and an EFIS control switch are located above the Captain on the forward overhead (P5) panel.



1 Displays Source Selector – DEU

Both DEUs or only one DEU can drive all six Captain and First Officer displays. There is a SOURCE selector on the overhead panel. The selector is normally set to the AUTO mode:

- ALL ON 1 – selects the Captain's DEU to drive all six Captain and First Officer displays
- AUTO – allows DEU 1 to drive the Captain outboard, Captain inboard, and upper display units while DEU 2 drives the First Officer outboard, First Officer inboard, and lower display units. Provides automatic switching from both DEUs to one in case of single DEU failure
- ALL ON 2 – selects the First Officer's DEU to drive all six Captain and First Officer displays.

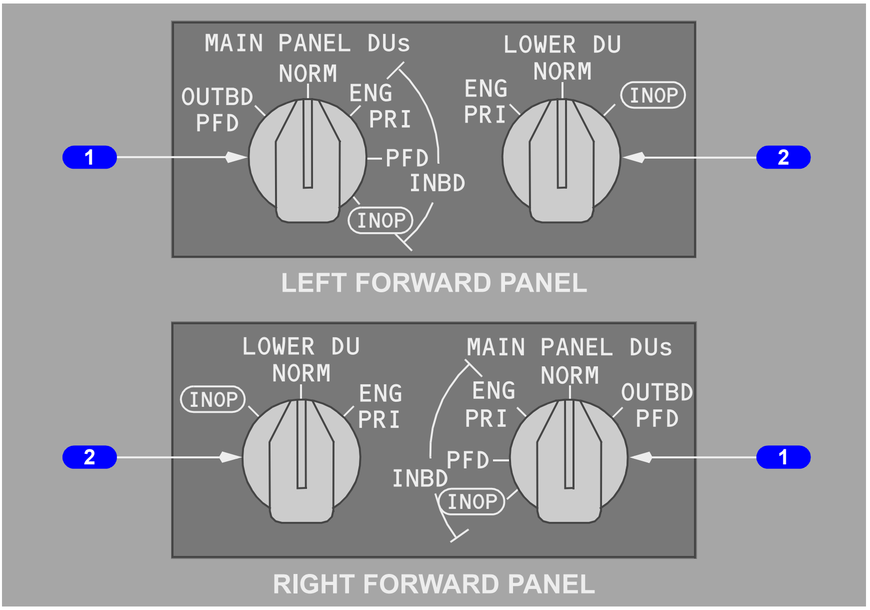
Note: These source selectors and switches are normally used while the aircraft is on the ground for maintenance purposes.

2 Displays Control Panel Switch – EFIS

- BOTH ON 1 – both pilots' displays are set to the Captain's EFIS control panel
- NORMAL – the left EFIS control panel controls the Captain's displays and the right EFIS control panel controls the First Officer's displays
- BOTH ON 2 – both pilots' displays are set to the First Officer's EFIS control panel.

Display Select Panels

[Option - Side by side display]



1 Main Panel Display Units (MAIN PANEL DUs) Selector

Selects what is displayed on the respective outboard and inboard display units:

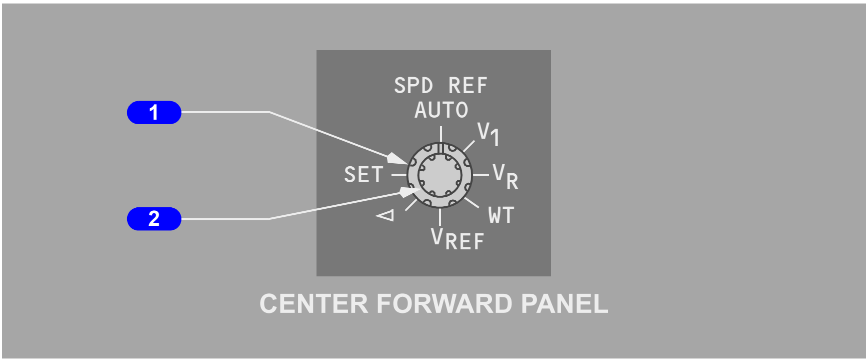
- Outboard Primary Flight Display (OUTBD PFD) – displays the compact EFIS format on the outboard display unit and blanks the inboard display unit
- Normal (NORM) – displays normal EFIS and MAP displays on the outboard and inboard display units; provides automatic display switching if a display unit fails
- Inboard Engine Primary (INBD ENG PRI) – displays the engine display on the inboard display unit and the compact EFIS format on the outboard display unit
- Inboard Primary Flight Display (INBD PFD) – displays the compact EFIS format on the inboard display unit and blanks the outboard display unit.

2 Lower Display Unit (LOWER DU) Selector

Selects what is displayed on the lower display unit:

- Engine Primary (ENG PRI) – displays the engine display on the lower display unit and blanks the upper display unit.
- Normal (NORM) – displays the engine display on the upper display unit and no display on the lower display unit; provides automatic display switching to the lower display unit if the upper display unit fails.

Speed Reference Selector



1 Speed Reference Selector (outer)

Sets the reference airspeed bugs on the Mach/airspeed indicator:

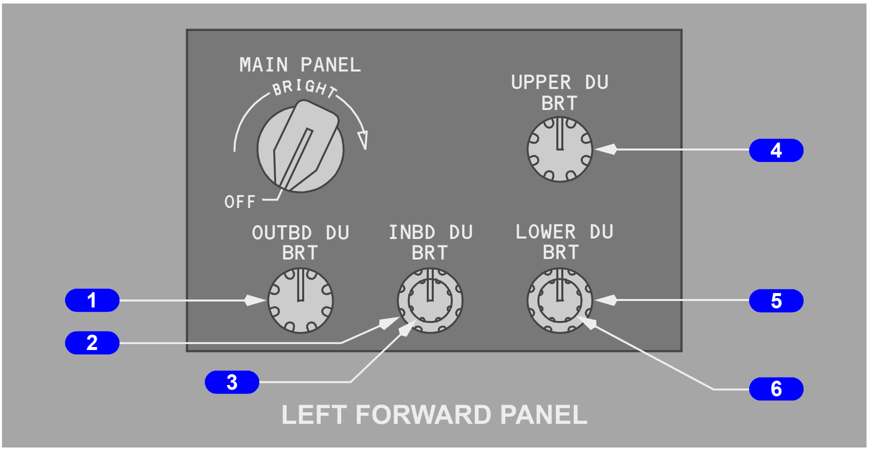
- AUTO – the reference airspeeds and gross weight are provided automatically through the FMC
- V1 – used to manually set decision speed on the ground; in flight, displays “INVALID ENTRY”
- VR – used to manually set rotation speed on the ground; in flight, displays “INVALID ENTRY”
- WT – allows manual entry of reference gross weight
- VREF – used to manually set the landing reference speed in flight; on the ground, displays “INVALID ENTRY”
- Bug 5 – used to manually set the white bug 5 to the desired value
- SET – removes the digital readout above the Mach/airspeed indicator.

2 Speed Reference Selector (inner) (two speed slew)

ROTATE –

- manually sets the appropriate reference airspeed or gross weight
- the digital display appears above the Mach/airspeed indicator.

Display Brightness Controls
Captain Brightness Controls



1 Outboard Display Unit Brightness (OUTBD DU BRT) Control (rotary)

ROTATE – adjusts the brightness of the Captain outboard display unit.

2 Inboard Display Unit Brightness (INBD DU BRT) Control (outer) (rotary)

ROTATE – adjusts the brightness of the Captain inboard display unit.

3 Inboard Display Unit Radar Brightness (INBD DU BRT) Control (inner) (rotary)

ROTATE – adjusts weather radar and terrain display brightness on the Captain inboard display unit.

4 Upper Display Unit Brightness (UPPER DU BRT) Control (rotary)

ROTATE – adjusts the brightness of the upper display unit.

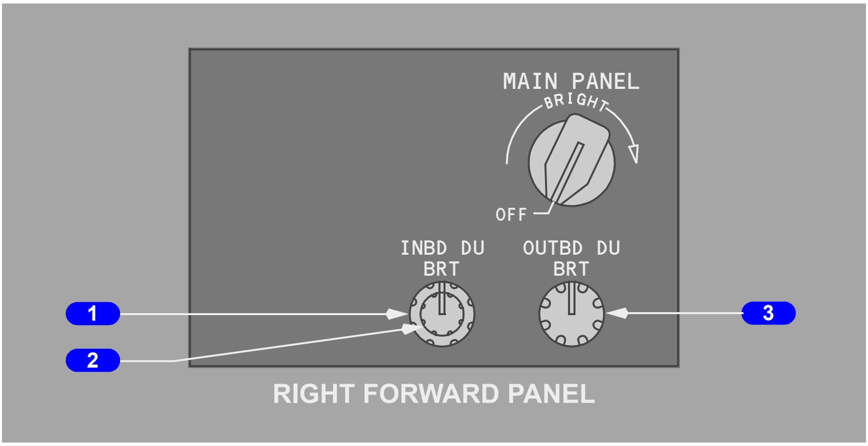
5 Lower Display Unit Brightness (LOWER DU BRT) Control (outer) (rotary)

ROTATE – adjusts the brightness of the lower display unit.

6 Lower Display Unit Brightness (LOWER DU BRT) Control (inner) (rotary)

Inoperative.

First Officer Brightness Controls



1 Inboard Display Unit Brightness (INBD DU BRT) Control (outer) (rotary)

ROTATE – adjusts the brightness of the First Officer inboard display unit.

2 Inboard Display Unit Radar Brightness (INBD DU BRT) Control (inner) (rotary)

ROTATE – adjusts weather radar and terrain display brightness on the First Officer inboard display unit.

3 Outboard Display Unit Brightness (OUTBD DU BRT) Control (rotary)

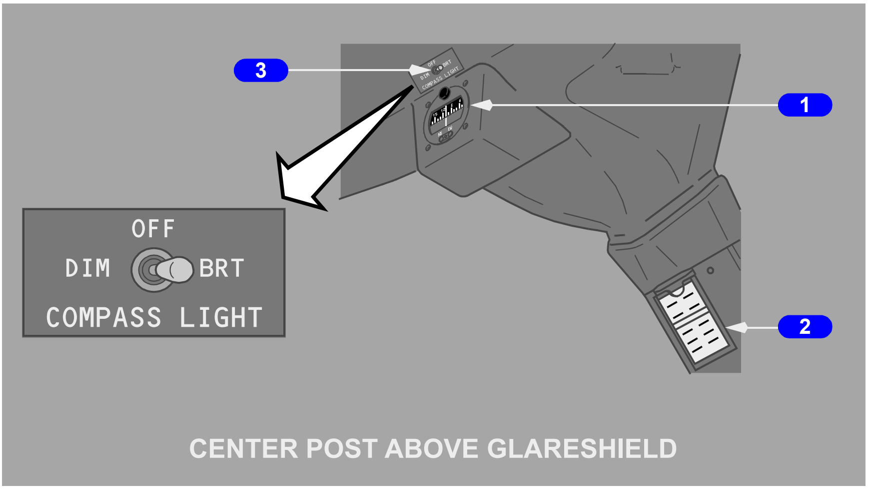
ROTATE – adjusts the brightness of the First Officer outboard display unit.

Standby Flight Instruments

The standby flight instruments include the:

- standby magnetic compass
- standby attitude indicator
- standby altimeter/airspeed indicator
- integrated standby flight display
- standby radio magnetic indicator

Standby Magnetic Compass



1 Standby Magnetic Compass

Displays magnetic heading.

2 Standby Magnetic Compass Correction Card

Provides appropriate heading corrections.

3 Compass Light Switch

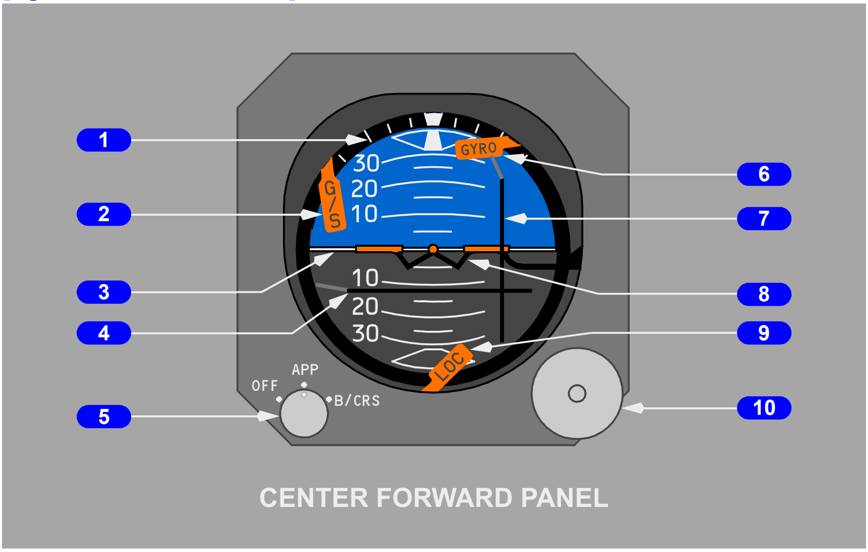
OFF – compass light is extinguished.

BRT – sets compass light to full brightness.

DIM – sets compass light to low brightness.

Standby Attitude Indicator

[Option - Sextant 705-7V4]



1 Bank Indicator and Scale

Scale marks are at 0, 10, 20, 30, 45 and 60 degrees.

2 Glideslope Flag

- glideslope receiver has failed
- glideslope pointer is removed.

3 Horizon Line and Pitch Angle Scale

Pitch scale is in 5 degree increments.

4 Glideslope Pointer and Deviation Scale

- pointer indicates glideslope position
- pointer is not displayed when
  - approach selector is off or in B/CRS
  - no computed data exists
  - glideslope receiver has failed
- scale indicates deviation.

5 Approach Mode Selector

OFF – glideslope and localizer pointers retracted from view.

APP – glideslope and localizer pointers in view; ILS signals provided by the No. 1 ILS receiver.

B/CRS – reverses sensing for localizer pointer during back course approaches; glideslope pointer not displayed.

6 GYRO Flag

Attitude is unreliable.

7 Localizer Pointer and Deviation Scale

- pointer indicates localizer position
- pointer is not displayed when
  - approach selector is off
  - no computed data exists
  - localizer receiver has failed
- scale indicates deviation.

8 Airplane Symbol

9 Localizer Flag

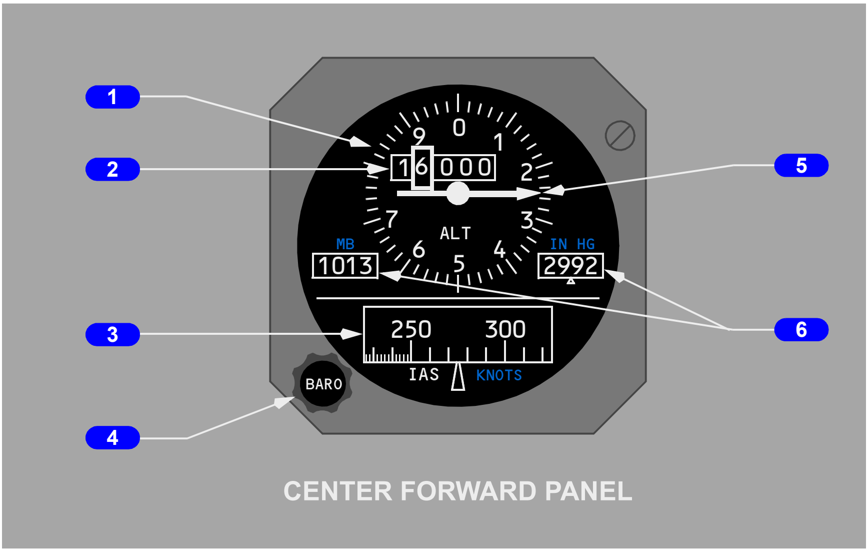
- localizer receiver has failed
- localizer pointer is removed.

10 Caging Control

PULL – aligns horizon line with the airplane symbol.

RELEASE – the control contracts.

Standby Altimeter/Airspeed Indicator



1 Standby Altimeter

Receives static pressure from the alternate static ports.

2 Digital Counter

- indicates thousand foot increments of current altitude
- a green flag appears in the left window when altitude is less than 10,000 feet
- a striped flag appears in the left window when altitude is less than zero feet.

3 Standby Airspeed Indicator

Receives ram pressure from the auxiliary pitot probe and static pressure from the alternate static ports.

4 Barometric Setting Control

ROTATE – adjusts the barometric correction in both barometric windows.

5 Altitude Pointer

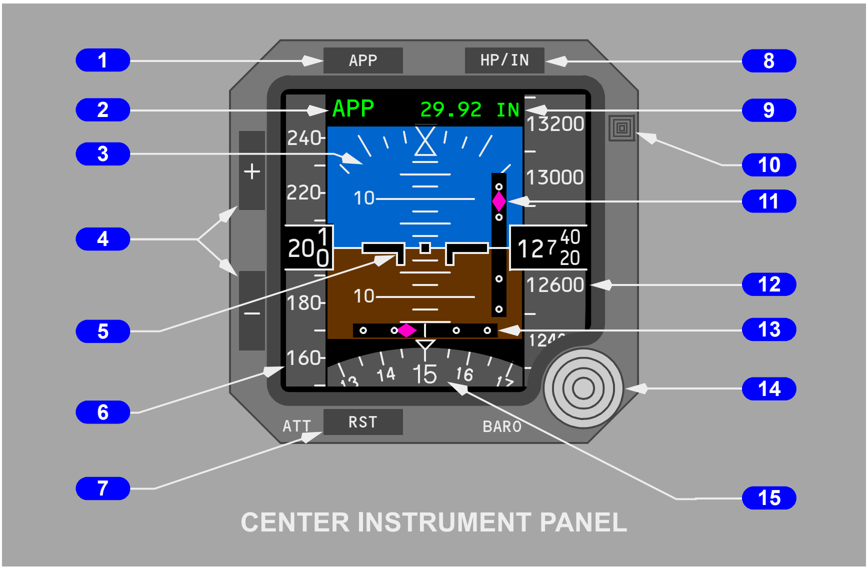
Indicates hundred foot increments of current altitude.

6 Barometric Setting Windows

Indicates barometric correction in millibars and inches of mercury as set by the barometric setting control.

Integrated Standby Flight Display

[Option - Sextant S231A120]



1 Approach (APP) Switch

Push –

- when blank, selects APP
- when APP displayed, selects BCRS
- when BCRS displayed, blanks.

2 Approach Mode Annunciation

Indicates approach mode selected.

- Blank – no approach deviation data displayed
- APP – ILS localizer and glideslope deviation data displayed.
- BCRS (Back course) – reverses sensing for localizer pointer during back course approaches

3 Attitude Display

Displays airplane attitude.

- Indicates bank in reference to the bank scale
- Indicates the horizon relative to the airplane symbol
- Beyond 30 degrees pitch, large red arrowheads (V-shaped) indicate the attitude has become excessive, and the direction to the horizon line.

4 Display Brightness Switches

Push –

- + increases display brightness
- – decreases display brightness.

5 Airplane Symbol

Indicates airplane attitude with reference to the horizon.

6 Airspeed Indications

Indicates current airspeed when above 30 knots.

7 Attitude Reset (RST) Switch

Push and hold at least two seconds

- aligns horizon with the airplane symbol
- reset takes approximately ten seconds

8 Hectopascal/Inch (HP/IN) Switch

Push – changes the units of the barometric reference.

9 Barometric Setting

Indicates the barometric setting selected with the barometric selector.

STD is displayed when selected with the barometric selector.

10 Ambient Light Sensor

Automatically adjusts display intensity for ambient lighting condition.

11 Glideslope Pointer and Deviation Scale

The glideslope pointer indicates glideslope position relative to the airplane.

- the pointer is in view when the glideslope signal is received
- the scale is in view when the APP mode is selected
- the pointer and scale are removed when the BCRS mode is selected.

12 **Current Altitude**

13 **Localizer Pointer and Deviation Scale**

The localizer pointer indicates localizer position relative to the airplane.

- the pointer is in view when the localizer signal is received
- the scale is in view when either the APP or BCRS mode is selected

14 **Barometric (BARO) Selector**

Rotate – changes barometric setting.

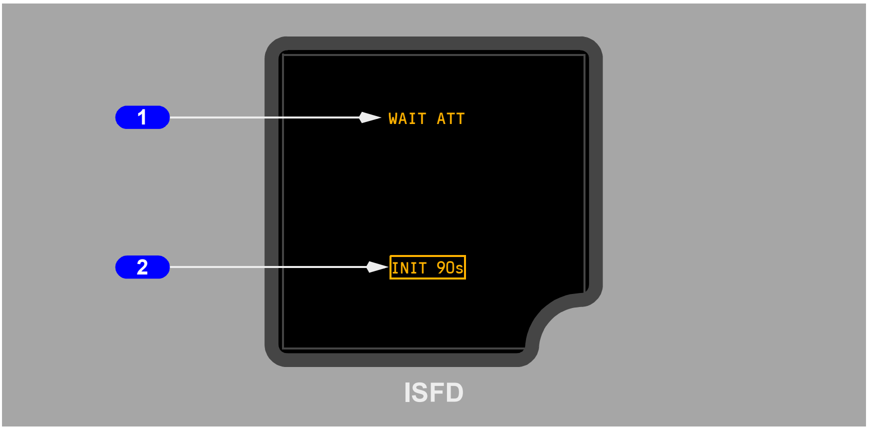
Push –

- selects standard barometric setting (29.92 inches Hg/1013 HPA)
- if STD is displayed, selects the preselected barometric setting.

15 **Heading Indication**

Displays airplane heading.

ISFD Messages



1 **Attitude Messages**

Indicates attitude display status.

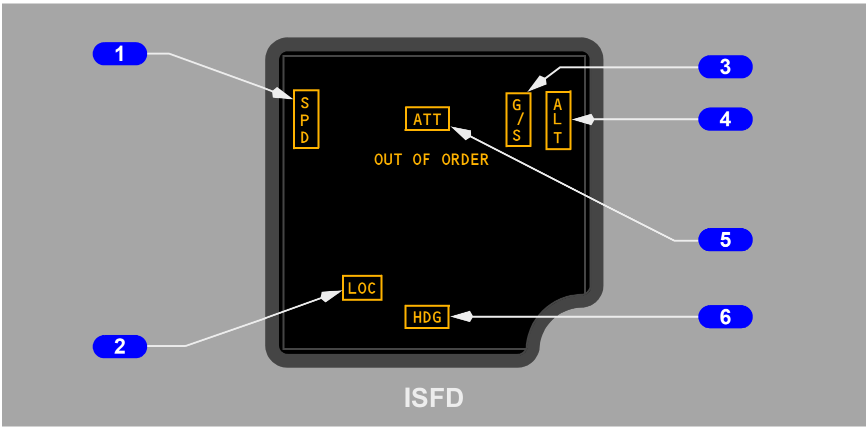
- ATT:RST (amber) – attitude must be reset using the attitude reset switch
- ATT 10s (amber) – 10 second attitude realignment in progress
- WAIT ATT (amber) – indicates temporary self-correcting loss of attitude.

2 **Initialization Message**

INIT 90s (amber) – 90 second initialization in progress.

ISFD Failure Flags

The OUT OF ORDER annunciation replaces the display when a total ISFD system failure occurs.



1 Airspeed flag

Airspeed information has failed.

2 ILS localizer failure flag

ILS localizer has failed.

3 ILS glideslope failure flag

ILS glideslope has failed.

4 Altitude flag

Altitude information has failed.

5 Attitude flag

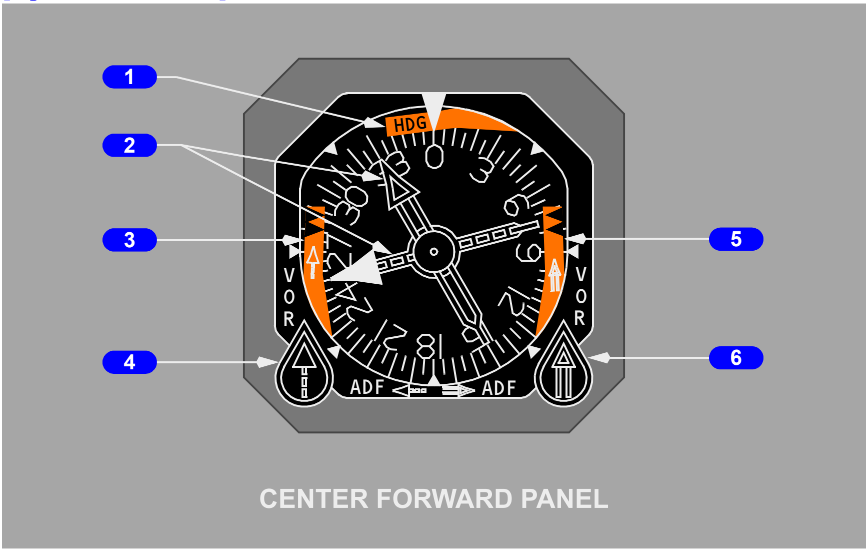
Attitude information has failed.

6 Heading flag

Heading data has failed.

Standby Radio Magnetic Indicator

[Option - Dual ADF]



1 Heading Warning Flag

The compass signal from the air data inertial reference system is lost.

2 Bearing Pointers

- narrow pointer uses signals from the VHF NAV receiver No. 1 or ADF receiver No. 1.

[Option - Dual ADF]

- wide pointer uses signals from the VHF NAV receiver No. 2 or ADF receiver No. 2.

3 Bearing Pointer No. 1 Warning Flag

VOR mode:

- RMI power failure
- VHF NAV signal unreliable.

ADF mode:

- RMI power failure
- ADF failure or signal unreliable.

4 VOR/ADF Bearing Pointer No. 1 Switch

ROTATE – selects VOR or ADF for the bearing pointer.

5 Bearing Pointer No. 2 Warning Flag

VOR mode

- RMI power failure
- VHF NAV signal unreliable.

[Option - Dual ADF]
ADF mode

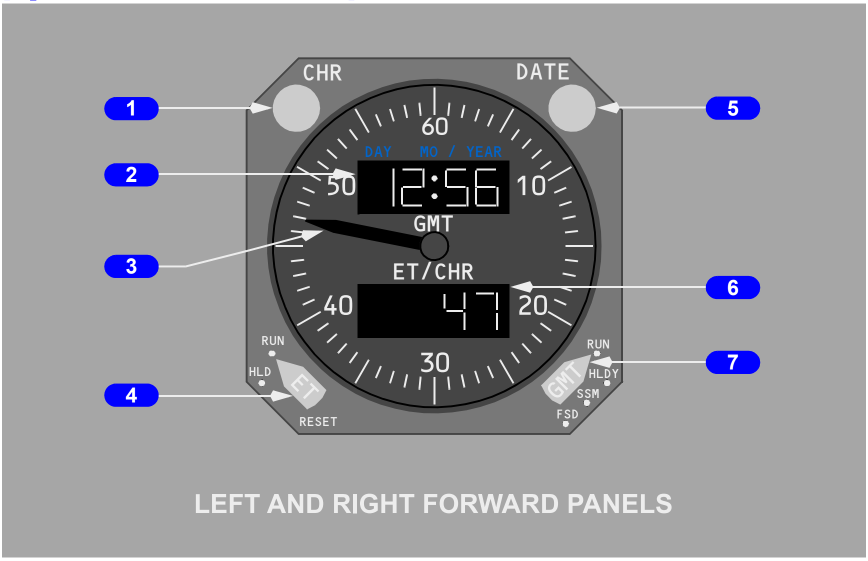
- RMI power failure
- ADF failure or signal unreliable.

[Option - Dual ADF]
6 VOR/ADF Bearing Pointer No. 2 Switch

ROTATE – selects VOR or ADF for the bearing pointer.

Clock

[Option - Smiths 60B00303-105]



1 Chronograph (CHR) Control

PUSH –

- controls the start, stop and reset functions of the CHR display and second hand with successive pushing
- overrides any existing ET display.

2 Time/Date Window

- displays time (hours, minutes) when time is selected with the date control
- alternately displays day–month and year when date is selected with the date control.

3 Chronograph Second Hand

- indicates chronograph seconds
- controlled by the CHR control.

4 Elapsed Time (ET) Selector (three position, rotary)

Controls the elapsed time function.

RESET – returns ET display to zero (spring loaded to HLD).

HLD (hold) – stops the elapsed time display.

RUN – starts the elapsed time display.

5 Date Control

Controls the date display.

PUSH – displays date (day, month) alternating with year.

PUSH – returns display to time.

6 Elapsed Time (ET)/Chronograph Window

- displays elapsed time (hours, minutes) or chronograph minutes
- the chronograph display replaces the elapsed time display
- elapsed time continues to run in the background and displays after the chronograph is reset.

7 Time Control (four position, rotary)

Sets the time and date when the time or date is selected with the date control.

FS D (fast slew, day) –

- advances hours when time is selected with the date control
- advances days when date is selected with the date control.

SS M (slow slew, month) –

- advances minutes when time is selected with the date control
- advances months when date is selected with the date control.

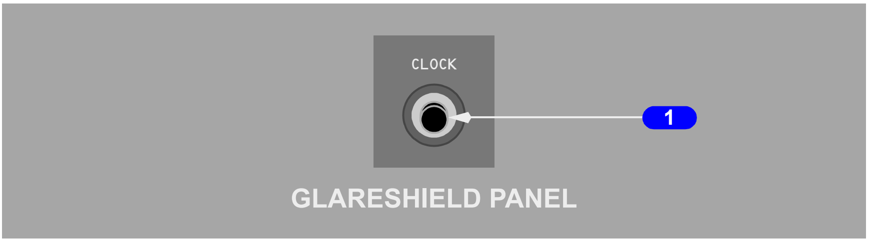
HLD Y (hold, year) –

- stops the time indicator and sets the seconds to zero when time is selected with the date control
- advances years when date is selected with the date control.

RUN – starts the time indicator.

Clock Switch

[Option]

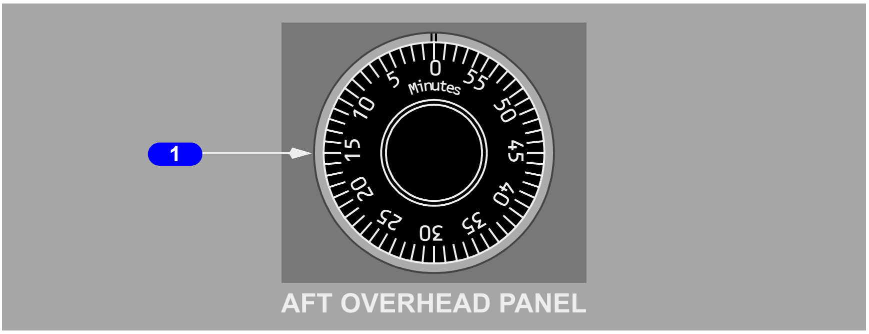


1 Clock Switch

Operates the same as the chronograph (CHR) control.

Timer

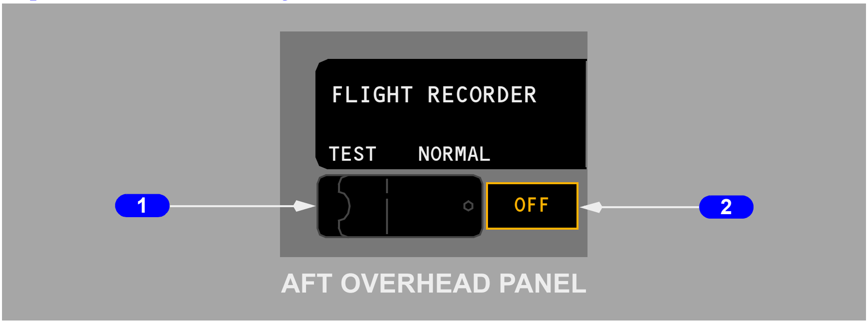
[Option]



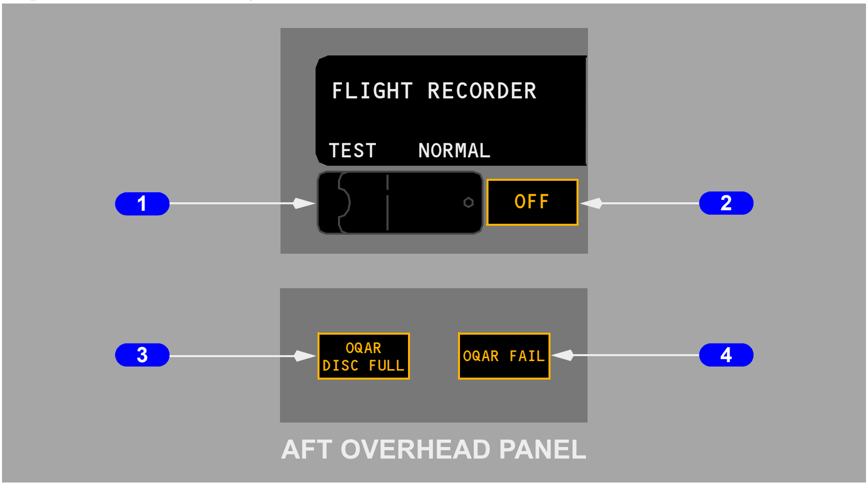
1 Mechanical Timer

Flight Recorder

[Option - Without QAR lights]



[Option - With QAR lights]



1 Flight Recorder Test Switch

NORMAL (guarded position) –

- inflight – the recorder operates anytime electrical power is available
- on the ground – either engine must also be operating.

TEST – powers the flight recorder on the ground.

2 OFF Light (amber)

ILLUMINATED –

- indicates the recorder is not operating or the test is invalid
- may indicate power failure, loss of input data, or electronic malfunction.

[Option - QAR lights]

3 Optical Quick Access Recorder (OQAR) Disc Full (blue)

ILLUMINATED –

- indicates the quick access recorder is full.

[Option - QAR lights]

4 Optical Quick Access Recorder (OQAR) FAIL (blue)

ILLUMINATED –

- indicates the quick access recorder has failed.

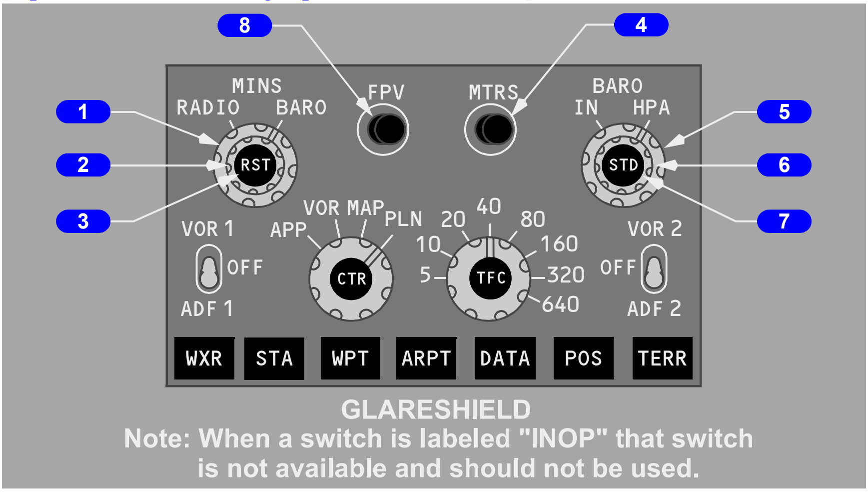
Intentionally
Blank

EFIS Control Panel (PFD/ND Display)

The left EFIS control panel controls the Captain outboard and inboard display units. The right EFIS control panel controls the First Officer outboard and inboard display units.

EFIS Control Panel Controls – Flight Instrument Displays

[Option - Dual ADF, Flight path vector, EGPWS]



1 Minimums (MINS) Reference Selector (outer) (two position)

RADIO – selects radio altitude as the minimums reference.

BARO – selects barometric altitude as the minimums reference.

2 Minimums (MINS) Selector (middle) (slew)

ROTATE – adjusts the radio or baro minimums altitude.

3 Radio Minimums (MINS) Reset (RST) Switch (inner) (momentary action)

PUSH –

- resets the alert minimums annunciation
- blanks minimums display if alert is not active.

4 Meters (MTRS) Switch (momentary action)

PUSH – displays altitude indications in meters.

5 Barometric (BARO) Reference Selector (outer) (two position)

IN – selects inches of mercury as the barometric altitude reference.

HPA – selects hectopascals as the barometric altitude reference.

6 Barometric (BARO) Selector (middle) (slew)

ROTATE –

- adjusts the barometric altitude setting on the altitude tape
- if STD displayed, adjusts the preselected BARO reference.

7 Barometric (BARO) Standard (STD) Switch (inner) (momentary action)

PUSH –

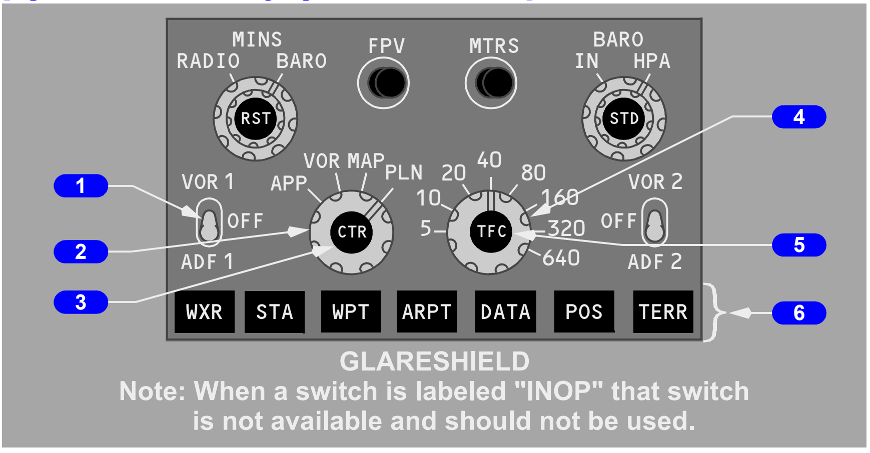
- selects the standard barometric setting (29.92 inches Hg/1013 HPA) for barometric altitude reference
- if STD is displayed, selects the preselected barometric reference
- if no preselected barometric is displayed, displays the last value before STD was selected.

8 Flight Path Vector (FPV) Switch (momentary action)

PUSH – displays flight path vector on the attitude indicator.

EFIS Control Panel Controls – Navigation Displays

[Option - Dual ADF, Flight path vector, EGPWS]



1 VOR/ADF Switch (three position)

Displays VOR or ADF information on all navigation modes except PLAN.

VOR – displays the selected VOR bearing pointer, frequency or identification and DME.

OFF – removes the VOR or ADF displays.

ADF – displays the selected ADF pointer and ADF frequency or identification.

2 Mode Selector (outer)

Selects the desired display.

APP –

- displays localizer and glideslope information in heading–up format.

[Option - IAN]
- displays FAC and glide path information in heading–up format.
- displays reference IAN procedure, distance to missed approach point and source of IAN deviations
- displays reference ILS receiver, ILS frequency or identification, course and DME.
- displays reference GLS receiver, GLS channel/course and GLS distance
- weather radar, TCAS, and TERRAIN are not displayed in center APP mode.

VOR –

- displays VOR navigation information in heading–up format
- displays reference VOR receiver, VOR frequency or identification, course, DME and TO/FROM information
- weather radar, TCAS, and TERRAIN are not displayed in center VOR mode.

MAP –

[Option - Track-up display]
- displays FMC generated route and MAP information, airplane position, heading and track, in a track–up format

[Option - Heading-up display]
- displays FMC generated route and MAP information, airplane position, heading and track, in a heading–up format
- displays waypoints, including the active waypoint, within the selected range
- displays VNAV path deviation.

PLN –

- displays a non–moving, true north up, route depiction
- the airplane symbol represents actual airplane position and orientation

- allows route step–through using the CDU LEGS page
- weather radar, TCAS, and TERRAIN are not displayed.

3 Center (CTR) Switch (inner)

PUSH –

- displays the full compass rose (center) for APP, VOR and MAP modes
- subsequent pushes alternate between expanded and center displays.

[Option - VSD]

- in MAP mode subsequent pushes alternate between center with VSD, expanded and center without VSD; in VOR or APP modes subsequent pushes alternate between expanded and center displays.

4 Range Selector (outer)

Selects desired display range in nautical miles for APP, VOR, MAP or PLN mode.

5 Traffic (TFC) Switch (inner)

PUSH – displays TCAS information on the navigation display (refer to Chapter 15, Warning Systems).

6 MAP Switches (momentary action)

The MAP switches:

- add background data/symbols to MAP and center MAP modes
- displays can be selected simultaneously
- second push removes the information.

WXR (weather radar) – energizes weather radar transmitter and displays weather radar returns in MAP, center MAP, expanded VOR, and expanded APP modes. When the 640 nm range is selected, weather radar returns are limited to 320 nm (refer to Chapter 11, Flight Management, Navigation).

Note: WXR switch is automatically selected "OFF" in the event of an EFIS CP failure in flight.

STA (station) –

- displays all FMC data base navigation aids if on map scales 5, 10, 20 or 40 nm
- displays FMC data base high altitude navigation aids on map scales 80, 160, 320 or 640 nm.

WPT (waypoint) – displays the waypoints in the FMC data base which are not in the flight plan route if the selected range is 40 nm or less.

ARPT (airport) – displays all airports which are stored in the FMC data base and which are within the viewable map area.

Option - No VSD and U11.0 or later
DATA – displays altitude constraint if applicable, estimated time of arrival and adds the RNP value for the subsequent leg on the navigation display when the route data is selected. An RNP value is only displayed when the subsequent leg defined in the NDB contains an RNP value and no manual RNP value has been entered. RNP values are also displayed on the Navigation Display when an RNAV (RNP) approach is selected and active and the "DATA" pushbutton is enabled.

[Option - VSD, Block Point 04 or later, but no U11.0 or later]
DATA – displays altitude constraint if applicable, and estimated time of arrival for each active route waypoint.

Route Data can be displayed on the lateral map area of the Vertical Situation Display (VSD) when in the VSD mode format. Displayed Route Data can be cycled on or off with the route “DATA” pushbutton.

[Option - VSD, and U11.0 or later]
DATA – displays altitude constraint if applicable, estimated time of arrival and adds the RNP value for the subsequent leg on the navigation display when the route data is selected. An RNP value is only displayed when the subsequent leg defined in the NDB contains an RNP value and no manual RNP value has been entered. RNP values are also displayed on the Navigation Display when an RNAV (RNP) approach is selected and active and the "DATA" pushbutton is enabled.

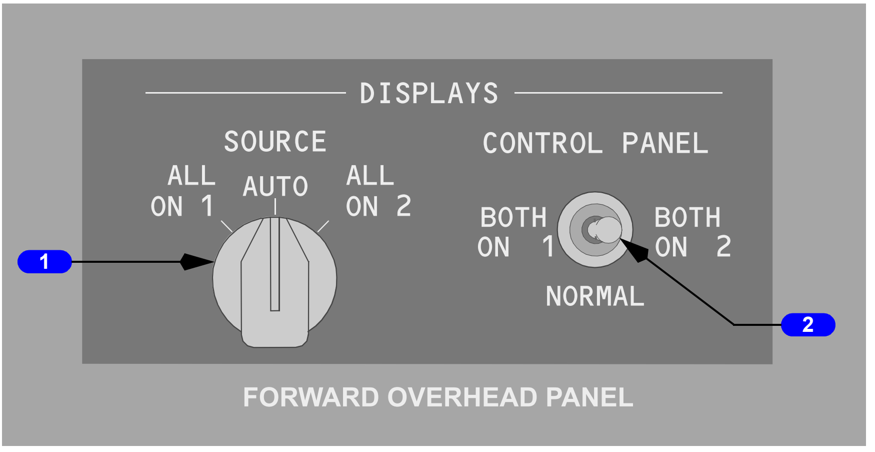
Route Data can be displayed on the lateral map area of the Vertical Situation Display (VSD) when in the VSD mode format. Displayed Route Data can be cycled on or off with the route “DATA” pushbutton.

POS (position) – displays IRS positions, GPS positions and VOR bearing vectors extended from the nose of the airplane symbol to the stations.

TERR (terrain) – displays GPWS generated terrain data in MAP, center MAP, VOR, and APP modes (refer to Chapter 15, Warning Systems).

Displays Source Control Panel

Both a display source Display Electronics Unit (DEU) selector and an EFIS control switch are located above the Captain on the forward overhead (P5) panel.



1 Displays Source Selector – DEU

Both DEUs or only one DEU can drive all six Captain and First Officer displays. There is a SOURCE selector on the overhead panel. The selector is normally set to the AUTO mode:

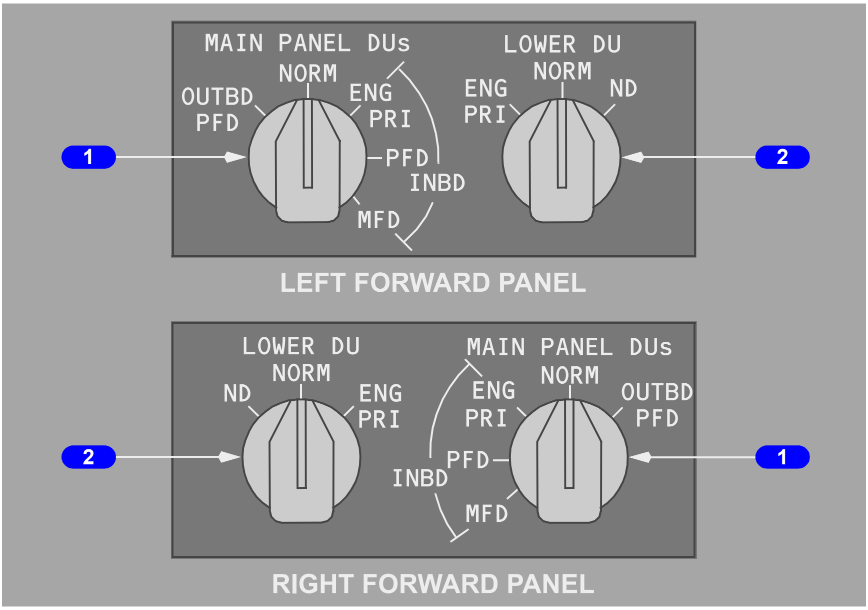
- ALL ON 1 – selects the Captain's DEU to drive all six Captain and First Officer displays
- AUTO – allows DEU 1 to drive the Captain outboard, Captain inboard, and upper display units while DEU 2 drives the First Officer outboard, First Officer inboard, and lower display units. Provides automatic switching from both DEUs to one in case of single DEU failure
- ALL ON 2 – selects the First Officer's DEU to drive all six Captain and First Officer displays.

Note: These source selectors and switches are normally used while the aircraft is on the ground for maintenance purposes.

2 Displays Control Panel Switch – EFIS

- BOTH ON 1 – both pilots' displays are set to the Captain's EFIS control panel
- NORMAL – the left EFIS control panel controls the Captain's displays and the right EFIS control panel controls the First Officer's displays
- BOTH ON 2 – both pilots' displays are set to the First Officer's EFIS control panel.

Display Select Panels



1 Main Panel Display Units (MAIN PANEL DUs) Selector

Selects what is displayed on the respective outboard and inboard display units:

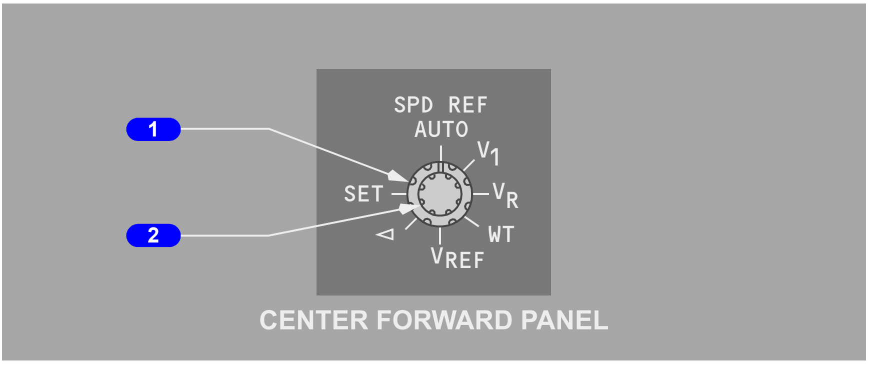
- Outboard Primary Flight Display (OUTBD PFD) – displays the PFD on the outboard display unit and blanks the inboard display unit
- Normal (NORM) – displays PFD on the outboard display unit and ND on the inboard display unit
- Inboard Engine Primary (INBD ENG PRI) – displays the primary engine instruments on the inboard display unit and the PFD on the outboard display unit
- Inboard Primary Flight Display (INBD PFD) – displays the PFD on the inboard display unit and blanks the outboard display unit
- Inboard Multifunction Display (INBD MFD) – displays PFD on the outboard display unit and blanks the inboard display unit. The inboard display unit stays blank until system format (SYS) or secondary engine format (ENG) is selected with MFD switches on the engine display control panel.

2 **Lower Display Unit (LOWER DU) Selector**

Selects what is displayed on the lower display unit:

- Engine Primary (ENG PRI) – displays the primary engine instruments on the lower display unit and blanks the upper display unit
- Normal (NORM) – display unit is normally blank or displays MFD format selected on the engine display control panel
- Navigation Display (ND) – displays the navigation display on the lower unit.

Speed Reference Selector



1 **Speed Reference Selector (outer)**

Sets the reference airspeed bugs on the airspeed indication:

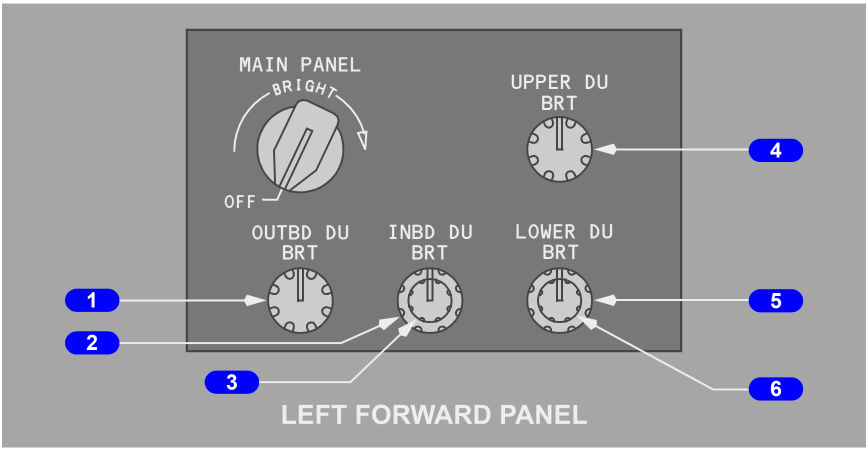
- AUTO – the reference airspeeds and gross weight are provided automatically through the FMC
- V1 – used to manually set decision speed on the ground; in flight, displays “INVALID ENTRY”
- VR – used to manually set rotation speed on the ground; in flight, displays “INVALID ENTRY”
- WT – allows manual entry of reference gross weight
- VREF – used to manually set the landing reference speed in flight; on the ground, displays “INVALID ENTRY”
- Bug 5 – used to manually set the white bug 5 to the desired value
- SET – removes the speed reference display.

2 **Speed Reference Selector (inner) (two speed slew)**

ROTATE –

- manually sets the appropriate reference airspeed or gross weight
- the digital display appears below the airspeed indication.

Display Brightness Controls
Captain Brightness Controls



1 Outboard Display Unit Brightness (OUTBD DU BRT) Control (rotary)

ROTATE – adjusts the brightness of the Captain outboard display unit.

2 Inboard Display Unit Brightness (INBD DU BRT) Control (outer) (rotary)

ROTATE – adjusts the brightness of the Captain inboard display unit.

3 Inboard Display Unit Radar Brightness (INBD DU BRT) Control (inner) (rotary)

ROTATE – adjusts weather radar and terrain display brightness on the Captain inboard display unit.

4 Upper Display Unit Brightness (UPPER DU BRT) Control (rotary)

ROTATE – adjusts the brightness of the upper display unit.

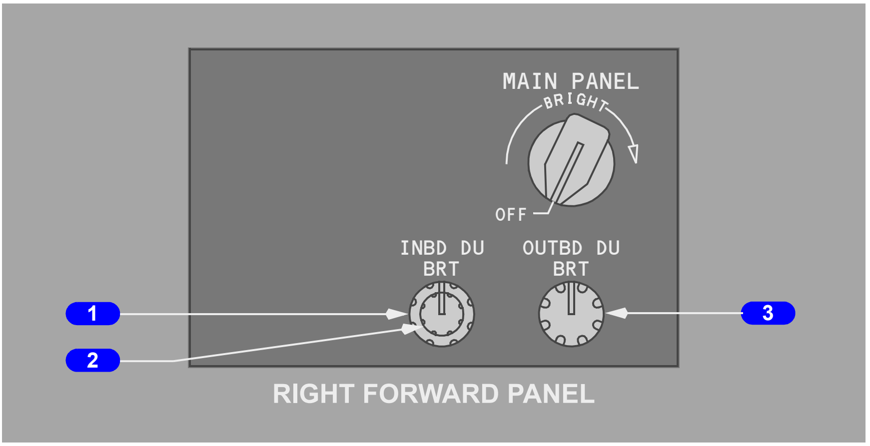
5 Lower Display Unit Brightness (LOWER DU BRT) Control (outer) (rotary)

ROTATE – adjusts the brightness of the lower display unit.

6 Lower Display Unit Brightness (LOWER DU BRT) Control (inner) (rotary)

ROTATE – adjusts weather radar and terrain display brightness on the lower display unit.

First Officer Brightness Controls



1 Inboard Display Unit Brightness (INBD DU BRT) Control (outer) (rotary)

ROTATE – adjusts the brightness of the First Officer inboard display unit.

2 Inboard Display Unit Radar Brightness (INBD DU BRT) Control (inner) (rotary)

ROTATE – adjusts weather radar and terrain display brightness on the First Officer inboard display unit.

3 Outboard Display Unit Brightness (OUTBD DU BRT) Control (rotary)

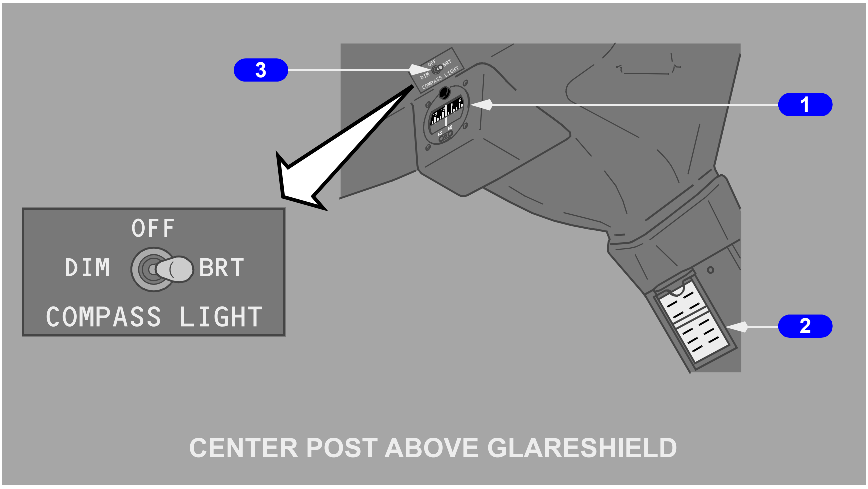
ROTATE – adjusts the brightness of the First Officer outboard display unit.

Standby Flight Instruments

The standby flight instruments include the:

- standby magnetic compass
- standby attitude indicator
- standby altimeter/airspeed indicator
- integrated standby flight display
- standby radio magnetic indicator

Standby Magnetic Compass



1 Standby Magnetic Compass

Displays magnetic heading.

2 Standby Magnetic Compass Correction Card

Provides appropriate heading corrections.

3 Compass Light Switch

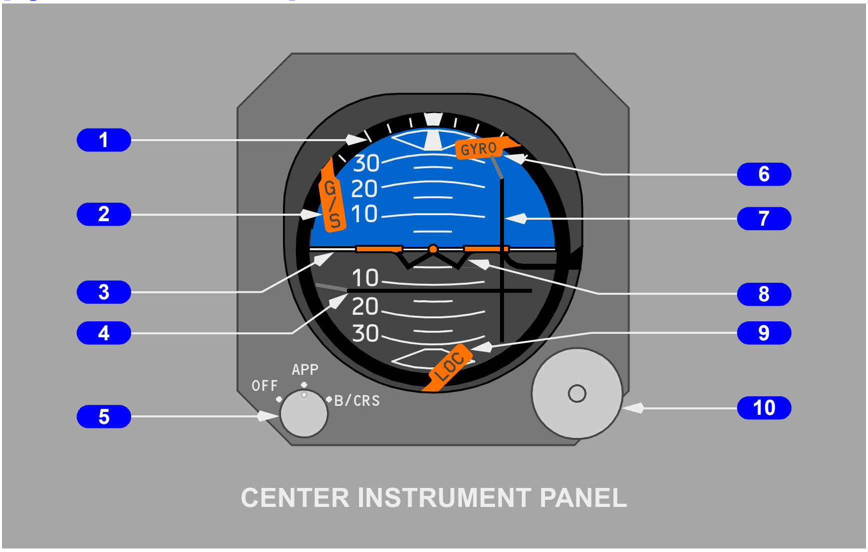
OFF – compass light is extinguished.

BRT – sets compass light to full brightness.

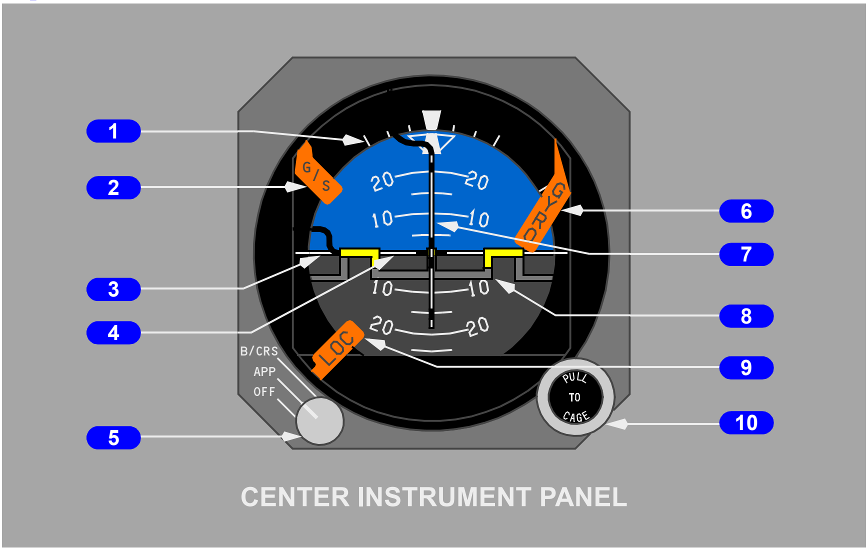
DIM – sets compass light to low brightness.

Standby Attitude Indicator

[Option - Sextant 705-7V4]



[Option - Jet 501-1568-27 or BFG 501-1657-02]



1 Bank Indicator and Scale

Scale marks are at 0, 10, 20, 30, 45 and 60 degrees.

2 Glideslope Flag

- glideslope receiver has failed
- glideslope pointer is removed.

3 Horizon Line and Pitch Angle Scale

Pitch scale is in 5 degree increments.

4 Glideslope Pointer and Deviation Scale

- pointer indicates glideslope position
- pointer is not displayed when
  - approach selector is off or in B/CRS
  - no computed data exists
  - glideslope receiver has failed
- scale indicates deviation.

5 Approach Mode Selector

OFF – glideslope and localizer pointers retracted from view.

APP – glideslope and localizer pointers in view; ILS signals provided by the No. 1 ILS receiver.

B/CRS – reverses sensing for localizer pointer during back course approaches; glideslope pointer not displayed.

6 GYRO Flag

Attitude is unreliable.

7 Localizer Pointer and Deviation Scale

- pointer indicates localizer position
- pointer is not displayed when
  - approach selector is off
  - no computed data exists
  - localizer receiver has failed
- scale indicates deviation.

8 Airplane Symbol

9 Localizer Flag

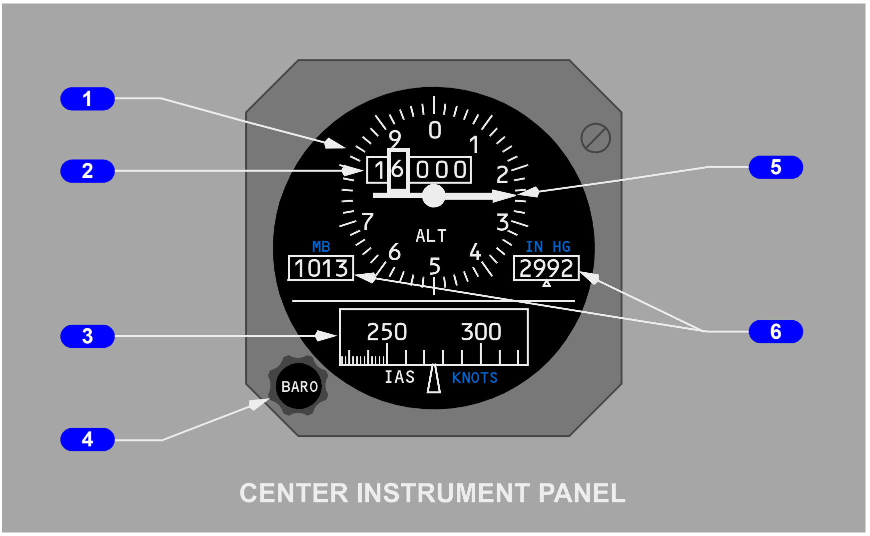
- localizer receiver has failed
- localizer pointer is removed.

10 Caging Control

PULL – aligns horizon line with the airplane symbol

RELEASE – the control contracts.

Standby Altimeter/Airspeed Indicator



1 Standby Altimeter

Receives static pressure from the alternate static ports.

2 Digital Counter

- indicates thousand foot increments of current altitude
- a green flag appears in the left side of the window when altitude is less than 10,000 feet
- a striped flag appears in the left side of the window when altitude is less than zero feet.

3 Standby Airspeed Indicator

Receives ram air pressure from the auxiliary pitot probe and static pressure from the alternate static ports.

4 Barometric Setting Control

ROTATE – adjusts the barometric correction in both barometric windows.

5 Altitude Pointer

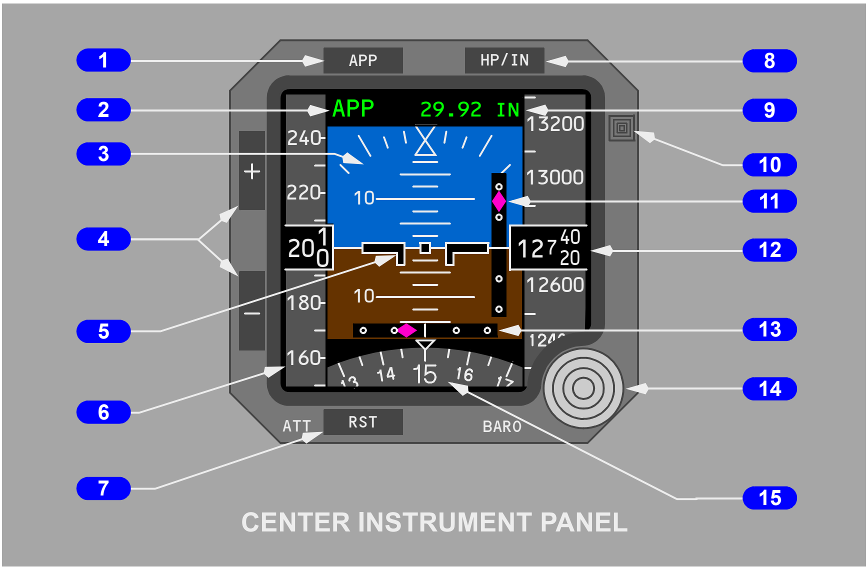
Indicates hundred foot increments of current altitude.

6 **Barometric Setting Windows**

Indicates barometric correction in millibars and inches of mercury as set by the barometric setting control.

Integrated Standby Flight Display

[Option - Sextant S231A120-1, Sextant S231A120-5, Thales C16221MA01]



1 **Approach (APP) Switch**

Push –

- when blank, selects APP
- when APP displayed, selects BCRS
- when BCRS displayed, blanks.

2 **Approach Mode Annunciation**

Indicates approach mode selected.

- Blank – no approach deviation data displayed
- APP – ILS localizer and glideslope deviation data displayed
- BCRS (Back course) – reverses sensing for localizer pointer during back course approaches.

3 Attitude Display

Displays airplane attitude.

- Indicates bank in reference to the bank scale
- Indicates the horizon relative to the airplane symbol
- Beyond 30 degrees pitch, large red arrowheads (V-shaped) indicate the attitude has become excessive, and the direction to the horizon line.

4 Display Brightness Switches

Push –

- + increases display brightness
- – decreases display brightness.

5 Airplane Symbol

Indicates airplane attitude with reference to the horizon.

6 Airspeed Indications

Indicates current airspeed when above 30 knots.

7 Attitude Reset (RST) Switch

Push and hold at least two seconds

- aligns horizon with the airplane symbol
- reset takes approximately ten seconds

8 Hectopascal/Inch (HP/IN) Switch

Push – changes the units of the barometric reference.

9 Barometric Setting

Indicates the barometric setting selected with the barometric selector.

STD is displayed when selected with the barometric selector.

10 Ambient Light Sensor

Automatically adjusts display intensity for ambient lighting condition.

11 Glideslope Pointer and Deviation Scale

The glideslope pointer indicates glideslope position relative to the airplane.

- the pointer is in view when the glideslope signal is received
- the scale is in view when the APP mode is selected.
- the pointer and scale are removed when the BCRS mode is selected

12 **Current Altitude**

13 **Localizer Pointer and Deviation Scale**

The localizer pointer indicates localizer position relative to the airplane.

- the pointer is in view when the localizer signal is received
- the scale is in view when either the APP or BCRS mode is selected

14 **Barometric (BARO) Selector**

Rotate – changes barometric setting

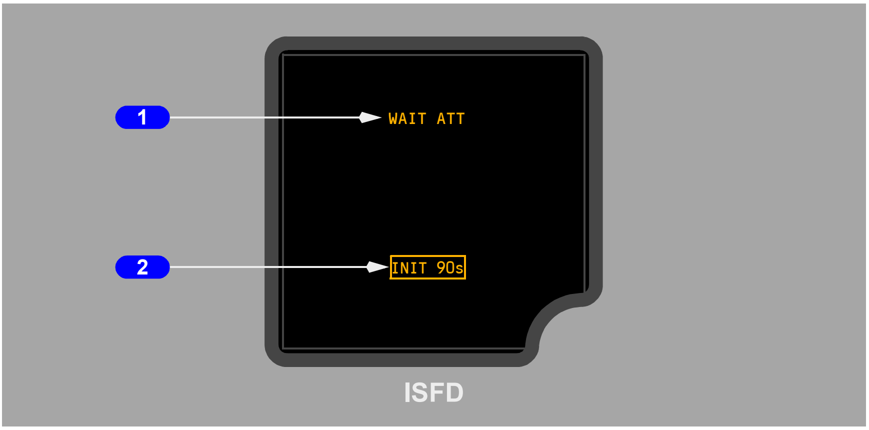
Push –

- selects standard barometric setting (29.92 inches Hg/1013 HPA)
- if STD is displayed, selects the preselected barometric setting.

15 **Heading Indication**

Displays airplane heading.

ISFD Messages



1 **Attitude Messages**

Indicates attitude display status.

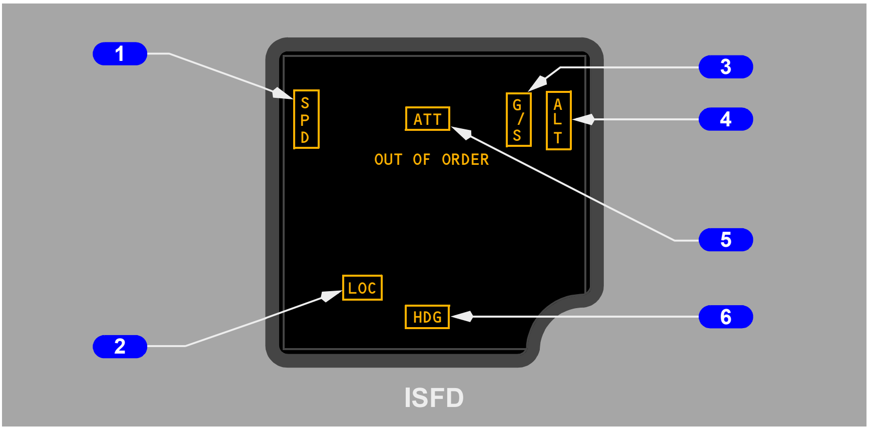
- ATT:RST (amber) – attitude must be reset using the attitude reset switch
- ATT 10s (amber) – 10 second attitude realignment in progress
- WAIT ATT (amber) – indicates temporary self-correcting loss of attitude.

2 **Initialization Message**

INIT 90s (amber) – 90 second initialization in progress.

ISFD Failure Flags

The OUT OF ORDER annunciation replaces the display when a total ISFD system failure occurs.



1 Airspeed flag

Airspeed information has failed.

2 ILS localizer failure flag

ILS localizer has failed.

3 ILS glideslope failure flag

ILS glideslope has failed.

4 Altitude flag

Altitude information has failed.

5 Attitude flag

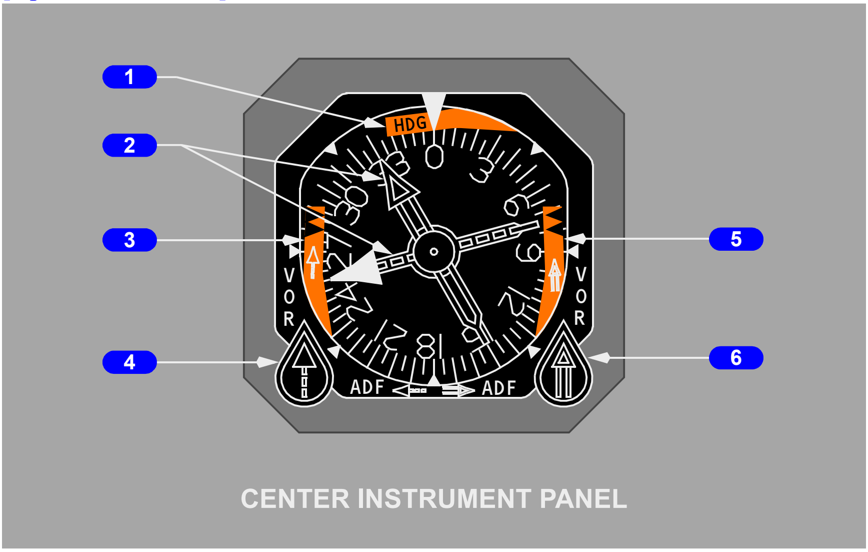
Attitude information has failed.

6 Heading flag

Heading data has failed.

Standby Radio Magnetic Indicator

[Option - Dual ADF]



1 Heading Warning Flag

The compass signal from the air data inertial reference system is lost.

2 Bearing Pointers

- narrow pointer uses signals from the VHF NAV receiver No. 1 or ADF receiver No. 1

[Option - Dual ADF]

- wide pointer uses signals from the VHF NAV receiver No. 2 or ADF receiver No. 2.

3 Bearing Pointer No. 1 Warning Flag

VOR mode:

- RMI power failure
- VHF NAV signal unreliable.

ADF mode:

- RMI power failure
- ADF failure or signal unreliable.

4 VOR/ADF Bearing Pointer No. 1 Switch

ROTATE – selects VOR or ADF for the bearing pointer.

5 Bearing Pointer No. 2 Warning Flag

VOR mode:

- RMI power failure
- VHF NAV signal unreliable.

[Option - Dual ADF]
ADF mode:

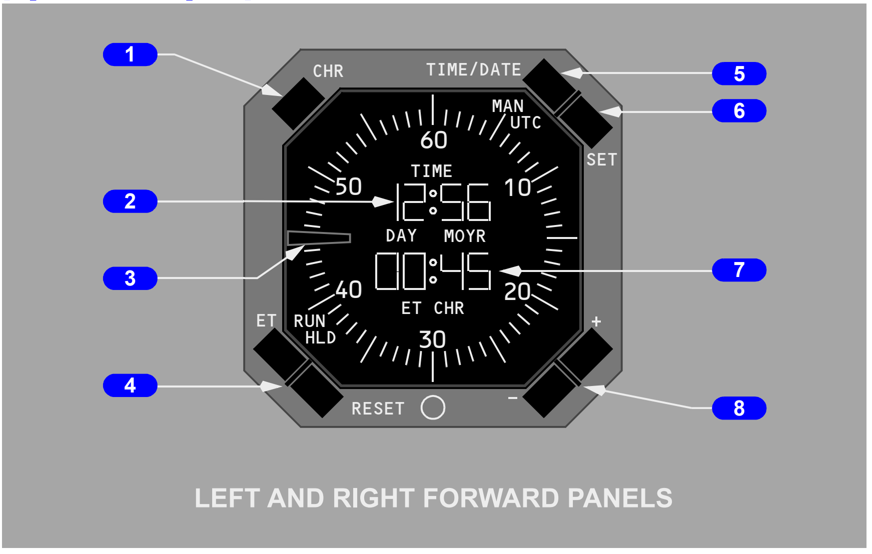
- RMI power failure
- ADF failure or signal unreliable.

[Option - Dual ADF]
6 VOR/ADF Bearing Pointer No. 2 Switch

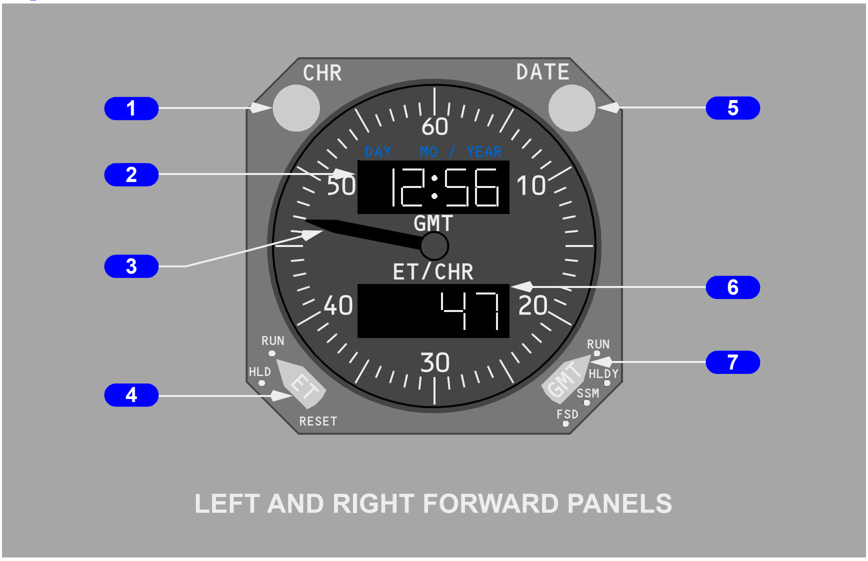
ROTATE – selects VOR or ADF for the bearing pointer.

Clock

[Option - GPS capable]



[Option - Smiths 60B00303-105]



1 Chronograph (CHR) Control

PUSH –

- controls the start, stop and reset functions of the CHR display and second hand with successive pushing
- overrides any existing ET display.

2 Time/Date Indicator

- displays UTC or manual time (hours, minutes) when time is selected with the time/date pushbutton
- alternately displays day–month and year when date is selected with the time/date pushbutton.

2 Time/Date Window

- displays time (hours, minutes) when time is selected with the date control
- alternately displays day–month and year when date is selected with the date control.

3 Chronograph Second Hand

- indicates chronograph seconds
- controlled by the CHR control.

4 Elapsed Time (ET) and RESET Pushbutton

Controls the elapsed time function:

- select the ET pushbutton once to run the elapsed time
- select the ET pushbutton again to hold the elapsed time
- select the RESET pushbutton to set the elapsed time to 0.

The RUN or HLD symbol is displayed on the lower left part of the LCD display.

4 Elapsed Time (ET) Selector (three position, rotary)

Controls the elapsed time function:

RESET – returns ET display to zero (spring loaded to HLD).

HLD (hold) – stops the elapsed time display.

RUN – starts the elapsed time display.

5 TIME/DATE Pushbutton

Controls the time/date function:

- select the TIME/DATE pushbutton once to see UTC time
- select the TIME/DATE pushbutton again to see UTC date
- select the TIME/DATE pushbutton again to see manual time
- select the TIME/DATE pushbutton again to see manual date.

The UTC or MAN symbol is displayed on the upper right part of the LCD display.

In MAN mode, clock time and date come from the clock. In UTC mode, clock time and date come from the global positioning system.

5 Date Control

Controls the date display:

PUSH – displays date (day, month) alternating with year.

PUSH – returns display to time.

6 SET Pushbutton

Controls the setting of manual time and date:

With manual time displayed:

- select the SET pushbutton once and the hours flash, use the plus or minus pushbutton to adjust the hours
- select the SET pushbutton again and the minutes flash, use the plus or minus pushbutton to adjust the minutes
- select the SET pushbutton again to run the time.

With manual date displayed:

- select the SET pushbutton once and the day flashes, use the plus or minus pushbutton to adjust the day
- select the SET pushbutton again and the month flashes, use the plus or minus pushbutton to adjust the month
- select the SET pushbutton again and the year flashes, use the plus or minus pushbutton to adjust the year
- select the SET pushbutton again to run the date.

Note: A delay greater than one minute while setting the time or date results in the clock reverting to the previous time/date setting.

6 Elapsed Time (ET)/Chronograph Window

- displays elapsed time (hours, minutes) or chronograph minutes
- the chronograph display replaces the elapsed time display
- elapsed time continues to run in the background and displays after the chronograph is reset.

7 Elapsed Time (ET)/Chronograph Indicator

- displays elapsed time (hours, minutes) or chronograph minutes
- the chronograph display replaces the elapsed time display
- elapsed time continues to run in the background and displays after the chronograph is reset.

7 Time Control (four position, rotary)

Sets the time and date when the time or date is selected with the date control.

FS D (fast slew, day) –

- advances hours when time is selected with the date control
- advances days when date is selected with the date control.

SS M (slow slew, month) –

- advances minutes when time is selected with the date control
- advances months when date is selected with the date control.

HLD Y (hold, year) –

- stops the time indicator and sets the seconds to zero when time is selected with the date control
- advances years when date is selected with the date control.

RUN – starts the time indicator.

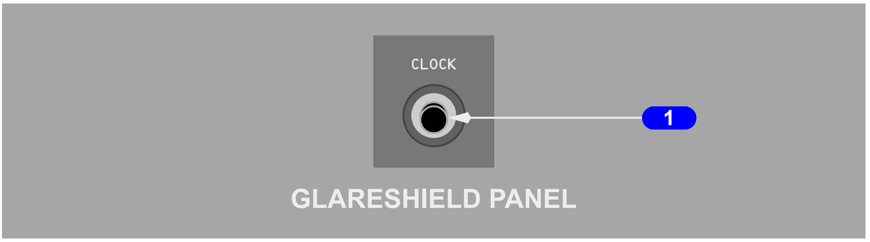
8 Plus (+) and Minus (-) Pushbuttons

Used to set the manual time and date:

- select the + pushbutton to increase the value
- select the - pushbutton to decrease the value.

Clock Switch

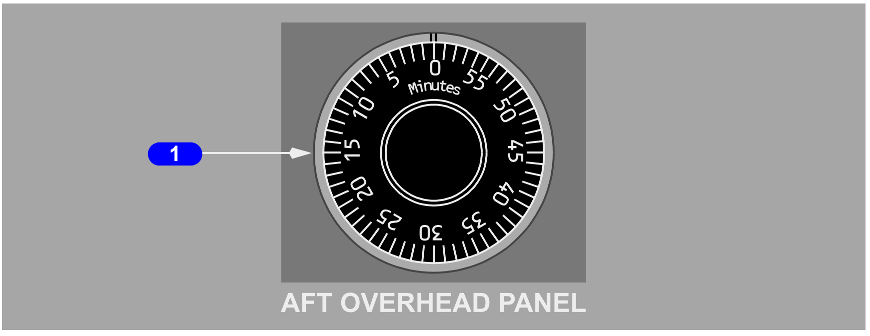
[Option]



1 Clock Switch

Operates the same as the chronograph (CHR) control.

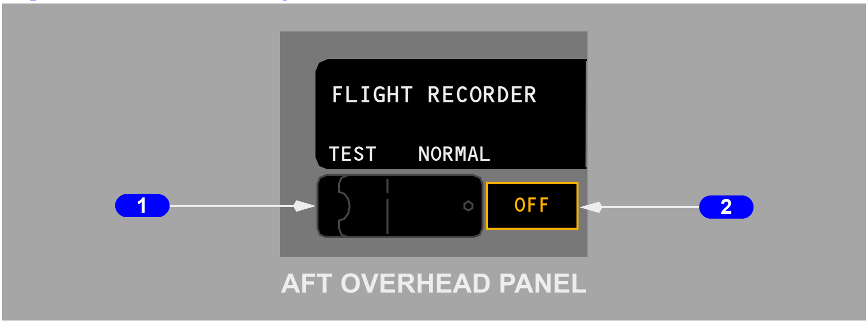
Timer



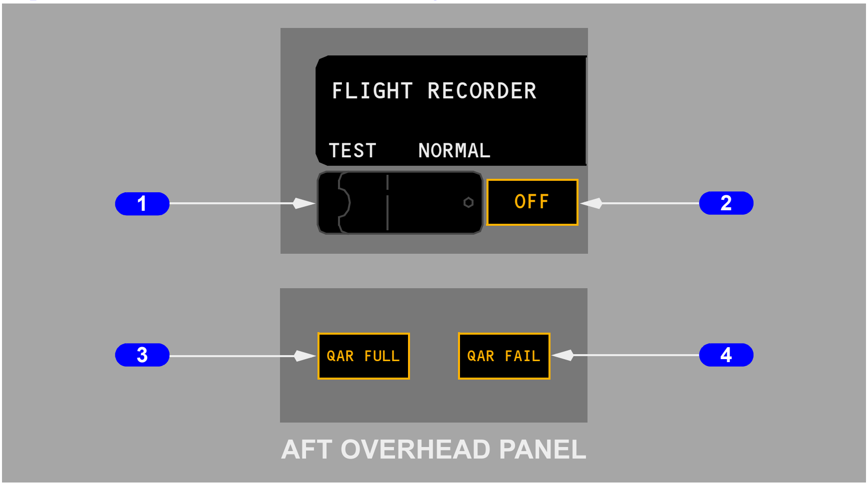
1 Mechanical Timer

Flight Recorder

[Option - Without QAR lights]



[Option - With QAR FULL and FAIL lights]



1 Flight Recorder Test Switch

NORMAL (guarded position) –

- in flight – the recorder operates anytime electrical power is available
- on the ground – either engine must also be operating.

TEST – powers the flight recorder on the ground.

2 OFF Light (amber)

ILLUMINATED –

- indicates the recorder is not operating or the test is invalid
- may indicate power failure, loss of input data, or electronic malfunction.

[Option - QAR FULL lights]

3 Optical Quick Access Recorder (QAR) FULL (white)

ILLUMINATED –

- indicates the quick access recorder is full

[Option - QAR FAIL lights]

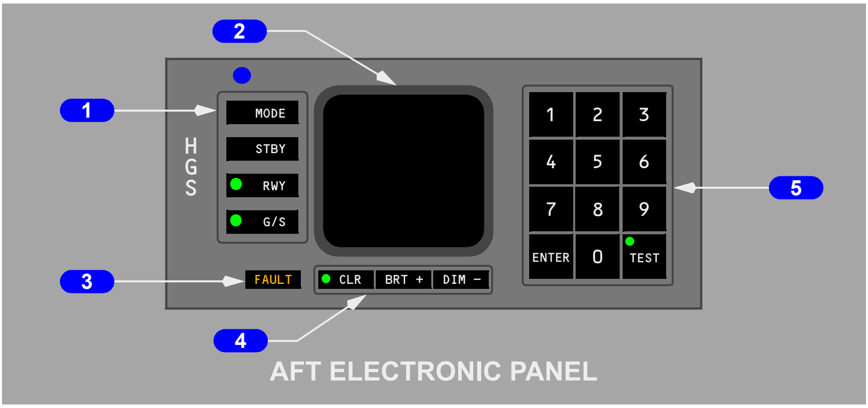
4 Optical Quick Access Recorder (QAR) FAIL (white)

ILLUMINATED –

- indicates the quick access recorder has failed.

HGS Control Panel

The HUD control panel controls modes of operation, display values, and system test and status information.



1 Mode/Function Keys

Push - selects mode or allows data entry:

- MODE – selects desired mode from available modes on the standby display line
- STBY – selects standby mode
- RWY – used to enter runway length and elevation or to toggle between entered values. Select once to enter runway length, select again to enter runway elevation. Use the DIM - (minus) key to enter negative values
- G/S – used to enter the glideslope angle for the landing runway.

Note: Values entered using the mode/function keys are stored in the HUD computer. If a power interruption should occur, the last mode and value will be displayed once power is restored.

2 Control Panel Display

Displays information entered using the mode/function keys. Refer to Section 12, Head–Up Display System – Displays.

3 FAULT Light

Illuminated (amber) – HUD BITE fault.

4 Clear and Brightness Keys

CLR – used to clear all symbology from the combiner display. Symbology can be re-displayed by selecting CLR again, changing modes, or entering TEST. CLR can also be used as a backspace key during data entry and TEST operations.

BRT + (plus) – used to manually increase control panel display intensity.

DIM – (minus) – used to manually decrease control panel display intensity.

Note: Display brightness is adjusted automatically based on ambient light measured by a sensor located in the upper left corner of the control panel.

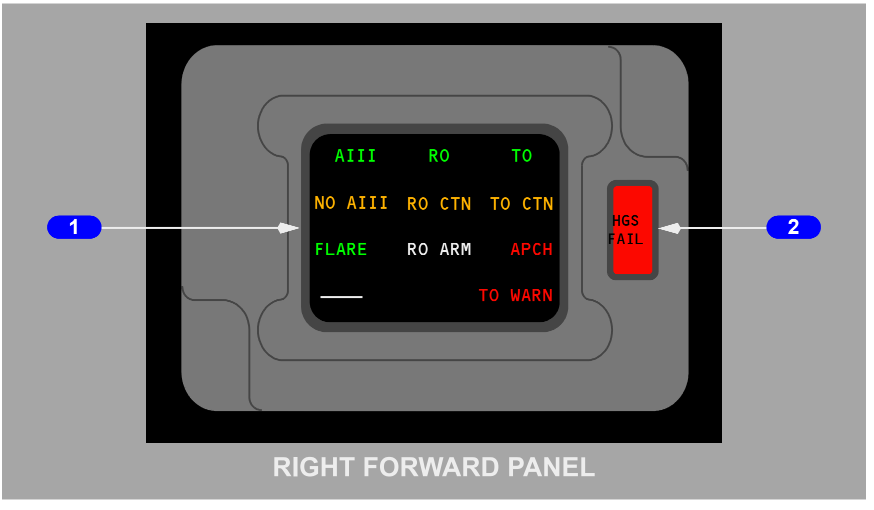
5 Numeric Keys

Push -

- 0 through 9 – puts selected number in display
- ENTER – used to enter selected values
- TEST – used by maintenance for system tests and troubleshooting.

HGS Annunciator Panel

[Option - Model 4000 Digital Twelve Light -Phases 1, 2, & 3]



1 HGS Status Annunciations

- AIII (green) – AIII mode is active and all required systems and equipment are valid
- NO AIII (amber) – loss of AIII capability above 500 feet AGL.
- APCH WARN (Approach Warning) (red) – system or approach conditions out of tolerance

- FLARE (green) – system derived flare guidance is active
- RO ARM (Rollout Guidance Armed) (white) – system capable of providing ground roll guidance during rollout. Displayed prior to touchdown during an AIII approach
- RO CTN (Rollout Guidance Caution) (amber) – loss of rollout guidance below 500 feet AGL
- RO (Rollout Guidance) (green) – rollout guidance is active
- TO (green) – not used, displayed only during maintenance test.
- TO CTN (Takeoff Caution) (amber) – not used, displayed only during maintenance test
- TO WARN (Takeoff Warning) (red) – not used, displayed only during maintenance test.

2 HGS FAIL Light (red)

Illuminated (red) – indicates HGS failure below 500 ft AGL.

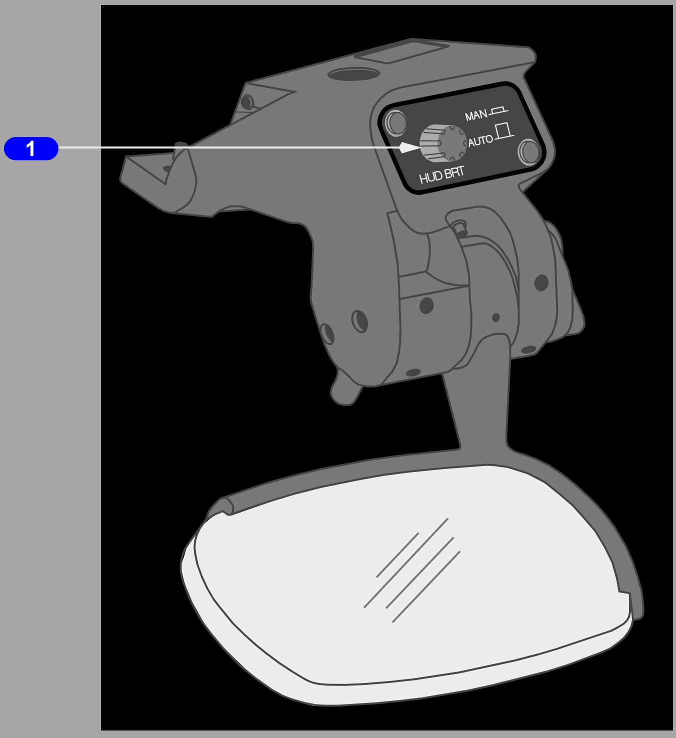
Push –

- extinguishes the HGS Fail Light
- will not illuminate again until failure is cleared and another failure occurs
- resets system for another failure.

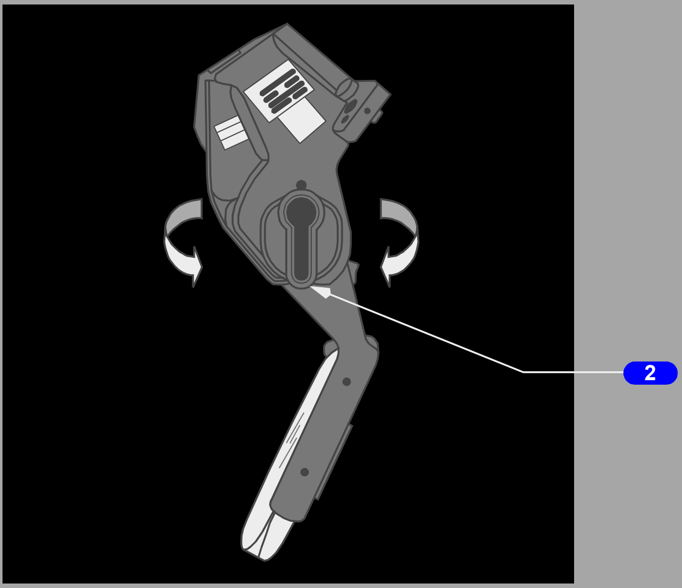
Combiner Controls

[Option - Model 4000]

Brightness and Stow Controls



OVERHEAD FLIGHT DECK



OVERHEAD FLIGHT DECK

1 Brightness Control Knob

MAN – push knob in for manual brightness adjustment.

AUTO – pull knob out for automatic brightness adjustment. Display intensity varies based on ambient light detected by a sensor on the combiner.

HUD BRT – rotate knob clockwise to increase display intensity. Rotate knob counter-clockwise to decrease display intensity.

2 Stow Lever

There are three positions for the combiner:

- Stow – AFT/UP
- Normal operating detent – DOWN
- Breakaway – FWD

Pull lower portion of the stow lever toward the pilot and rotate the glass down and forward to the normal operating detent. To stow the combiner glass, grasp and rotate toward the pilot, aft and up, until it locks in the stowed position.

The forward breakaway position allows the combiner glass to be displaced forward from its normal operating position. The combiner glass can be returned from the breakaway position by rotating the stow lever away from the pilot and rotating the glass aft to the normal operating detent.

Note: If the combiner glass is not in the normal operating position (detent) the ALIGN HUD message will display when in IMC and VMC modes. If the ALIGN HUD message can not be extinguished by grasping and moving the combiner glass forward or aft, then back into its normal operating detent, IMC and VMC modes should not be used.

The ALIGN HUD restriction does not apply to use of the HUD in PRI mode.

Introduction

The Common Display System (CDS) supplies information to the flight crew on six flat panel liquid crystal display units (DUs). The outboard and inboard display units present all primary flight and navigation information. Engine and system data are normally shown on the upper display unit. The lower display unit serves as a spare.

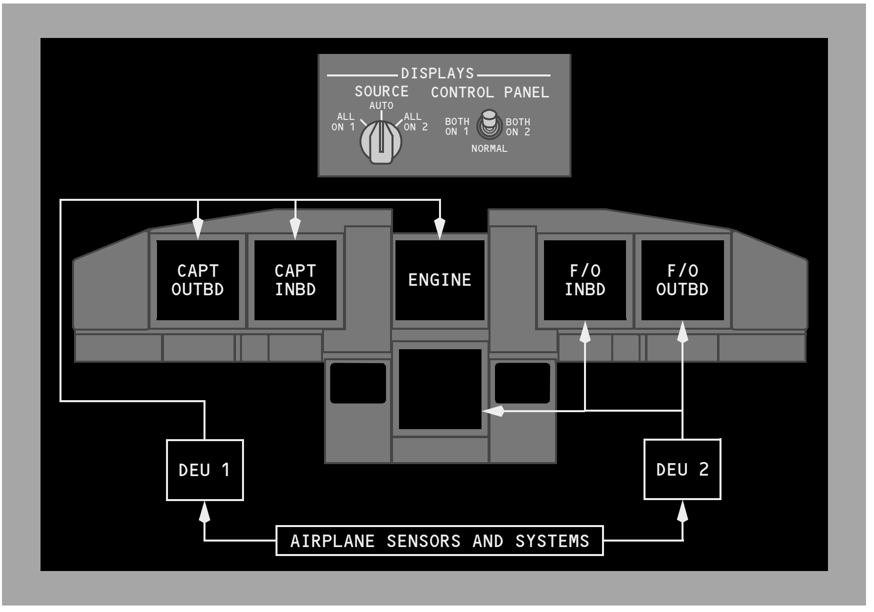
Detailed information on the following subjects is found in other sections of this chapter:

- Electronic Flight Instrument System (EFIS) – Section 30
- Navigation display – Section 40.

Display Brightness Control

Adjustment of the brightness of each DU is controlled by a combination of light sensors and brightness controls. Two remote light sensors, located left and right on the top of the glareshield, compensate for the amount of ambient light entering through the flight deck windows and adjust the brightness of the related DUs. Each DU also has an integral light sensor which provides automatic control of brightness as a function of ambient light striking the face of the DU. Brightness controls are used by the pilot to further adjust the intensity of each display unit.

DISPLAYS SOURCE Panel



The DISPLAYS source panel, located on the forward overhead panel, contains source controls for the display electronic units (DEUs) and EFIS control panels.

Two DEUs receive data from sensors and airplane systems and supply data to the DUs. During normal operation, with the display SOURCE selector in the AUTO position, DEU 1 supplies data to the Captain outboard, Captain inboard and upper DUs while DEU 2 supplies data to the First Officer outboard, First Officer inboard and lower DUs. If a DEU fails, the remaining DEU automatically supplies data to all six displays. A single DEU failure will continue to supply each pilot with flight instrument information from independent sources. Each DEU receives data from both ADIRUs.

The display SOURCE selector, used on the ground for maintenance purposes, allows manual selection of either DEU 1 or DEU 2 for all six display units. If the displays are automatically or manually switched to a single DEU source, a "DSPLY SOURCE" annunciation illuminates above the altimeters.

The CONTROL PANEL select switch determines which EFIS control panel controls the pilots' display functions. With the switch positioned to either BOTH ON 1 or BOTH ON 2, the selected EFIS control panel provides inputs for both sets of pilot displays. When in the NORMAL position, a "DISPLAYS CONTROL PANEL" annunciation illuminates and indicates a failure of the associated EFIS control panel.

EFIS Control Panels

Two EFIS control panels, located on the glare shield of the center main panel, control display options, mode, and range for the related pilot's displays.

If one EFIS control panel fails, the displays can be controlled by the remaining control panel. Refer to the EFIS and navigation display sections of this chapter for more information.

Display Select Panel

The display select panel, located on the left and right forward panels, controls the displays on the inboard, outboard and lower DUs. Normal operation is all selectors in the NORMAL position. The pilots' outboard and inboard DUs display primary flight and navigation data and the upper DU displays engine data.

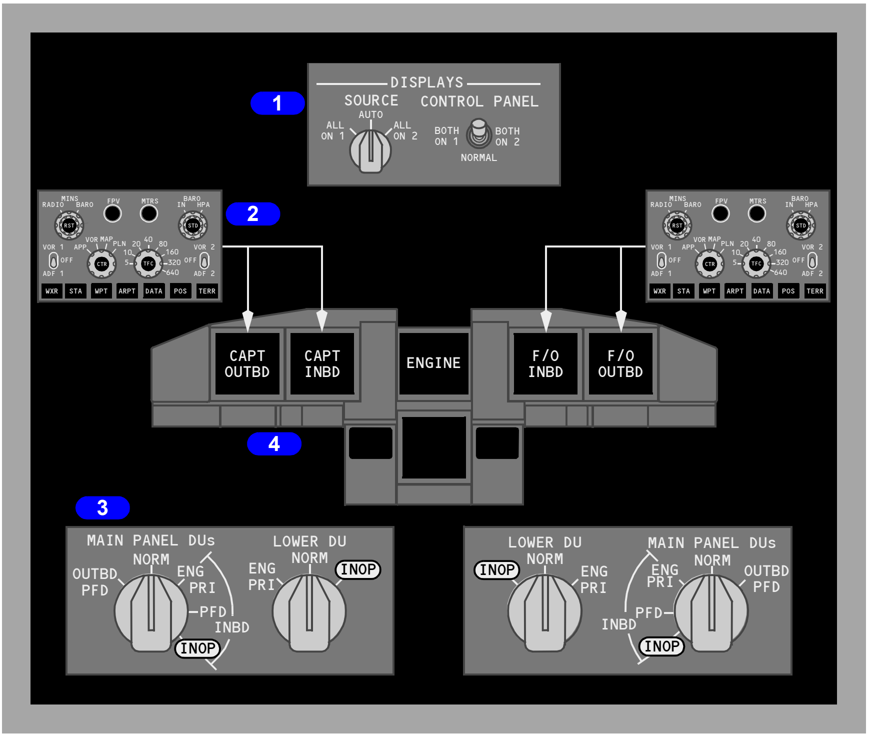
If a DU fails, automatic display switching ensures critical information remains available to the pilots at all times. If the system detects an operational failure on an outboard DU, the compact EFIS format automatically moves to the inboard DU and the failed outboard DU blanks. If the system detects a failure on an inboard DU, the compact EFIS format automatically moves to the outboard DU and the failed inboard DU blanks. If the upper DU fails, the engine display automatically moves to the lower DU.

Manual control of display formats is provided for undetected failures. The outboard rotary switch on the display select panel controls the formats displayed on either the outboard or inboard DUs. The inboard rotary switch controls the display format shown on the lower DU.

Display Selection and Control Examples

The following examples show display selections.

Normal Display Configuration



1 DISPLAYS Source Panel

The display SOURCE select switch is in AUTO and the CONTROL PANEL select switch is in NORMAL.

2 EFIS Control Panel

The left EFIS control panel controls the Captain outboard and inboard display units. The right EFIS control panel controls the First Officer outboard and inboard display units.

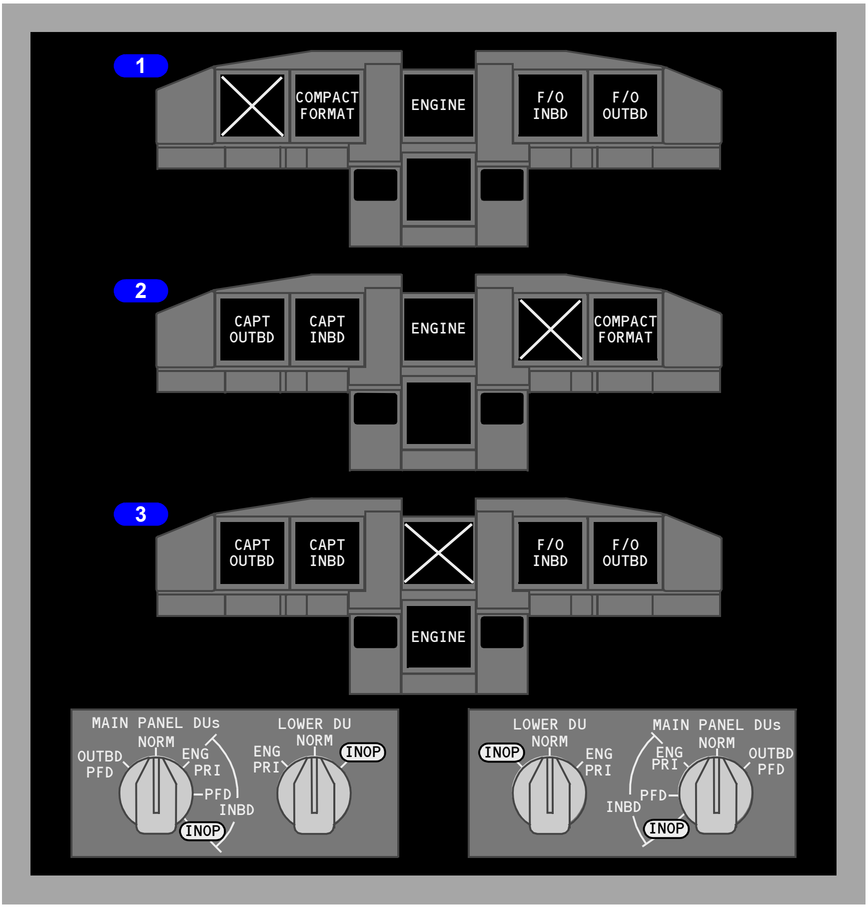
3 Display Select Panel

All selectors are in NORMAL.

4 Display Units

The pilots' outboard and inboard DUs show the normal EFIS/MAP displays.

Display Unit Failure Automatic Switching



1 Outboard Display Unit Fails

If an outboard display unit fails, the compact EFIS format is automatically displayed on the inboard display unit and the outboard display unit blanks.

2 Inboard Display Unit Fails

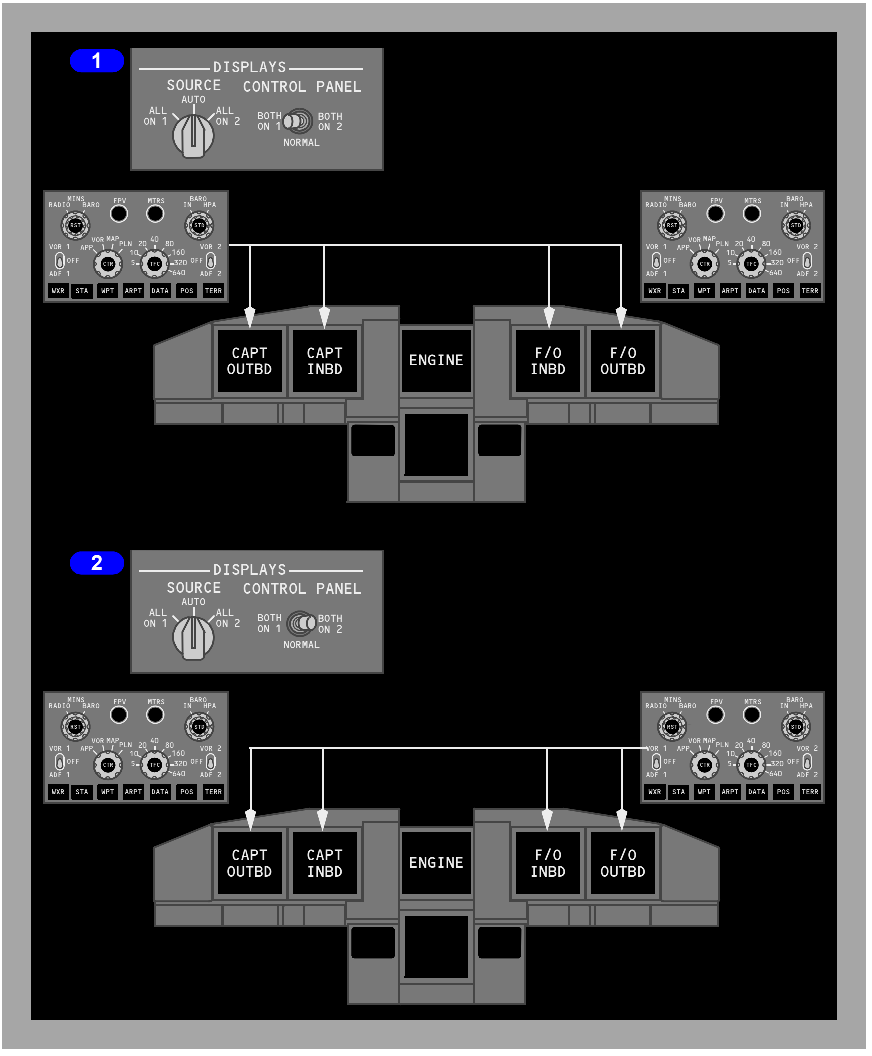
If an inboard display unit fails, the compact EFIS format is automatically displayed on the outboard display unit and the inboard display unit blanks.

3 Upper Display Unit Fails

If the upper display unit fails, the engine display automatically moves to the lower display unit and the upper display unit blanks.

Note: There is no automatic switching for a lower DU failure.

EFIS Control Panel



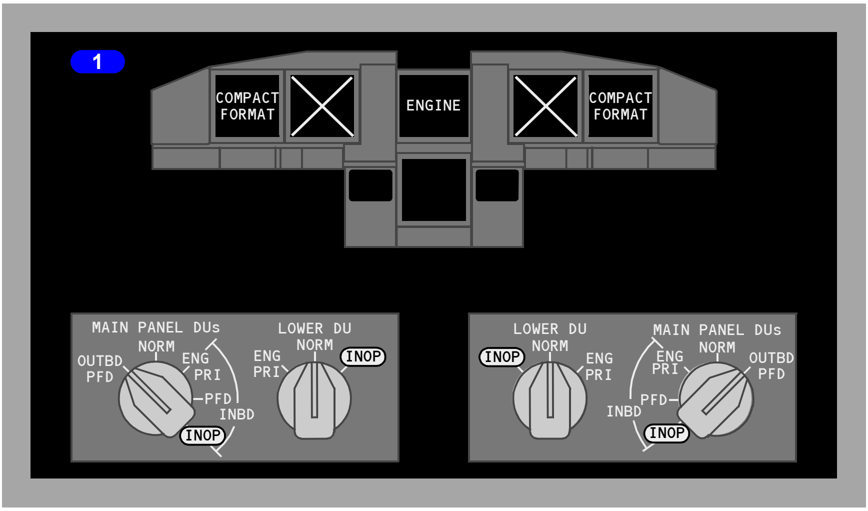
1 CONTROL PANEL Select Switch BOTH ON 1

The left EFIS control panel controls both pilots' outboard and inboard display units.

2 CONTROL PANEL Select Switch BOTH ON 2

The right EFIS control panel controls both pilots' outboard and inboard display units.

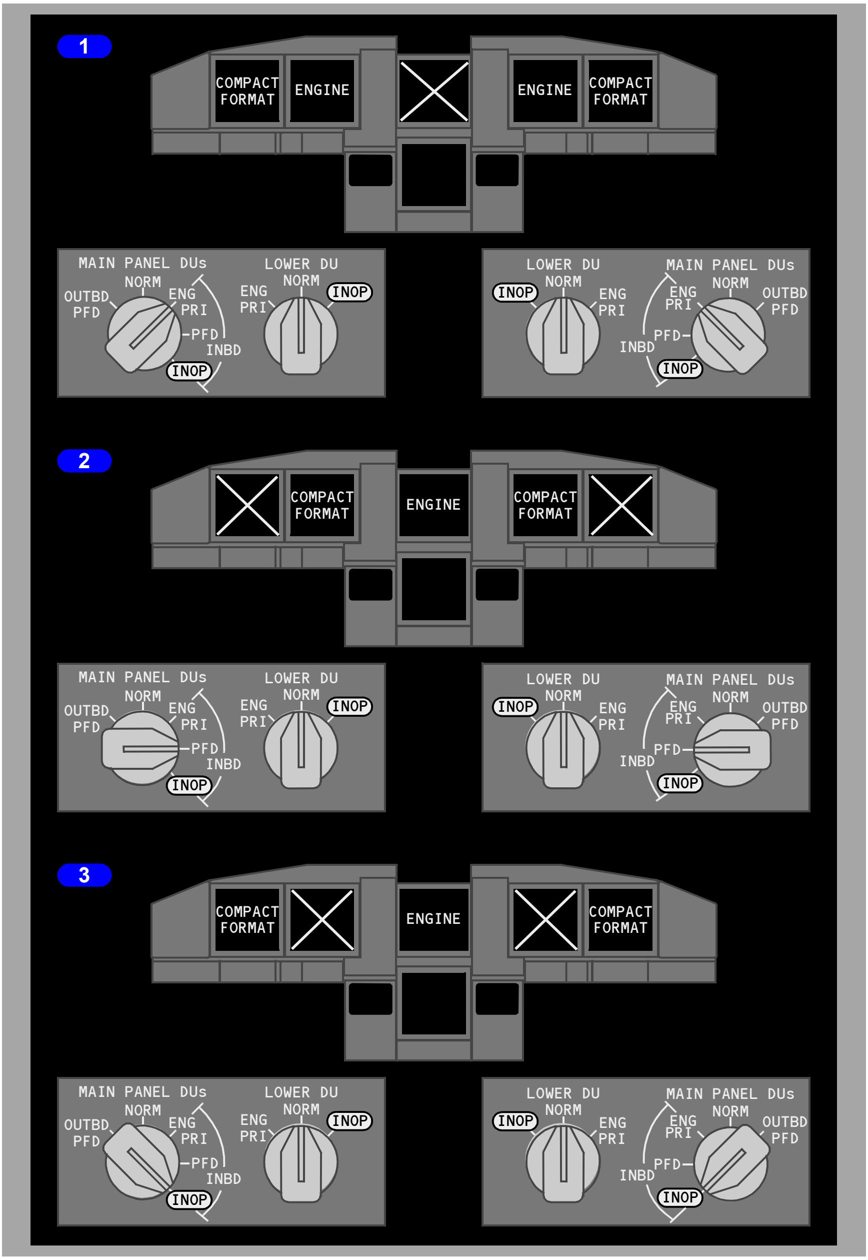
Outboard Display Switching



1 MAIN PANEL DUs Switch to OUTBD PFD

If the MAIN PANEL DUs switch is turned to Outboard Primary Flight Display (OUTBD PFD), the compact EFIS format is displayed on the outboard display unit and the inboard display unit blanks.

Inboard Display Switching



1 MAIN PANEL DUs Switch to INBD ENG PRI

If the MAIN PANEL DUs switch is turned to INBD ENG PRI, the engine display moves to the inboard DU, the compact EFIS format is displayed on the outboard DU and the upper DU blanks.

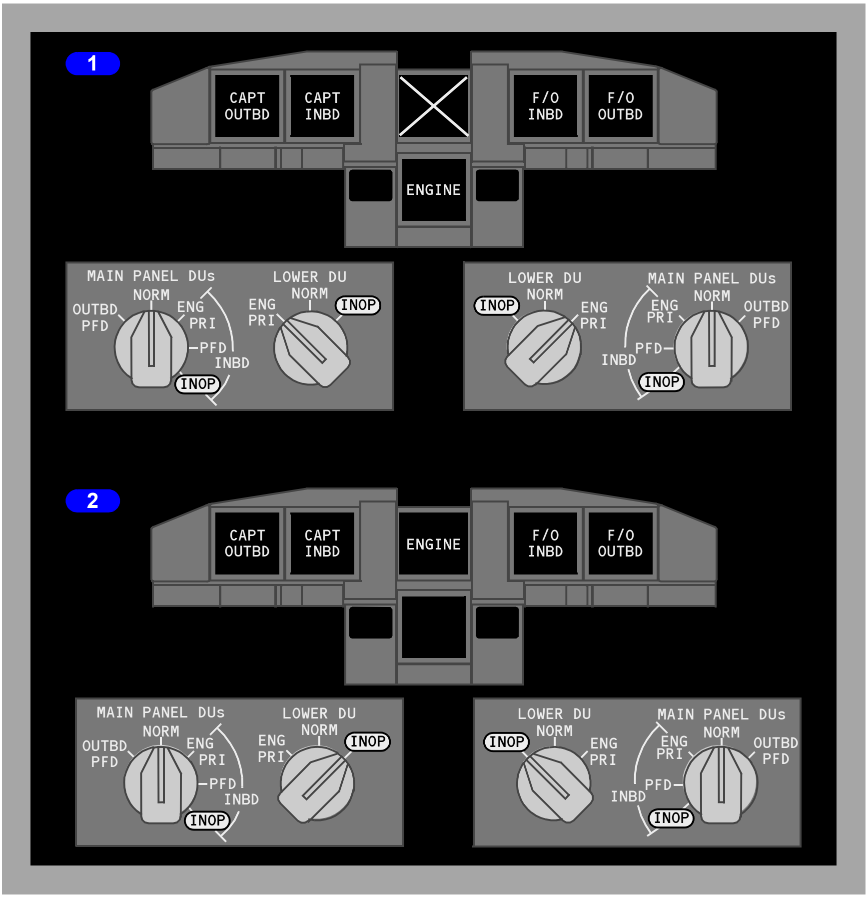
2 MAIN PANEL DUs Switch to INBD PFD

If the MAIN PANEL DUs switch is turned to INBD PFD the compact EFIS format is displayed on the inboard DU and the outboard DU blanks.

3 MAIN PANEL DUs Switch to INOP

If the MAIN PANEL DUs switch is turned to INBD INOP the compact EFIS format is displayed on the outboard DU and the inboard DU blanks.

Lower Display Switching



1 LOWER DU Switch to ENG PRI

If the LOWER DU switch is turned to ENG PRI, the engine display moves to the lower DU and the upper DU blanks.

2 LOWER DU Switch to INOP

If the LOWER DU switch is turned to INOP the engine display is shown on the upper DU and the lower DU blanks.

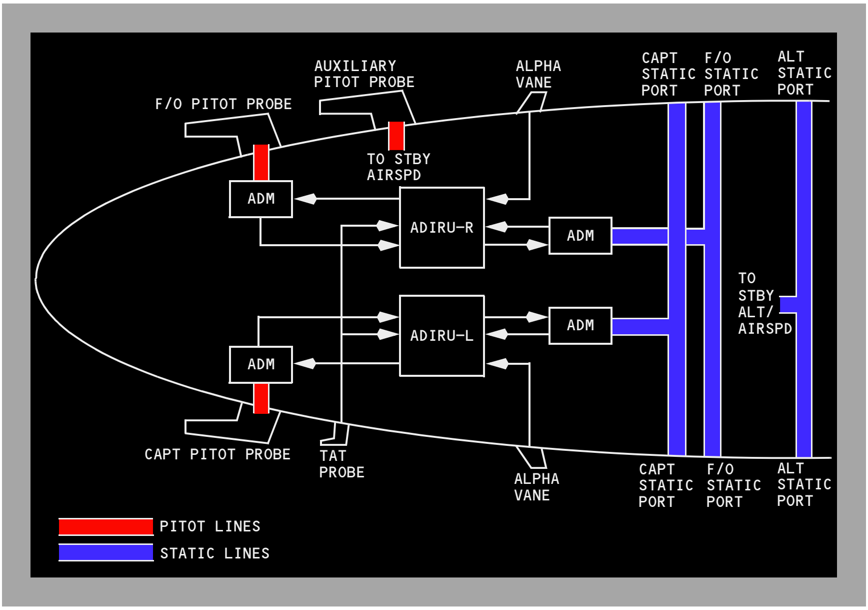
Display System Information Sources

Air Data Inertial Reference System (ADIRS)

The ADIRS produces flight data such as position, speed, altitude and attitude for the flight displays, flight management computers, flight controls, engine controls and all other systems requiring inertial and air data.

The major components of the ADIRS are:

- two air data inertial reference units (ADIRUs)
- four air data modules (ADMs)
- one inertial system display unit (ISDU)
- one dual mode select unit (MSU)
- six static ports
- three pitot probes
- two alpha vanes
- one total air temperature probe



Air Data Inertial Reference Unit (ADIRU)

The ADIRUs provide inertial position and track data to the FMC as well as attitude, altitude and airspeed data to the displays. The ADIRUs process information measured by internal gyros and accelerometers, and from air data module inputs, the alpha vanes and other systems.

The ADIRUs are described in Chapter 11, Flight Management, Navigation.

Air Data

The pitot static system is comprised of three separate pitot probes and six flush static ports. Two pitot probes and four static ports interface with the air data modules. The remaining auxiliary pitot probe and alternate static ports provide pitot and static pressure to the standby instruments. The auxiliary pitot probe is located on the first officer's side of the airplane.

The air data modules convert pneumatic pressure to electrical signals and send these data to the ADIRUs. Each pitot air data module is connected to its on–side pitot probe; there is no cross connection. The air data module connected to the Captain's pitot probe sends information to the left ADIRU, while the air data module connected to the First Officer's pitot probe sends information to the right ADIRU. The remaining air data modules are located at the balance centers of the Captain's and First Officer's static ports. The air data module connected to the Captain's static ports sends information to the left ADIRU, while the air data module connected to the First Officer's static ports sends information to the right ADIRU.

Angle–of–Attack

There are two alpha vanes, one located on each side of the forward fuselage. The vanes measure airplane angle–of–attack relative to the air mass.

Total Air Temperature (TAT)

A total air temperature probe is mounted outside the airplane to sense air mass temperature. The temperature sensed by the probe is used by the ADIRUs to compute total air temperature.

Note: TAT indication should not be used in lieu of ambient OAT to calculate takeoff performance.

Static Air Temperature (SAT)

Static air temperature, displayed on the CDU PROGRESS page, comes from the ADIRUs, using total air temperature probe information.

Standby Flight Instruments

The standby flight instruments include:

- standby magnetic compass
- standby attitude indicator
- standby altimeter/airspeed indicator
- integrated standby flight display
- standby radio magnetic indicator

Standby Magnetic Compass

A standard liquid–damped magnetic standby compass is provided. A card located near the compass provides heading correction factors.

Standby Attitude Indicator

The standby attitude indicator provides attitude information that is independent of the primary attitude displays. The indicator is powered by the battery bus and remains powered after the loss of all normal AC power as long as battery power is available. The gyro reaches operational speed approximately 60 seconds after power is applied. The indicator requires three minutes to achieve accuracy requirements.

Integrated Standby Flight Display (ISFD)

The ISFD displays attitude, airspeed, altitude, localizer/glideslope deviation and magnetic heading information. Attitude information is computed from data provided by internal inertial sensors. Airspeed and altitude are computed from pneumatic pressure data provided by direct connections to the auxiliary pitot and alternate static sources. Localizer/Glideslope deviation is provided by the #1 MMR (The MMR can provide Localizer and Glideslope deviation from ILS or GLS sources). Magnetic heading is provided by the #1 ADIRU. Magnetic heading is not available in polar regions. (Later versions of the ISFD will automatically switch to True Heading when Magnetic Heading becomes unusable in polar regions).

Note: The standby magnetic compass must be used to validate information.

The battery bus powers the ISFD. Selecting the battery switch ON activates the ISFD. After 10 seconds, an initialization sequence begins that requires 90 seconds to complete. ATT and INIT 90s messages are displayed during initialization. Upon completion of the initialization sequence, attitude information is displayed.

Note: Any change in airplane position during the initialization sequence may result in an inaccurate alignment. Inaccurate alignment is not annunciated and may result in the display of inaccurate attitude prior to, and during flight. Re-initialization can only be accomplished through maintenance action.

Detection of a momentary out-of-limit ISFD condition may cause the attitude display to blank and the WAIT ATT or ATT:RST message to display. Operation of the attitude reset switch is required in response to the ATT:RST message. This will reset the horizon line with the airplane symbol.

Note: Operation of the attitude reset switch will not correct an inaccurate alignment.

On the ground, operation of the attitude reset switch must be performed with the airplane stationary. In flight, operation of the attitude reset switch must be performed with the airplane in wings level, non-accelerated flight. During the process, the ATT 10s message displays. Failure to maintain straight and level flight for 10 seconds may result in an ATT:RST message. If the reset attempt is unsuccessful, the ATT:RST message remains displayed and the ISFD does not enter normal operation.

Standby Altimeter/Airspeed Indicator

Standby altitude and airspeed are displayed on a single indicator.

The standby altimeter receives static pressure from the alternate static ports. Current altitude is displayed digitally. A pointer indicates altitude in hundreds of feet. Barometric setting windows display the barometric setting in both millibars and inches of mercury as set by the barometric setting control. The altimeter has a range of –1000 to 50,000 feet.

The standby airspeed indicator receives ram pressure from the auxiliary pitot probe and static pressure from the alternate static ports. It provides current airspeed in knots.

Standby Radio Magnetic Indicator

The standby radio magnetic indicator (RMI) displays magnetic heading and VOR/ADF bearing to the station. The RMI is powered by the AC standby bus and remains powered after the loss of all normal AC power as long as battery power is available.

Clocks

[Option - Smiths 60B00303-105]
Two electronic clocks are installed, with two digital displays on each clock. Either Greenwich Mean Time (GMT) or local time may be set on the upper time display. The lower ET/CHR display is used for either elapsed time or the chronograph. Separate controls are provided for each display.

Clock Switch

[Option - Remote clock switch]
A remote clock switch, on the glareshield panel, operates the same as the chronograph (CHR) control.

Flight Recorder (DFDR)

The Digital Flight Data Recorder (DFDR) provides a permanent record of operational and systems information including time, heading, altitude, airspeed, acceleration, attitude, engine thrust, and flight control surface position.

The recorder is a solid state device and complies with Federal Aviation Administration and European Aviation Safety Agency requirements for data sampling rates and number/type of parameters sampled.

Operational and systems information are automatically recorded whenever the flight recorder is powered.

The DFDR has the following features:

- Continuously records the most recent flight data, saving the most current data for the last 25 hours of operation
- The DFDR is housed in a sealed container located behind an access door in the far aft cabin ceiling
- Corrosion, fire and impact resistant, survives deep sea pressure to 20,000 feet (6,096 m)
- Locator beacon operable for 30 days
- Receptacle for downloading and copying data for analysis.

Aircraft Condition Monitoring System (ACMS)

[Option - ACMS]
The Aircraft Condition Monitoring System (ACMS) contains software that provides the operator useful reports on the condition of the airframe, engines, trends monitoring, and maintenance.

The ACMS consists of:

- ACMS software containing applicable maintenance and operations algorithms for each phase of flight
- Digital Flight Data Acquisition Unit (DFDAU). The DFDAU receives signals representing certain flight condition and airplane systems operating performance and converts them to a digital form for recording on the DFDR
- ACARS air/ground message functionality continuing to expand with additional message formats.

[Option - Quick Access Recorder (QAR) lights]

- indicator on the aft overhead panel that illuminates when the QAR is full.

Flight Instruments, Displays — Chapter 10
PFD/ND – System Description — Section 21

Introduction

The Common Display System (CDS) supplies information to the flight crew on six flat panel liquid crystal display units (DUs). The outboard and inboard display units present all primary flight and navigation information. Primary engine indications are normally displayed on the upper DU. Secondary engine indications or system data are normally displayed on the lower DU.

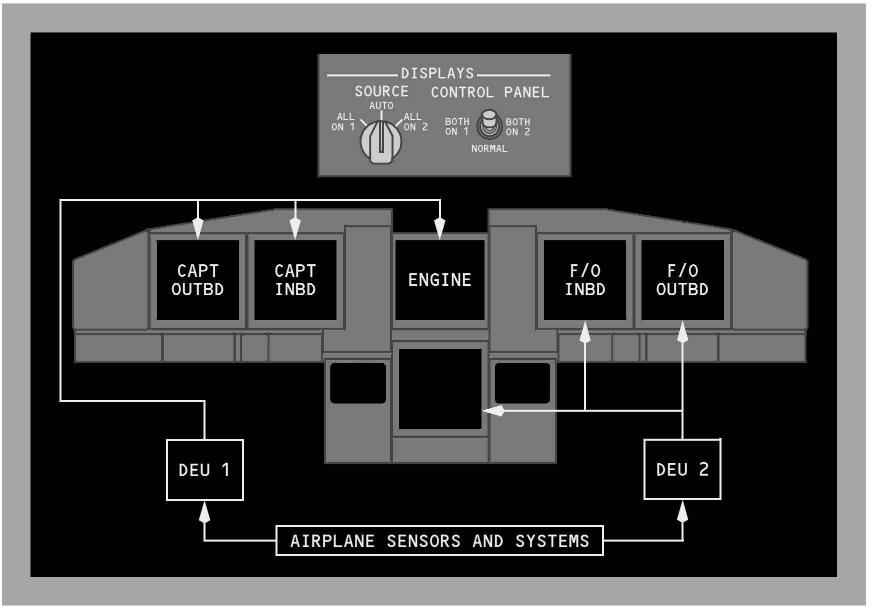
Detailed information on the following subjects is found in other sections of this chapter:

- Primary Flight Display (PFD)– Section 31
- Navigation display (ND)– Section 41.

Display Brightness Control

Adjustment of the brightness of each DU is controlled by a combination of light sensors and brightness controls. Two remote light sensors, located left and right on the top of the glareshield, compensate for the amount of ambient light entering through the flight deck windows and adjust the brightness of the related DUs. Each DU also has an integral light sensor which provides automatic control of brightness as a function of ambient light striking the face of the DU. Brightness controls are used by the pilot to further adjust the intensity of each display unit.

DISPLAYS SOURCE Panel



The DISPLAYS source panel, located on the forward overhead panel, contains source controls for the display electronic units (DEUs) and EFIS control panels.

Two DEUs receive data from sensors and airplane systems and supply data to the DUs. During normal operation, with the display SOURCE selector switch in the AUTO position, DEU 1 supplies data to the Captain outboard, Captain inboard and upper DUs while DEU 2 supplies data to the First Officer outboard, First Officer inboard and lower DUs. If a DEU fails, the remaining DEU automatically supplies data to all six displays. A single DEU failure will continue to supply each pilot with flight instrument information from independent sources. Each DEU receives data from both ADIRUs.

The display SOURCE selector, used on the ground for maintenance purposes, allows manual selection of either DEU 1 or DEU 2 for all six display units. If the displays are automatically or manually switched to a single DEU source, a "DSPLY SOURCE" annunciation illuminates on the primary flight displays.

The display SOURCE selector, used on the ground for maintenance purposes, allows manual selection of either DEU 1 or DEU 2 for all six display units. If the displays are automatically or manually switched to a single DEU source, a "DSPLY SOURCE 1" or "DSPLY SOURCE 2" annunciation illuminates on the primary flight displays.

The CONTROL PANEL select switch determines which EFIS control panel controls the pilots' display functions. This switch should remain in NORMAL. With the switch positioned to either BOTH ON 1 or BOTH ON 2, the selected EFIS control panel provides inputs for both sets of pilot displays.

EFIS Control Panels

Two EFIS control panels, located on the glare shield of the center main panel, control display options, mode, and range for the related pilot's displays.

If one EFIS control panel fails, the displays can be controlled by the remaining control panel. Refer to the PFD and ND sections of this chapter for more information.

Display Select Panel

The display select panel, located on the left and right forward panels, controls the displays on the inboard, outboard and lower DUs. Normal operation is all selectors in the NORMAL position. The pilots' outboard and inboard DUs display primary flight and navigation data and the upper DU displays primary engine data and fuel quantity.

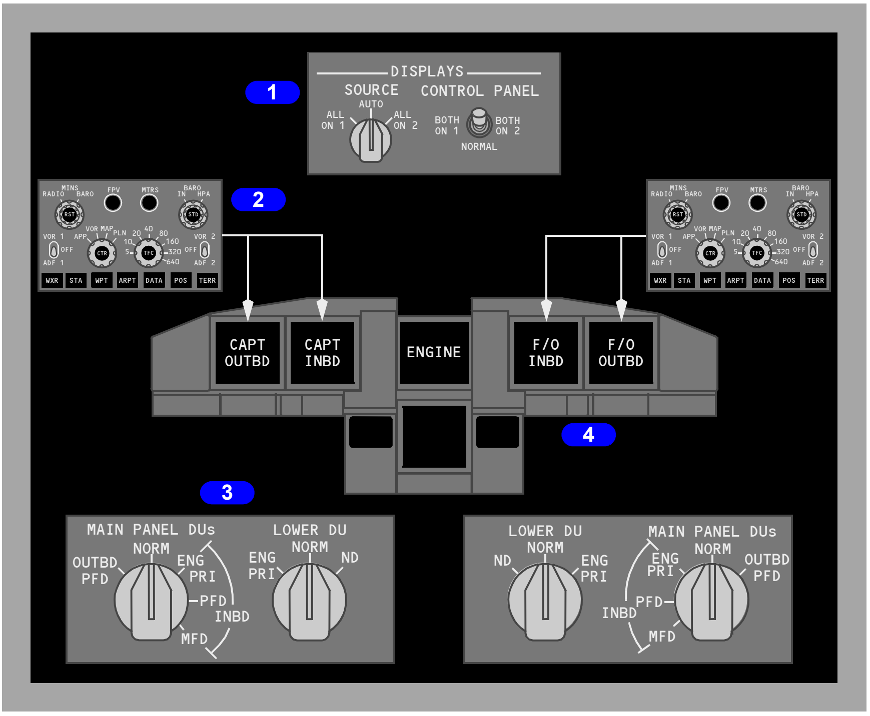
If a DU fails, automatic display switching ensures critical information remains available to the pilots at all times. If the system detects an operational failure on an outboard DU, the primary flight display automatically moves to the inboard DU and the failed outboard DU blanks. The OUTBD/INDB selector no longer has control over that display unit. If the upper DU fails, the engine display automatically moves to the lower DU.

Manual control of display formats is provided for undetected failures. The outboard rotary switch on the display select panel controls the formats displayed on either the outboard or inboard DUs. The inboard rotary switch controls the display format shown on the lower DU.

Display Selection and Control Examples

The following examples show display selections.

Normal Display Configuration



1 DISPLAYS Source Panel

The display SOURCE select switch is in AUTO and the CONTROL PANEL select switch is in NORMAL.

2 EFIS Control Panel

The left EFIS control panel controls the Captain outboard and inboard display units. The right EFIS control panel controls the First Officer outboard and inboard display units.

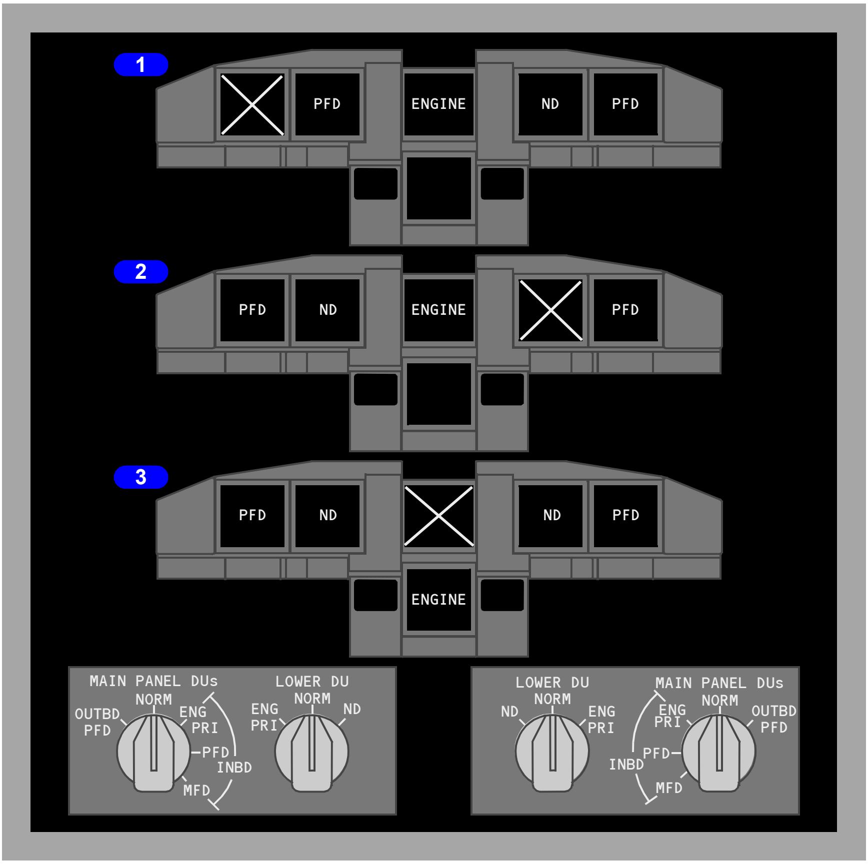
3 Display Select Panel

All selectors are in NORMAL.

4 **Display Units**

The pilots' outboard and inboard DUs show the normal PFD/ND displays.

Display Unit Failure Automatic Switching



1 **Outboard Display Unit Fails**

If an outboard display unit fails, the PFD is automatically displayed on the inboard display unit and the outboard display unit blanks.

2 **Inboard Display Unit Fails**

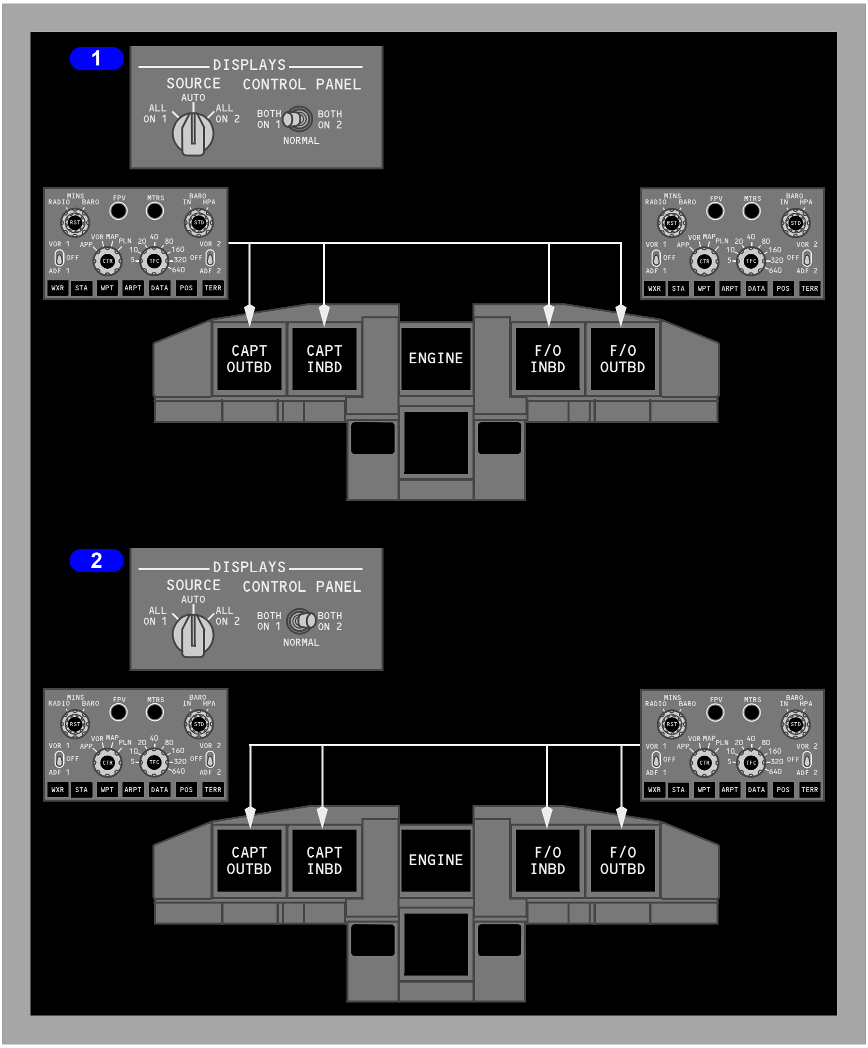
If an inboard display unit fails, the PFD format remains displayed on the outboard display unit and the inboard display unit blanks.

3 Upper Display Unit Fails

If the upper display unit fails, the primary engine display automatically moves to the lower display unit and the upper display unit blanks. If the secondary engine display is already on the lower display unit, a compact engine display is then displayed.

Note: There is no automatic switching for a lower DU failure.

EFIS Control Panel



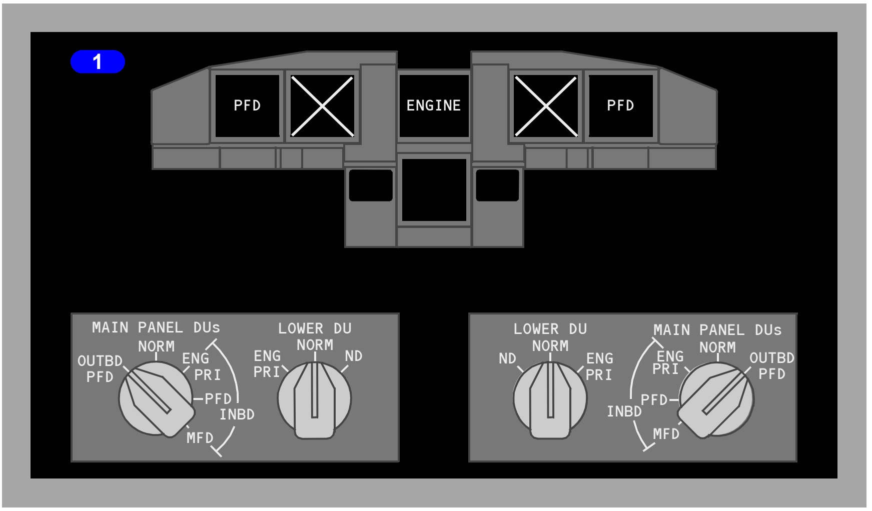
1 CONTROL PANEL Select Switch BOTH ON 1

The left EFIS control panel controls both pilots’ outboard and inboard display units.

2 CONTROL PANEL Select Switch BOTH ON 2

The right EFIS control panel controls both pilots’ outboard and inboard display units.

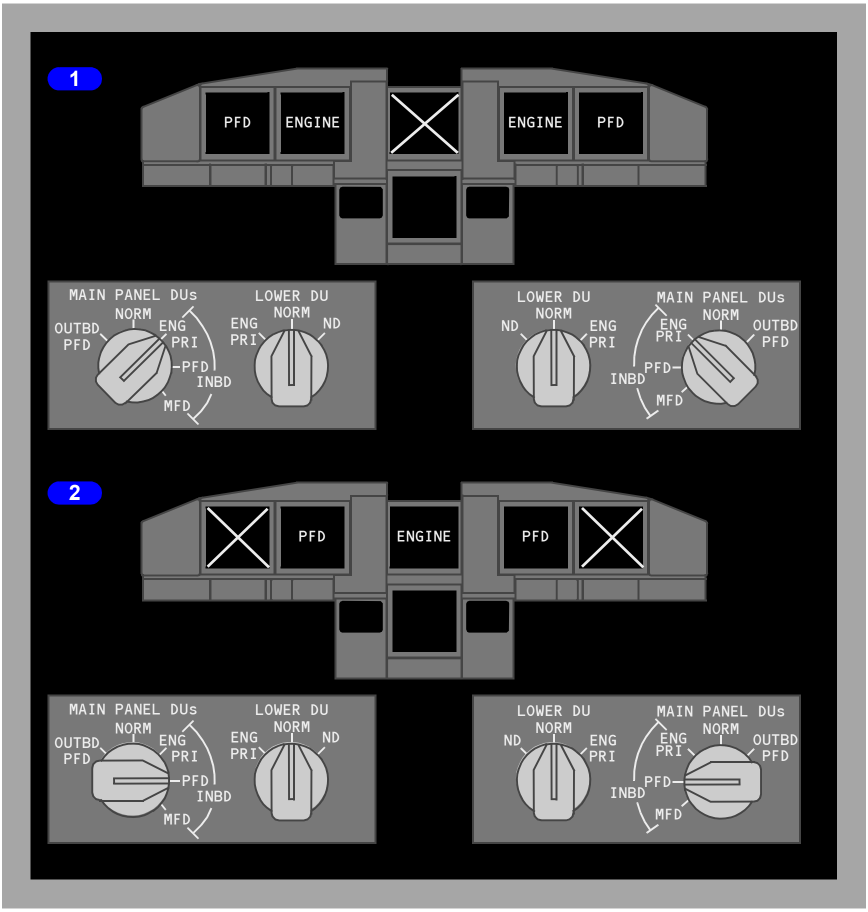
Outboard Display Switching

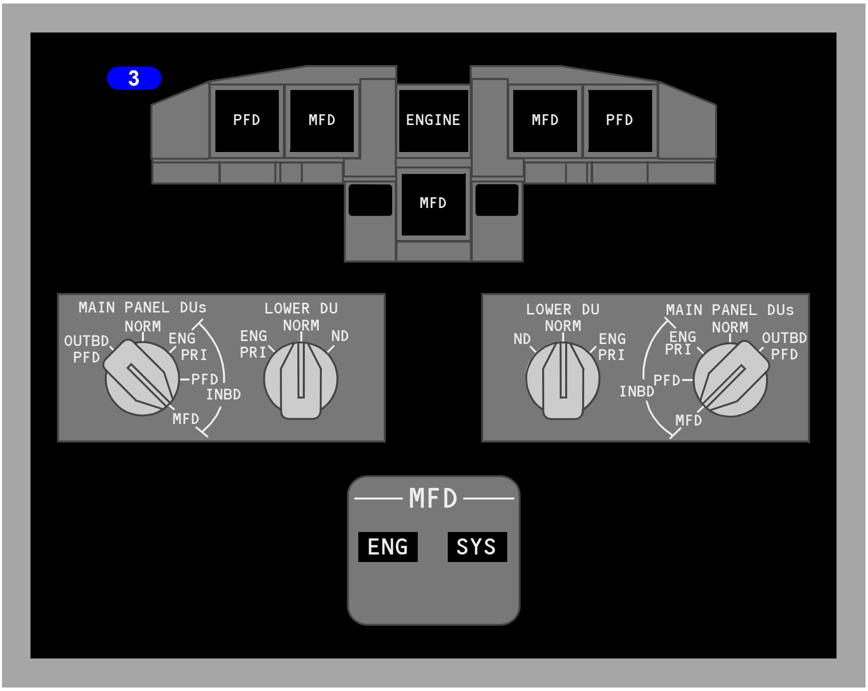


1 MAIN PANEL DUs Switch to OUTBD PFD

If the MAIN PANEL DUs switch is turned to Outboard Primary Flight Display (OUTBD PFD), the PFD format is displayed on the outboard display unit and the inboard display unit blanks.

Inboard Display Switching





1 **MAIN PANEL DUs Switch to INBD ENG PRI**

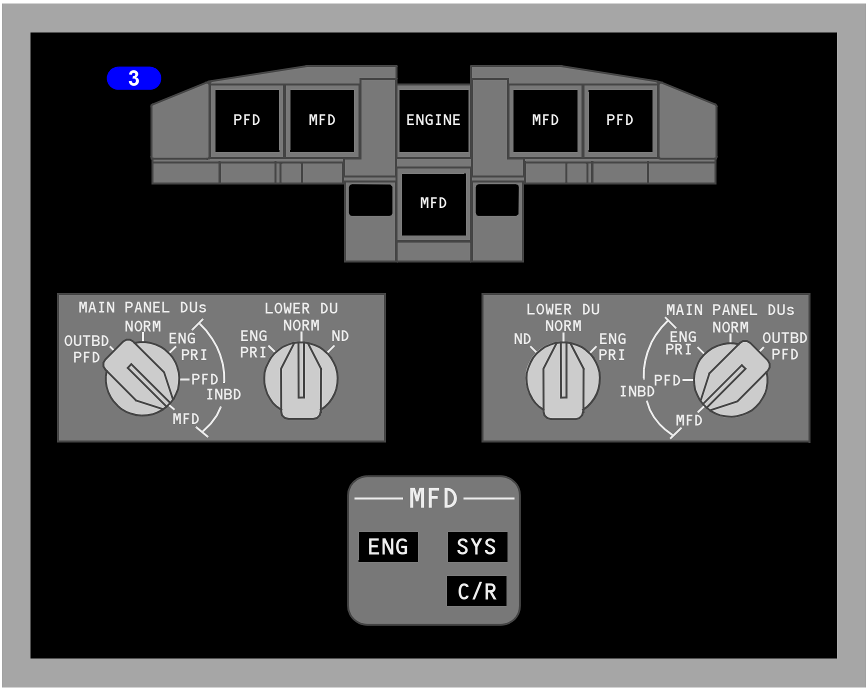
If the MAIN PANEL DUs switch is turned to INBD ENG PRI, the primary engine display moves to the inboard DU, the PFD format is displayed on the outboard DU and the upper DU blanks.

2 **MAIN PANEL DUs Switch to INBD PFD**

If the MAIN PANEL DUs switch is turned to INBD PFD, the PFD format is displayed on the inboard DU and the outboard DU blanks.

3 **MAIN PANEL DUs Switch to MFD**

If the MAIN PANEL DUs switch is turned to INBD MFD, the PFD continues to be displayed on the outboard display unit and the inboard display is blank. The system format (SYS) or secondary engine format (ENG) can then be selected to the inboard display unit and lower display unit with the MFD switches on the engine display control unit.



1 MAIN PANEL DUs Switch to INBD ENG PRI

If the MAIN PANEL DUs switch is turned to INBD ENG PRI, the primary engine display moves to the inboard DU, the PFD format is displayed on the outboard DU and the upper DU blanks.

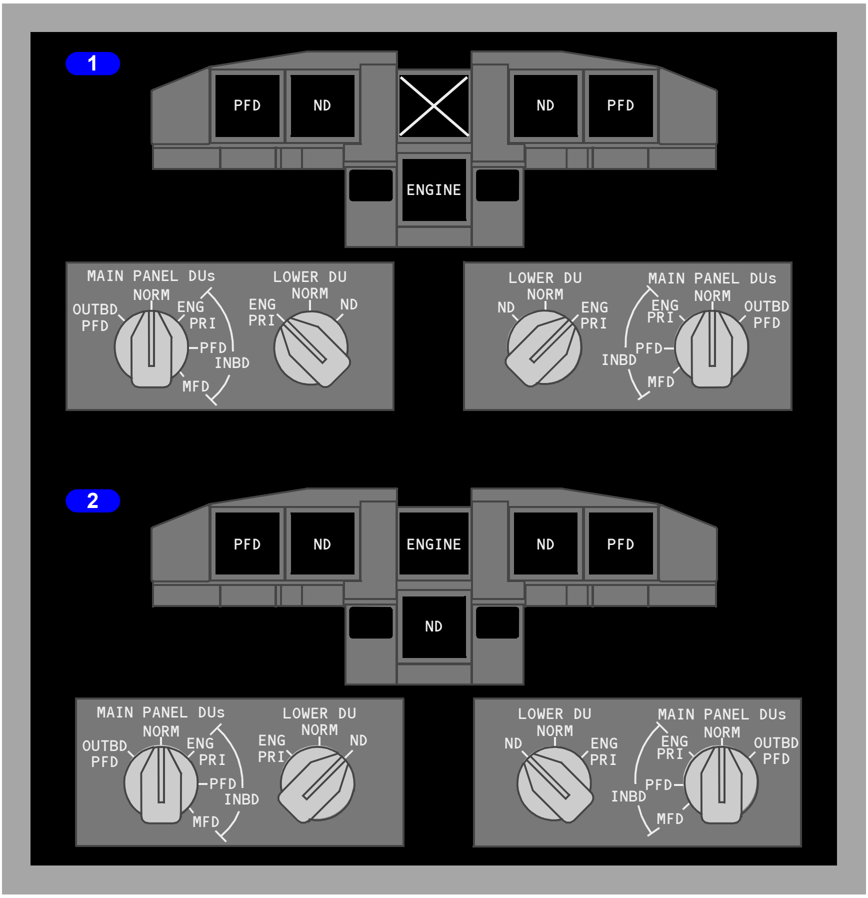
2 MAIN PANEL DUs Switch to INBD PFD

If the MAIN PANEL DUs switch is turned to INBD PFD, the PFD format is displayed on the inboard DU and the outboard DU blanks.

3 MAIN PANEL DUs Switch to MFD

If the MAIN PANEL DUs switch is turned to INBD MFD, the PFD continues to be displayed on the outboard display unit and the inboard display is blank. The system format (SYS) or secondary engine format (ENG) can then be selected to the inboard display unit and lower display unit with the MFD switches on the engine display control unit. The C/R switch cancels or recalls autoland advisory messages on the display.

Lower Display Switching



1 LOWER DU Switch to ENG PRI

If the LOWER DU switch is turned to ENG PRI, the engine display moves to the lower DU and the upper DU blanks.

2 LOWER DU Switch to ND

If the LOWER DU switch is turned to ND, the engine display is shown on the upper DU and the navigation display is shown on the lower DU. When the MFD ENG switch is selected, the compact engine display is shown on the upper DU.

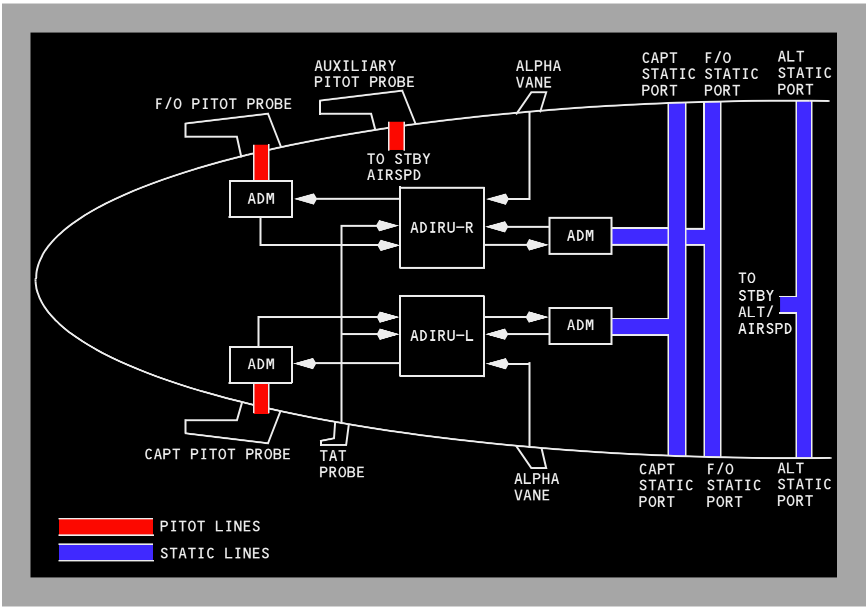
Display System Information Sources

Air Data Inertial Reference System (ADIRS)

The ADIRS produces flight data such as position, speed, altitude and attitude for the flight displays, flight management computers, flight controls, engine controls and all other systems requiring inertial and air data.

The major components of the ADIRS are:

- two air data inertial reference units (ADIRUs)
- four air data modules (ADMs)
- one inertial system display unit (ISDU)
- one dual mode select unit (MSU)
- six static ports
- three pitot probes
- two alpha vanes
- one total air temperature probe



Air Data Inertial Reference Unit (ADIRU)

The ADIRUs provide inertial position and track data to the FMC as well as attitude, altitude and airspeed data to the displays. The ADIRUs process information measured by internal gyros and accelerometers, and from air data module inputs, the alpha vanes and other systems.

The ADIRUs are described in Chapter 11, Flight Management, Navigation.

Air Data

The pitot static system is comprised of three separate pitot probes and six flush static ports. Two pitot probes and four static ports interface with the air data modules. The remaining auxiliary pitot probe and alternate static ports provide pitot and static pressure to the standby instruments. The auxiliary pitot probe is located on the first officer's side of the airplane.

The air data modules convert pneumatic pressure to electrical signals and send these data to the ADIRUs. Each pitot air data module is connected to its on–side pitot probe; there is no cross connection. The air data module connected to the Captain's pitot probe sends information to the left ADIRU, while the air data module connected to the First Officer's pitot probe sends information to the right ADIRU. The remaining air data modules are located at the balance centers of the Captain's and First Officer's static ports. The air data module connected to the Captain's static ports sends information to the left ADIRU, while the air data module connected to the First Officer's static ports sends information to the right ADIRU.

Angle–of–Attack

There are two alpha vanes, one located on each side of the forward fuselage. The vanes measure airplane angle–of–attack relative to the air mass.

[Option - Angle of attack indicator]
The primary source of data for the AOA indicator on the PFD is supplied by the ADIRU, with the Stall Management Yaw Damper (SMYD) as the backup source. The source selection is automatic in the event of primary source failure. Slight differences between the Captain's and FO's indications may be noticed due to sideslip or vane installation errors. These differences could be as large as 2 degrees alpha.

Total Air Temperature (TAT)

A total air temperature probe is mounted outside the airplane to sense air mass temperature. The temperature sensed by the probe is used by the ADIRUs to compute total air temperature.

Note: TAT indication should not be used in lieu of ambient OAT to calculate takeoff performance.

Static Air Temperature (SAT)

Static air temperature, displayed on the CDU PROGRESS page, comes from the ADIRUs, using total air temperature probe information.

Standby Flight Instruments

The standby flight instruments include:

- standby magnetic compass
- standby attitude indicator
- standby altimeter/airspeed indicator
- integrated standby flight display
- standby radio magnetic indicator

Standby Magnetic Compass

A standard liquid–damped magnetic standby compass is provided. A card located near the compass provides correction factors.

Standby Attitude Indicator

The standby attitude indicator provides attitude information that is independent of the primary attitude displays. The indicator is powered by the battery bus and remains powered after the loss of all normal AC power as long as battery power is available. The gyro reaches operational speed approximately 60 seconds after power is applied. The indicator requires three minutes to achieve accuracy requirements.

Integrated Standby Flight Display (ISFD)

The ISFD displays attitude, airspeed, altitude, localizer/glideslope deviation and magnetic heading information. Attitude information is computed from data provided by internal inertial sensors. Airspeed and altitude are computed from pneumatic pressure data provided by direct connections to the auxiliary pitot and alternate static sources. Localizer/Glideslope deviation is provided by the #1 MMR (The MMR can provide Localizer and Glideslope deviation from ILS or GLS sources). Magnetic heading is provided by the #1 ADIRU. Magnetic heading is not available in polar regions. (Later versions of the ISFD will automatically switch to True Heading when Magnetic Heading becomes unusable in polar regions).

Note: The standby magnetic compass must be used to validate information.

The battery bus powers the ISFD. Selecting the battery switch ON activates the ISFD. After 10 seconds, an initialization sequence begins that requires 90 seconds to complete. ATT and INIT 90s messages are displayed during initialization. Upon completion of the initialization sequence, attitude information is displayed.

Note: Any change in airplane position during the initialization sequence may result in an inaccurate alignment. Inaccurate alignment is not annunciated and may result in the display of inaccurate attitude prior to, and during flight. Re-initialization can only be accomplished through maintenance action.

Detection of a momentary out-of-limit ISFD condition may cause the attitude display to blank and the WAIT ATT or ATT:RST message to display. Operation of the attitude reset switch is required in response to the ATT:RST message. This will reset the horizon line with the airplane symbol.

Note: Operation of the attitude reset switch will not correct an inaccurate alignment.

On the ground, operation of the attitude reset switch must be performed with the airplane stationary. In flight, operation of the attitude reset switch must be performed with the airplane in wings level, non-accelerated flight. During the process, the ATT 10s message displays. Failure to maintain straight and level flight for 10 seconds may result in an ATT:RST message. If the reset attempt is unsuccessful, the ATT:RST message remains displayed and the ISFD does not enter normal operation.

Standby Altimeter/Airspeed Indicator

Standby altitude and airspeed are displayed on a single indicator.

The standby altimeter receives static pressure from the alternate static ports. Current altitude is displayed digitally. A pointer indicates altitude in hundreds of feet. Barometric setting windows display the barometric setting in both millibars and inches of mercury as set by the barometric setting control. The altimeter has a range of –1000 to 50,000 feet.

The standby airspeed indicator receives ram air pressure from the auxiliary pitot probe and static pressure from the alternate static ports. It provides current airspeed in knots.

Standby Radio Magnetic Indicator

The standby Radio Magnetic Indicator (RMI) displays magnetic and VOR/ADF bearing to the station. The RMI is powered by the AC standby bus and remains powered after the loss of all normal AC power as long as battery power is available.

Clocks

[Option - GPS capable]
Two electronic clocks are installed in the flight deck, each clock has 2 digital displays with time or date set on the upper display, and elapsed or the chronograph (ET/CHR) on the lower display. Separate controls are provided for each display.

This clock is a GPS compatible electronic clock and can be initialized using Coordinated Universal Time (UTC) or Manual Time Mode. Standby 28V DC power is used when the main 28V DC power is not available. The clock reverts to standby power when the airplane is powered down. The standby power keeps the time base but does not provide power for the display, buttons, or output of clock data. When the airplane is powered up and a valid Global Position System (GPS) signal is restored, the clock will initialize to UTC time.

If no signal is valid, the clock will revert to initialization in manual mode. If a UTC signal becomes valid after manual function is started or completed, UTC time can be selected by using the TIME/DATE button.

Clock Switch

[Option - Remote clock switch]
A remote clock switch, on the glareshield panel, operates the same as the chronograph (CHR) control.

Digital Flight Data Recorder (DFDR)

The Digital Flight Data Recorder (DFDR) provides a permanent record of operational and systems information including time, heading, altitude, airspeed, acceleration, attitude, engine thrust, and flight control surface position.

The recorder is a solid state device and complies with Federal Aviation Administration and European Aviation Safety Agency requirements for data sampling rates and number/type of parameters sampled.

Operational and systems information are automatically recorded whenever the flight recorder is powered.

The DFDR has the following features:

- Continuously records the most recent flight data, saving the most current data for the last 25 hours of operation
- The DFDR is housed in a sealed container located behind an access door in the far aft cabin ceiling
- Corrosion, fire and impact resistant, survives deep sea pressure to 20,000 feet (6096 m)
- Locator beacon operable for 30 days
- Receptacle for downloading and copying data for analysis.

Aircraft Condition Monitoring System (ACMS)

[Option - ACMS]
The Aircraft Condition Monitoring System (ACMS) contains software that provides the operator useful reports on the condition of the airframe, engines, trends monitoring, and maintenance.

The ACMS consists of:

- ACMS software containing applicable maintenance and operations algorithms for each phase of flight
- Digital Flight Data Acquisition Unit (DFDAU). The DFDAU receives signals representing certain flight condition and airplane systems operating performance and converts them to a digital form for recording on the DFDR
- Aircraft Communication Addressing and Reporting System (ACARS).
- ACARS air/ground message functionality continuing to expand with additional message formats.

[Option - Quick Access Recorder (QAR) lights]
- indicator on the aft overhead panel that illuminates when the QAR is full.

Flight Instruments, Displays — Chapter 10
Head-Up Display System Description — Section 22

Introduction

The Head-Up Display (HUD) system uses electronics and optics to calculate and display flight information. The flight information is displayed as flight symbols which project on to a transparent glass screen in front of the pilot. The flight symbols overlay and combine with the outside view through window No. 1.

The HUD system can be used during manual flight operations, or with the AFDS engaged during automatic flight operations. When used manually, internal HUD guidance is used to control flight symbology and is independent of any AFDS derived or displayed flight director guidance.

HUD system components, combined with other airplane systems, produce flight symbology displayed in four distinct modes of operation. Each mode of operation has unique characteristics, and is intended to be used during a particular phase of flight based on system capability and meteorological conditions. TCAS resolution advisories and system failure flags are also displayed when active. Detailed information on display symbology is found in Section 42 of this chapter.

The HUD system consists of the following components:

- HUD computer
- Overhead unit (OHU)
- Combiner
- Control panel
- Annunciator panel

HUD Computer

The HUD computer receives input signals from aircraft sensors and equipment and converts this data to symbology for display on the combiner. The computer also evaluates system and approach performance through extensive Built-In Test Equipment (BITE), input validation, and approach monitor processing. If an out of tolerance condition exists, the applicable annunciation appears on the combiner and/or annunciator panel. Internal components control the following functions:

- Guidance control
- Shape and position of flight symbols
- Airplane sensor status
- HUD system status
- HUD system mode.

Overhead Unit (OHU)

The OHU contains the CRT and projection optics to display flight symbology on the combiner. Electronic circuitry within the OHU controls display intensity and system monitoring.

Combiner

The combiner optically combines flight symbology from the OHU, with the pilot's view through window No.1. It acts as a wavelength selective mirror, reflecting only the flight symbology color (green) and lets other colors pass through.

The combiner alignment detector monitors the angular position of the combiner. The HUD computer uses the detector to verify correct combiner position for normal viewing. If the combiner is not in the correct position, and the HUD is in the IMC or VMC modes, the ALIGN HUD message appears on the combiner.

The combiner glass element has a break away safety feature which allows the element to rotate forward from the normal position, in case of abnormal deceleration.

Control Panel

The HUD control panel is used to select and display modes of operation and enter data. Display intensity is controlled by panel switches or by an ambient light sensor located on the upper left corner of the panel.

Annunciator Panel

The annunciator panel consists of lights to indicate HUD system status annunciations during AIII mode approach and landing operations.

Modes of Operation

The HUD system provides a mode–selectable display on the combiner. The modes are:

- PRI (Primary) - used for most HUD operations
- AIII - primarily used for manually flown CAT II or CAT IIIa ILS approach and landing operations
- IMC - used for AFDS autopilot/flight director approaches
- VMC - used for visual approaches.

Primary (PRI) Mode

The primary mode may be used during all phases of flight from takeoff to landing. This can include low visibility takeoff operations utilizing ground roll guidance, all enroute operations and either non-precision or precision approaches to CAT I or II minimums utilizing flight director guidance and/or raw data.

Attitude information is displayed in the form of a horizon line and pitch scales positioned relative to an airplane reference symbol. Airspeed and altitude are displayed in tapes along the left and right edges of the display. A sectored HSI is displayed in flight in the lower center of the display. On the ground, the HSI, flight path and guidance cue are not displayed. These symbols are automatically displayed once the aircraft is in flight.

During takeoff, a TO/GA pitch target line and a guidance cue are displayed. The TO/GA pitch target line is displayed as a horizontal dash line initially positioned at the top of the display. As the pitch attitude increases during rotation, its vertical position relative to the airplane reference symbol is adjusted to display the pitch command from the Captain's flight director. Initially, the flight director guidance cue is displayed when the airplane reference is within 2 degrees of the TO/GA pitch target line or when climbing through 50 feet radio altitude, whichever occurs first. The TO/GA pitch target line remains until the TO/GA mode is exited. The flight director guidance cue is displayed throughout flight when the Captain's flight director is selected on and both pitch and roll commands remain valid.

A full time slip-skid symbol is displayed as part of the roll scale. During any takeoff (after rotation) or go-around (below 1000 feet), additional slip-skid symbols are displayed to enhance lateral control in the event of an engine failure. These two additional symbols are displayed relative to the airplane reference and the flight path symbols and are removed above 1500 feet.

AFDS engaged modes, autothrottle modes and autopilot status is indicated across the top of the display similar to the flight mode annunciator display. Navigation information is displayed dependent on the selected navigation source and active AFDS mode. During LNAV operations, vertical and lateral deviations are similarly displayed based on FMC data. During ILS/VOR operations, course deviation is displayed within the HSI. Glideslope data is presented on a glideslope deviation scale adjacent to the altitude tape.

If the HUD is in a mode other than primary, depressing a TO/GA switch activates the primary mode independent of the standby mode indicated on the HUD control panel.

Primary Mode - Low Visibility Takeoff

The primary mode includes special symbology used for a low visibility takeoff. The display supports visual runway centerline tracking and enhances situational awareness.

Note: Approval must be obtained from the appropriate regulatory authority prior to conducting HUD low visibility takeoff operations.

The low visibility takeoff display incorporates a ground roll reference symbol, ground roll guidance cue and a ground localizer line (if an ILS frequency is tuned on both nav receivers). The HUD derived ground roll guidance cue provides lateral guidance relative to the ground roll reference symbol to track the localizer. The ground localizer line provides raw localizer information any time the aircraft is on the ground and the Captain's navigation receiver is tuned to a localizer frequency. The localizer deviation is presented relative to the selected course mark on the horizon.

A ground localizer scale and pointer indicates localizer deviation relative to the Captain's nav receiver localizer bearing.

Primary Mode - Approach and Landing

[Option - Model 4000]
If the primary mode is used for an approach and landing, flight director guidance and navigation raw data is displayed. Once on the ground, the ground localizer line and ground localizer scale is displayed (if an ILS frequency is tuned on both nav receivers) to enhance centerline tracking.

AIII Approach Mode

[Option - Model 4000]
The HUD AIII mode is specifically designed for manual ILS approach and landing operations to CAT II or CAT IIIa minimums. Altitude and airspeed tape displays are replaced with digital values. The HSI is also replaced with ILS raw data displayed in proximity to the flight path group around the center of the display. In the AIII mode, flight path guidance is provided by the guidance cue which is derived from internal approach and landing guidance algorithms, and is independent of any AFDS derived or displayed flight director guidance.

Note: Approval must be obtained from the appropriate regulatory authority prior to conducting HUD Cat II or CAT IIIa operations.

AIII mode is dependent on the availability of all required systems and ILS approach criteria. Because of these requirements, the AIII mode is not identified as a selectable standby mode until these requirements are met. AIII capability is displayed on the control panel at any time, and on the combiner after LOC and G/S capture in the PRI mode.

ILS approach criteria requirements are satisfied when:

- Both VHF navigation receivers tuned to an ILS frequency, and
- VHF #1 or VHF #2 localizer deviation is less than approximately ¼ dot and glideslope deviation is less than approximately 1 and ¼ dots for at least five seconds, and
- The difference between the airplane’s magnetic track and the captain’s selected course is less than 15 degrees, and
- Radio altitude is greater than 500 feet.

Note: Once these criteria have been satisfied, subsequent deviations outside the criteria prior to AIII mode selection, will result in a loss of ability to select the AIII mode.

Automatic AIII mode arming requirements are satisfied when:

- PRI or IMC mode selected, and
- all required systems operating normally (AIII capable), and
- ILS frequency tuned on VHF NAV receiver No. 1 or No. 2, and
- radio altitude is greater than 500 feet, and
- TO/GA mode not active.

To activate AIII ARM, push the STBY function key on the HUD control panel. When armed, “AIII ARM” is displayed on the standby mode display line and “AIII ARM” is displayed on the combiner. Approximately five seconds after the requirements for ILS approach criteria are satisfied, the AIII mode is automatically activated.

Once the AIII mode is active, the AIII mode symbology and related annunciations are displayed on the combiner, the control panel display, and the HUD annunciator panel.

Any sensor or equipment condition that results in a loss of AIII capability will cause a NO AIII annunciation displayed on the combiner and on the control panel display. The first officer’s AIII annunciation is also extinguished. The annunciation will remain until another mode is selected or AIII capability is regained.

Below 500 feet radio altitude, with a loss of AIII capability or if the approach or flare performance does not ensure a safe touchdown within the required touchdown zone, an APCH WARN annunciation will be displayed on the combiner and on the HUD annunciator panel.

IMC Mode

The IMC mode is an alternate approach mode primarily intended for autopilot approaches. Like the PRI mode, the IMC mode guidance cue utilizes AFDS derived guidance. The guidance cue is displayed when the Captain's flight director is active and both pitch and roll commands are valid.

Approach symbology format for the IMC mode is similar to the AIII approach mode. Altitude and airspeed data is displayed as digital values and navigation raw data is displayed in close proximity to the flight path vector.

VMC Mode

The VMC mode is intended for visual approach operations. No flight director or HUD guidance is displayed. The flight path vector is used to control the approach to the runway.

Approach symbology format for the VMC mode is similar to the AIII and IMC modes. However, navigation data is not displayed.

The proper mechanical alignment of the combiner is critical during visual operations. Combiner position is monitored by the combiner alignment detector, to determine if the combiner is within allowable position tolerances while in the IMC or VMC mode. If its position is out of tolerance, an ALIGN HUD message is displayed on the combiner. Elimination of the message is accomplished by gently pushing the combiner in the breakaway direction and releasing. This allows the combiner to reposition itself. If the message cannot be removed, the IMC or VMC mode should not be used.

TCAS Resolution Advisory

TCAS resolution advisories are displayed as preventive and corrective symbols, and are similar to the pitch commands displayed on the attitude indicator.

Preventive advisories do not require any crew action, but indicate an unsafe zone, displayed as a double lined bracket. On the unsafe side of the bracket, two angled lines are extended from the corners. The position of the bracket is determined by TCAS, and represents the vertical flight path position that is safe.

Corrective advisories require positive action by the crew and are indicated by a double lined box. The position of the box is determined by the vertical speed requirements from TCAS, and represents the vertical flight path position that is safe.

For additional information on TCAS, refer to Chapter 15, Warning Systems.

Failure Flags and Data Source Annunciations

Failure flags are displayed for invalid sensor status and miscompares between similar parameters. These flags are generally indicated by boxed annunciations for the affected parameters, and in the case of failure, the removal of all symbols related to the fault. In some cases, symbols are removed as a result of other symbols being removed due to a fault.

Flags associated with a miscompare of similar data result in the display of a flag without the removal of the related symbols. The flag indicates the applicable data should be verified by cross-checks with other flight deck displays.

Data source annunciations are provided in a few cases to annunciate the source of displayed data when other than normal.

Dashes replace numbers if there is no computed data.

Intentionally
Blank

Introduction

The Electronic Flight Instrument system (EFIS) presents a dynamic color display of the parameters necessary for flight path control. The displays provide the following information:

- flight mode annunciation
- airspeed
- attitude
- steering information
- instrument landing system display
- approach minimums
- radio altitude
- altitude
- vertical speed
- GPWS annunciations
- TCAS indications.

Failure flags are displayed for airplane system failures. Displayed information is blanked or replaced by dashes if no valid information is available to the display system (because of out–of–range or malfunctioning navigation aids). Failure flags are displayed when aircraft systems cannot generate a reliable display.

Flight mode annunciations are described in Chapter 4, Automatic Flight.

Airspeed

Airspeed is displayed on a round dial Mach/airspeed indicator, or MASI. Current airspeed is displayed by an airspeed pointer and digital counter. Current Mach number is digitally displayed when the Mach number is greater than 0.40. Target airspeed is shown by the magenta airspeed cursor.

Takeoff and landing reference speeds and flap maneuvering speeds are shown along the circumference of the indicator. Maximum and minimum airspeeds are also displayed.

Attitude

The attitude indicator displays airplane pitch and roll attitude referenced to the horizon.

Pitch attitude is displayed by an airplane symbol against a pitch scale. The pitch scale is in 2.5 degree increments.

A pointer indicates bank angle in increments of 10, 20, and 30 degrees. Single marks indicate 45 and 60 degrees of bank. A small rectangle under the bank angle pointer indicates slip and skid conditions. Bank angle is also represented by the attitude of the airplane symbol against the horizon line and pitch scale.

[Option - PLI pop-up]
A pitch limit indication is displayed at all times when the flaps are not up, or when flaps are up and airspeed approaches stick shaker activation for existing flight conditions.

Steering Indications

[Option - Integrated cue command bar]
The flight director is displayed when the related flight director switch is on. Pitch and roll commands are combined on a single display.

[Option - Split axis command bars]
Flight director pitch and roll bars are displayed when the related flight director switch is on. Pitch and roll commands are displayed independently.

[Option - Flight path vector]
The Flight Path Vector (FPV) symbol represents airplane flight path angle vertically and drift angle laterally. The flight path vector is displayed on the attitude indicator when the EFIS control panel FPV switch is selected on. The FPV shows the Flight Path Angle (FPA) above or below the horizon line and drift angle left or right of the pitch scale's center. The FPA uses inertial and barometric altitude inputs. The vertical FPA is unreliable with unreliable primary altitude displays.

The FPV symbol is displayed in two brightness levels. The FPV symbol is displayed dim when either the flight director or a TCAS resolution advisory is displayed. The FPV symbol is displayed bright when the flight director is off and there is no TCAS resolution advisory displayed.

Instrument Landing System Indications

ILS glideslope and localizer deviation are provided.

The glideslope pointer and scale appear on the right side of the attitude indication when a valid signal is received. The scale turns amber and the pointer flashes to indicate an excessive glideslope deviation. The pointer is not displayed when the glideslope signal is unusable or when the track and the front course on the mode control panel differ by more than 90 degrees (backcourse).

The localizer pointer and scale appear at the bottom of the attitude indicator when a valid signal is received. When the course deviation is slightly more than ½ dot and the localizer mode is engaged and track is within 5 degrees of the MCP selected course, the scale automatically expands. At low radio altitudes with autopilot engaged the scale turns amber and the pointer flashes to indicate excessive deviation. Below 1,000 feet AGL, with LNAV engaged and LOC armed, the localizer scale turns amber and the pointer flashes if the localizer is not captured.

Each pilot's deviation alerting system self-tests upon becoming armed at 1500 feet radio altitude. This self-test generates a two second LOC and G/S deviation alerting display on each attitude indicator.

[Option - Rising runway]
Below 2500 feet radio altitude, with the localizer pointer in view, a rising runway symbol comes into view. The symbol provides lateral guidance. At 200 feet radio altitude, the symbol rises toward the airplane symbol.

Approach Minimums

[Option - Radio altitude below ADI]
The selected radio altitude set on the EFIS control panel is displayed near the bottom right of the attitude indicator. The barometric approach minimums is displayed as a marker on the altimeter.

Digital barometric approach minimums are displayed under the altimeter.

Radio Altitude

[Option - Radio altitude below ADI, round dial]
The current radio altitude is displayed near the bottom right of the attitude indicator when radio altitude is below 2,500 feet AGL. When between 1000 feet and 2500 feet AGL, the readout is digital. When below 1000 feet AGL, the readout is displayed in a round dial format. The display turns amber and the circumference flashes for 3 seconds as the radio altitude descends through the selected minimum altitude. The display changes back to white after one of the following occurs:

- when passing the selected minimum altitude plus 75 feet during go–around
- at touchdown
- after pressing the RST switch on the EFIS control panel.

Radio Altitude Alert

[Option - 2500 ft height alert]
The altitude alert is triggered and "ALT" is shown above the radio altitude display when radio altitude is less than or equal to 2500 feet AGL.

Altitude

Altitude is displayed on a round dial altimeter. Current altitude is displayed by an altitude pointer and a digital readout. A green reference altitude marker indicates the barometric minimums set on the EFIS control panel.

When meters is selected on the EFIS control panel, current altitude in meters is shown above the altitude window and the metric altitude equivalent of the selected MCP altitude is displayed above the altimeter. Metric readouts are not available in the compact EFIS mode.

The current barometric reference is displayed in either inches of mercury or hectopascals as selected on the EFIS control panel.

Vertical Speed

Vertical speed is indicted by a vertical speed pointer. The pointer depicts rate of climb or descent from 0 to 6000 feet.

Traffic Alert and Collision Avoidance (TCAS) Indications

[Option - VSI TCAS advisory]
TCAS resolution advisories are displayed on the attitude indicator and vertical speed indicator.

Refer to Chapter 15, Warning Systems.

GPWS Warnings

GPWS warnings are displayed in large capital letters on the attitude indicator. Refer to Chapter 15, Warning Systems.

Introduction

The Primary Flight Displays (PFDs) present a dynamic color display of all the parameters necessary for flight path control. The displays provide the following information:

- flight mode annunciation
- airspeed
- altitude
- vertical speed
- attitude
- steering information
- radio altitude
- instrument landing system display
- approach minimums
- heading/track indications
- TCAS indications
- GPWS annunciations

Failure flags are displayed for airplane system failures. Displayed information is blanked or replaced by dashes if no valid information is available to the display system (because of out–of–range or malfunctioning navigation aids). Failure flags are displayed when aircraft systems cannot generate a reliable display.

Flight mode annunciations are described in Chapter 4, Automatic Flight.

Airspeed

[Option - Without groundspeed displayed]
Airspeed is displayed on a tape and in a digital window on the left side of the PFD. The current Mach number is digitally displayed below the airspeed tape when the current Mach number is greater than 0.40. An airspeed trend vector indicates predicted airspeed in 10 seconds. Selected airspeed is displayed above the airspeed tape.

[Option - With groundspeed displayed]
Airspeed is displayed on a tape and in a digital window on the left side of the PFD. The current Mach number is digitally displayed below the airspeed tape when the current Mach number is 0.40 Mach or above. Ground speed is displayed when airspeed decreases below 0.40 Mach. An airspeed trend vector indicates predicted airspeed in 10 seconds. Selected airspeed is displayed above the airspeed tape.

Takeoff and landing reference speeds and flap maneuvering speeds are shown along the right edge of the airspeed tape. Maximum and minimum airspeeds are also displayed along the right edge of the airspeed tape.

Attitude

The attitude indication displays the airplane pitch and roll attitude referenced to the horizon.

Pitch attitude is displayed by an airplane symbol against a pitch scale. The pitch scale is in 2.5 degree increments.

A pointer indicates bank angle in increments of 10, 20, and 30 degrees. Single marks indicate 45 and 60 degrees of bank. A small rectangle under the bank angle pointer indicates slip and skid conditions. Bank angle is also represented by the attitude of the airplane symbol against the horizon line and pitch scale.

A pitch limit indication is displayed at all times when the flaps are not up.

[Option - PLI pop-up]
A pitch limit indication is displayed at all times when the flaps are not up, or when flaps are up and airspeed approaches stick shaker activation for existing flight conditions.

Angle of Attack

[Option - Angle of Attack Indicator]
The Angle of Attack (AOA) indicator displays aircraft body angle of attack, stick shaker angle of attack, and the appropriate range of approach angle of attack. The indicator is located in the upper-right corner of the PFD, above the ADI.

If the AOA signal is determined to have failed or is invalid when ground speed is greater than 80 knots, the AOA indicator will be blanked and replaced with a fail flag.

During normal operation, the approach reference band moves with flap handle position. When the flap handle is in a landing flap detent, the band will depict the appropriate range of AOA for a Vref(xx)+5 approach, where Vref(xx) is for the corresponding flap detent position. If the flaps are driven in alternate mode, the band moves depending on actual flap position. If flap position is determined to be invalid, the band is blanked.

If an approach is flown faster than Vref(xx)+5, AOA is lower than normal and could potentially be below the band. If a slower approach is flown, AOA is higher than normal and could be above the band.

Steering Indications

[Option - Integrated cue command bar]
The flight director is displayed when the related flight director switch is on. Pitch and roll commands are combined on a single display.

[Option - Split axis command bars]
The flight director is displayed when the related flight director switch is on. Pitch and roll commands are displayed independently.

The Flight Path Vector (FPV) symbol represents airplane flight path angle vertically and drift angle laterally. The flight path vector is displayed on the PFD when the EFIS control panel FPV switch is selected on. The FPV shows the Flight Path Angle (FPA) above or below the horizon line and drift angle left or right of the pitch scale's center. The FPA uses inertial and barometric altitude inputs. The vertical FPA is unreliable with unreliable primary altitude displays.

The FPV symbol is displayed in two brightness levels. The FPV symbol is displayed dim when either the flight director or a TCAS resolution advisory is displayed. The FPV symbol is displayed bright when the flight director is off and there is no TCAS resolution advisory displayed.

Instrument Landing System Indications

ILS glideslope and localizer deviation, frequency/identification, DME, course, and marker beacon indications are provided.

The approach reference information appears above and to the left of the attitude display. The ILS station identification or frequency, course, and (if available) DME are displayed.

The marker beacon indication (OM – outer marker, IM – inner marker, or MM – middle marker) is displayed in the upper right corner of the attitude display area.

The glideslope pointer and scale appear on the right side of the attitude indication when a valid signal is received. At low radio altitudes with autopilot engaged the scale turns amber and the pointer flashes to indicate an excessive glideslope deviation. The pointer is not displayed when the glideslope signal is unusable or when the track and the front course on the mode control panel differ by more than 90 degrees (backcourse).

The localizer pointer and scale appear at the bottom of the attitude indication when a valid signal is received. When the course deviation is slightly more than ½ dot, the localizer mode is engaged and track is within 5 degrees of the MCP selected course, the scale automatically expands. At low radio altitudes with autopilot engaged the scale turns amber and the pointer flashes to indicate excessive deviation. Below 1,000 feet AGL with LNAV engaged and LOC armed, the localizer scale turns amber and the pointer flashes if the localizer is not captured.

Each pilot’s deviation alerting system self-tests upon becoming armed at 1500 feet radio altitude. This self-test generates a two second LOC and G/S deviation alerting display on each attitude indicator.

[Option - Rising runway]
Below 2500 feet radio altitude with the localizer pointer in view, a rising runway symbol comes into view. The symbol provides lateral guidance. At 200 feet radio altitude, the symbol rises toward the airplane symbol.

Integrated Approach Navigation (IAN) Indications

[Option - IAN]
FMC glide path and FAC deviation, approach identifier, distance, and course are provided. The approach data appears above and to the left of the attitude display. Below the approach data is the IAN deviation source annunciation. Marker beacon indications are provided as in an ILS approach.

IAN glide path and FAC deviation indications and alerts are displayed like ILS. Deviation indications appear when a valid IAN approach is selected. IAN approach deviations are not available with QFE selected in the FMC.

Approach Minimums

[Option - Radio altitude below ADI]
The selected radio altitude or barometric approach minimums are set on the EFIS control panel. They are displayed near the bottom left of the altitude display.

[Option - Radio altitude above ADI]
The selected radio altitude or barometric approach minimums are set on the EFIS control panel. The radio altitude approach minimum is displayed near the top left of the altitude display and the barometric approach minimums is displayed near the bottom left of the altitude display.

Radio Altitude

[Option - Radio altitude below ADI]
The current radio altitude is displayed in the bottom center of the attitude indication area when radio altitude is below 2,500 feet AGL. The display turns amber when the radio altitude is below the radio altitude minimums.

[Option - Radio altitude above ADI, round dial]
The current radio altitude is displayed above the upper right corner of the attitude indication area when radio altitude is below 2,500 feet AGL. When between 1000 feet and 2500 feet AGL, the readout is digital. When below 1000 feet AGL, the readout is displayed in a round dial format. The display turns amber when the radio altimeter is below the radio altitude minimums.

Altitude

Altitude is displayed on an altitude tape along the right side of the PFD. It is also shown digitally in a window in the middle of the tape. When meters is selected on the EFIS control panel:

- current altitude in meters is also shown above the altitude window
- selected altitude in meters is displayed above the altitude tape.

Selected altitude is displayed above the altitude tape and is boxed when approaching the selected altitude. Selected altitude is also depicted with a bug on the altitude tape.

The selected barometric approach minimum is indicated on the altitude tape with a triangular pointer and a line when BARO minimums are selected.

[Option - Landing altitude reference bar]
A landing altitude reference bar is displayed along the inner edge of the altitude indication. The reference bar indicates the height above touchdown. A white bar is displayed from 1000 to 500 feet above landing altitude. An amber bar is displayed from 500 feet to the landing altitude.

A landing altitude indication is displayed as a crosshatched area and indicates:

- the FMC landing altitude for destination runway or airport, or
- the landing altitude for departure runway or airport until 400 NM from departure or one–half the distance to destination, whichever occurs first.

The current barometric reference is displayed below the altitude tape in either inches of mercury or hectopascals as selected on the EFIS control panel. A preselected barometric reference can be displayed when STD is displayed.

[Option - Altimeter with QFE]
Altitude reference is selectable between QNH and QFE. QNH is the normal operating mode. A description of QFE operation is contained in the CDU Approach Reference Page description in Chapter 11, Flight Management, Navigation.

Vertical Speed

Vertical speed is displayed to the right of the altitude tape with a tape and pointer. Vertical speed is digitally displayed above or below the vertical speed display when vertical speed is greater than 400 feet per minute. It is displayed above with positive vertical speed and below with negative vertical speed. The selected vertical speed bug shows the selected vertical speed when in the AFDS vertical speed (V/S) pitch mode.

Heading/Track Indications

Heading/track information is displayed in the bottom section of the PFD on a section of the compass rose. Current heading is displayed under a pointer at the top of the compass rose. The MCP selected heading is displayed as a bug on the outside of the compass rose and digitally in the left half of the compass rose.

The current heading/track reference (MAG/TRU) is shown in the right half of the compass rose. A line drawn perpendicular to the edge of the compass rose from the invisible center depicts the current airplane track.

Traffic Alert and Collision Avoidance (TCAS) Indications

TCAS resolution advisories are displayed in the attitude indication area.

[Option - VSI TCAS advisory]
TCAS resolution advisories are displayed in the attitude indication and vertical speed indication areas.

Refer to Chapter 15, Warning Systems.

GPWS Warnings

GPWS warnings are displayed in large capital letters between the attitude display and the heading/track compass rose. Refer to Chapter 15, Warning Systems.

Introduction

The navigation displays provide a color display of flight progress. The displays consist of the following:

- horizontal situation indicator
- radio distance magnetic indicator
- navigation display with MAP, APP (approach), VOR, and PLN (plan) modes

The MAP, VOR, and APP modes can be switched between an expanded mode with a partial compass rose and a center mode with a full compass rose.

Horizontal Situation Indicator (HSI)

The HSI provides heading and track data with VOR navigation or ILS approach information. The data are normally displayed on a compass rose with 200 degrees of heading. In the compact EFIS mode, the data are presented on a 360 degree display.

Radio Distance Magnetic Indicator (RDMI)

The RDMI provides the same information as a conventional RDMI.

Navigation Display – MAP Mode

The MAP mode is recommended for most phases of flight. This mode shows airplane position relative to the route of flight against a moving map background.

Displayed information can include:

- current track
- selected and current heading
- position trend vector
- range to selected altitude
- map range scale
- ground speed
- true airspeed
- wind direction and speed
- next waypoint distance
- waypoint estimated time of arrival
- selected navigation data points

Navigation Data Points

Additional navigation facility (STA), waypoint (WPT), airport (ARPT), route progress (DATA) and position (POS) data are available for display in both the expanded and center MAP modes.

VOR and Approach Modes

The VOR and APP modes are presented heading up. The VOR and APP modes display track, heading, and wind speed and direction with VOR navigation or approach information.

Plan Mode

The PLN mode is presented true north up. The active route may be viewed using the STEP prompt on the CDU LEGS pages.

Navigation Display Information

Heading

Heading is supplied by air data inertial reference system (ADIRS). The compass rose can be referenced to magnetic north or true north.

Track

Track is supplied by the FMC during normal operation.

Traffic

Traffic information from the TCAS can be displayed on the navigation display when in MAP, Center MAP, APP and VOR modes. TCAS is described in Chapter 15, Warning Systems.

Weather Radar

Weather radar information can be displayed on the navigation display when in MAP, Center MAP, APP and VOR modes. The weather radar system is described in Chapter 11, Flight Management, Navigation.

Failure Flags and Messages

Failure flags are displayed for system failures or invalid information. Indications are blanked or replaced by dashes when source system information is not available.

The message EXCESS DATA is displayed if the amount of information sent to the navigation display exceeds the display capability. The message can be removed by:

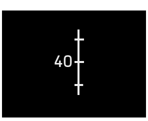
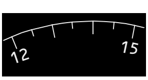
- reducing the amount of map information
- reducing range, or
- deselecting one or more of the EFIS control panel map switches (STA, WPT, ARPT, DATA, POS).

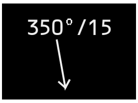
Navigation Display Symbology

The following symbols can be displayed, depending on EFIS control panel switch selections. Colors indicate the following:

- W (white) – present status, range scales
- G (green) – dynamic conditions
- M (magenta) – command information, pointers, symbols, fly–to condition
- C (cyan) – nonactive or background information
- A (amber) – cautions, faults, flags
- R (red) – warnings
- B (black) – blank area, off condition

Heading, Track, and Speed

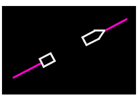
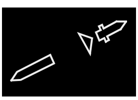
SYMBOL	NAME	MODE	REMARKS
	Selected heading bug (M)	All except PLN	Displays the MCP–selected heading. A dashed reference line (M) extends from the marker to the airplane symbol (VOR CTR and APP CTR do not display dashed line).
	Current heading pointer (W)	All except PLN	Points to current heading on the compass rose.
	Track line and range scale (W)	MAP, MAP CTR, APP, VOR	Indicates current track.
	Expanded compass (W)	MAP, APP, VOR	Displays 60 degrees of compass rose.
	Groundspeed (W)	All	Current ground speed.
	True airspeed (W)	All	Current true airspeed displayed above 100 knots.

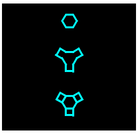
SYMBOL	NAME	MODE	REMARKS
	Wind direction/ speed and wind arrow (W)	All	Indicates wind speed and direction, with respect to display orientation and heading/track reference. Displayed if wind magnitude is greater than 6 knots and blanked if wind magnitude becomes less than 4 knots. Blank until TAS is greater than 101 knots. PLN mode displays speed/direction only.
	Heading/track reference (G), box (W) in TRU, box (A) if TRU displayed in descent	All except PLN	Indicates heading/track is referenced to magnetic north or true north. On transition from TRU to M, a highlight box is displayed around M for 10 seconds. When TRU is the reference, the highlight box is displayed full time (white).

[Option - Heading-up display]

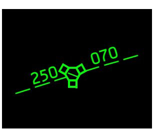
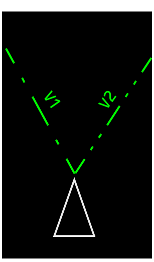
SYMBOL	NAME	MODE	REMARKS
	Heading orientation (G), current heading (W), heading reference (G), heading pointer (W)	All except PLN	Displays HDG as the display orientation, current heading, MAG or TRU as the heading reference, and points to the heading on the compass rose.

Radio Navigation

SYMBOL	NAME	MODE	REMARKS
116.80	ILS/VOR frequency display (G)	APP, APP CTR, VOR, VOR CTR	Displays frequency of manually tuned navaid.
DME 24.6	DME distance (W)	APP, APP CTR, VOR, VOR CTR	Indicates DME distance to the reference navaid.
	Selected course pointer (W) and line (M)	VOR, APP	Displays selected course as set by the related MCP course selector.
	Selected course pointer (W) TO/FROM pointer (W)	APP CTR, VOR CTR	Displays selected course as set by the related MCP course selector. TO/FROM pointer is displayed when VOR navigation is being used.
TO FROM	To/from indication (W)	VOR, VOR CTR	Displays VOR to/from indication.

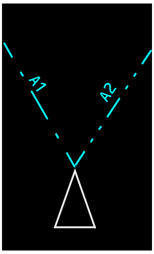
SYMBOL	NAME	MODE	REMARKS
	VOR (C, G), DME/TACAN (C, G), VORTAC (C, G)	MAP, MAP CTR, PLN	When the EFIS control panel STA map switch is selected on, appropriate navaids are displayed. All navaids contained in the FMC data base and within the MAP area are displayed when the selected range is 5, 10, 20 or 40 nm. Only high altitude navaids are displayed when the selected range is 80, 160, 320 or 640 nm. Nav aids not being used are displayed in cyan. Manually tuned VHF navaids are displayed in green, regardless of STA map switch selection.

[Option - VOR course lines displayed]

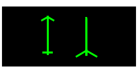
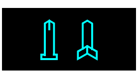
	Manually tuned VOR radials (G)	MAP, MAP CTR, PLN	When a navaid is manually tuned, the selected course and reciprocal are displayed.
	VOR radials (G)	MAP, MAP CTR	When the POS map switch is selected on and a valid VOR signal is received, the station radial is displayed.

SYMBOL	NAME	MODE	REMARKS

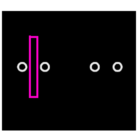
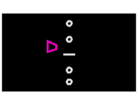
[Option - Dual ADF]

	ADF bearings (C)	MAP, MAP CTR	When the POS map switch is selected on and a valid ADF signal is received, the relative bearing to the tuned ADF station is displayed.

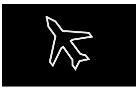
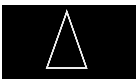
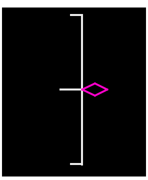
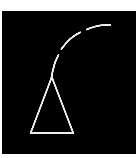
[Option - ADF Full time MAP]

	ADF 1 (C) pointer head and tail	All except PLN	Indicates bearing to (head) or from (tail) the tuned station. Not displayed if POS selected on the EFIS control panel.
	ADF 2 (C) pointer head and tail		

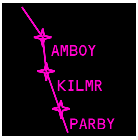
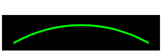
[Option - GLS]

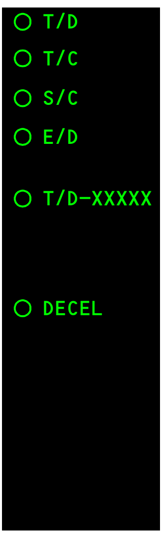
	System source annunciation (G)	VOR, VOR CTR, APP, APP CTR	Indicates the selected receiver as the display reference.
	ILS localizer or VOR course deviation indication (M) and scale (W)	VOR, VOR CTR, APP, APP CTR	Displays LOC or VOR course deviation.
	Glideslope pointer (M) and scale (W)	APP, APP CTR	Displays glideslope position and deviation.

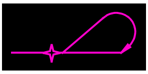
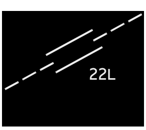
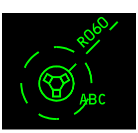
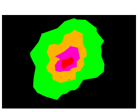
MAP

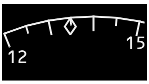
SYMBOL	NAME	MODE	REMARKS
	Airplane symbol (W)	VOR CTR, APP CTR	Current airplane position is at the center of the symbol.
	Airplane symbol (W)	PLN	Indicates actual position and track along the flight plan route. Inhibited north of 82N latitude and south of 82S latitude.
	Airplane symbol (W)	MAP, MAP CTR, VOR, APP	Current airplane position is at the apex of the triangle.
[Option - BP04/BP06]			
	VNAV path pointer (M) and deviation scale (W)	MAP, MAP CTR	Displays vertical deviation from selected VNAV PATH during descent only. Scale indicates ± 400 feet deviation. Digital display is provided when the pointer deviates more than ± 30 feet from center.
	Position trend vector (W) (dashed line)	MAP, MAP CTR	Predicts position at the end of 30, 60, and 90 second intervals. Each segment represents 30 seconds. Based on bank angle and ground speed. Selected range determines the number of segments displayed. For range: • > 20 NM, 3 segments • = 20 NM, 2 segments • < = 10 NM, 1 segment.

SYMBOL	NAME	MODE	REMARKS
ABCDE	Active waypoint identifier (M)	MAP, MAP CTR, PLN	Indicates the active flight plan waypoint, the next waypoint on the route of flight.
124NM	Active waypoint distance (W)	MAP, MAP CTR, PLN	Distance to the active waypoint.
0835.4z	Active waypoint ETA (W)	MAP, MAP CTR, PLN	Indicates FMS–calculated ETA at the active waypoint.
AMBOY	Waypoint: active (M), modified (W), inactive (C)	MAP, MAP CTR, PLN	Active– represents the waypoint the airplane is currently navigating to. Modified – represents the waypoints on the active route that are being modified. Inactive – represents the waypoints on the active route.
MLF	Off route waypoint (C)	MAP, MAP CTR, PLN	When the EFIS control panel WPT map switch is selected on, waypoints not on the selected route are displayed, for ranges of 5, 10, 20, or 40 NM.

SYMBOL	NAME	MODE	REMARKS
	Flight plan route: active (M), modified (W), inactive (C), offset (M)	MAP, MAP CTR, PLN	The active route is displayed with a continuous line (M) between waypoints. Active route modifications are displayed with short dashes (W) between waypoints. Inactive routes are displayed with long dashes between waypoints. An offset route, selected through the FMC, is displayed with a dot–dash line (M) parallel to the active route.
	Route data: active (M), inactive (W)	MAP, MAP CTR, PLN	When the EFIS control panel DATA switch is selected on, entered or procedural altitude and ETAs for route waypoints are displayed.
	Holding pattern: active (M), modified (W), inactive (C)	MAP, MAP CTR, PLN	A holding pattern appears when in the flight plan. The holding pattern appears as a fixed size if the selected range is greater than 80 NM. A scaled representation of the holding pattern is displayed when the selected range is 80 NM or less and the airplane is within 3 minutes of the holding fix.
	Altitude range arc (G)	MAP, MAP CTR	Based on vertical speed and groundspeed, indicates the approximate map position where the MCP altitude will be reached.

SYMBOL	NAME	MODE	REMARKS
	Conditional waypoint: active (M), inactive (W)	MAP, MAP CTR, PLN	Active - represents the conditional waypoint event the airplane is currently navigating to. Inactive - represents the conditional waypoints on the route. Data within parentheses for conditional waypoints indicates type of conditional waypoint (ALTITUDE, COURSE INTERCEPT, etc.)
	Altitude profile point and identifier (G)	MAP, MAP CTR, PLN	Indicates the approximate map position of the FMC–calculated T/C (top–of–climb), T/D (top–of–descent), S/C (step climb), and E/D (end of descent) points. Indicates intermediate T/D points for level flight path segments during descent. Level flight path segment altitude is displayed. Indicates the beginning of a deceleration segment resulting from deceleration to a holding pattern, a waypoint speed restriction or flaps up maneuvering speed. Indicates airport speed restriction deceleration point (no identifier).

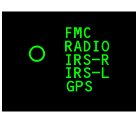
SYMBOL	NAME	MODE	REMARKS
	Procedure turn: active (M), modified (W), inactive (C)	MAP, MAP CTR, PLN	A procedure turn appears when in the flight plan. The procedure turn appears as a fixed size if the selected range is greater than 80 NM. A scaled representation of the procedure turn is displayed when the selected range is 80 NM or less and the airplane is within 3 minutes of the procedure turn.
	Airport and runway (W)	MAP, MAP CTR, PLN	Displayed when selected as the origin or destination and selected range is 80, 160, 320, or 640 NM.
	Airport (C)	MAP, MAP CTR, PLN	Displayed if the EFIS control panel ARPT map switch is selected on. Origin and destination airports are always displayed, regardless of map switch selection.
	Airport and runway (W)	MAP, MAP CTR, PLN	Displayed when selected as the origin or destination and selected range is 5, 10, 20, or 40 NM. Dashed runway centerlines extend 14.2 NM.
	Selected reference point and bearing distance information (G)	MAP, MAP CTR, PLN	Displays the reference point selected on the CDU FIX page. Bearing and/or distance from the fix are displayed with dashes (G).
	Weather radar returns (R, A, G, M)	MAP, MAP CTR, VOR, APP	The most intense areas are displayed in red, lesser intensity in amber, and lowest intensity green. Turbulence is displayed in magenta.

SYMBOL	NAME	MODE	REMARKS
	Selected map options (C)	MAP, MAP CTR, PLN	Displays EFIS control panel selected map options.
	Drift angle pointer (W)	VOR CTR, APP CTR	Indicates airplane’s present track. Replaces track line in the center APP and VOR modes.

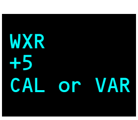
[Option - AUTO Position Difference]

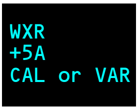
SYMBOL	NAME	MODE	REMARKS
	Position difference display (W)	MAP, MAP CTR	Values indicate NM difference between present FMC position and IRS-L/R present positions. The selected IRS source is displayed on the first line. Arrows indicate the relative bearing to IRS present positions. Displayed when the position difference of the IRS-L and/or IRS-R exceeds limits.

[Option - GPS]

SYMBOL	NAME	MODE	REMARKS
	Position shift: Active (M), Update (W), Other position (G)	PLN	Displays the position of each navigation sensor. Symbols only appear if the POS SHIFT page is displayed on the CDU.

[Option - FMC Qty 1]

SYMBOL	NAME	MODE	REMARKS
	MAP source annunciation (G)	MAP, MAP CTR, PLN	Displays source of FMC data used by CDS for data presentation.
	Weather radar annunciations: Mode (C), Tilt (C), Gain (C)	MAP, MAP CTR, VOR, APP	Annunciations vary with option selected

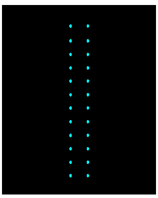
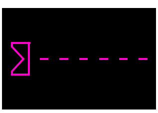
SYMBOL	NAME	MODE	REMARKS
[Option - WXR AutoTilt]			
	Weather radar annunciations: Mode (C), Tilt (C), Tilt Mode (C), Gain (C)	MAP, MAP CTR, VOR, APP	Annunciations vary with option selected

Vertical Situation Display (VSD)

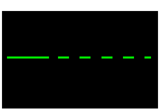
[Option VSD]

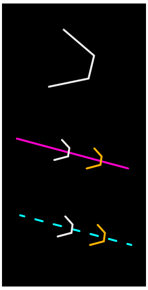
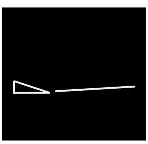
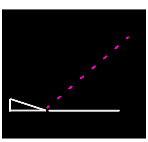
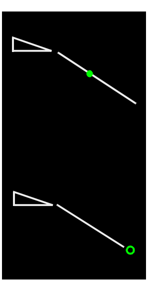
SYMBOL	NAME	REMARKS
	Airplane symbol (W)	Current airplane altitude is the bottom of the triangle. Current airplane lateral position relative to terrain is the point of the triangle.

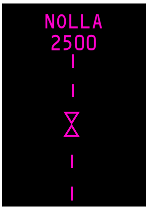
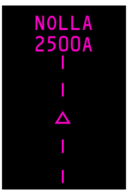
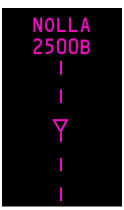
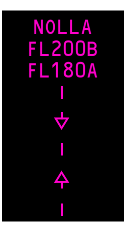
[Option - BP04/BP06]

	Enroute swath (C) (dashed line)	Indicates area of the map that is shown on the VSD. Display is inhibited both on takeoff and approach when the airplane is within 6 NM of the runway and less than 3000 feet above field elevation. During turns, the swath edge leading the turn opens in the direction of the turn.
	Selected altitude bug and line (M)	Bug indicates the altitude set in the MCP altitude window. When the selected altitude is off scale, the bug is parked at the top or bottom, with only one half the bug visible. Dashed line extends from bug to background display boundary. Line does not park.

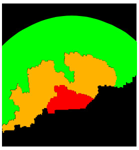
[Option - Reference Altitude Marker]

	Reference altitude marker and line (G)	Marker indicates the barometric minimums selected on the EFIS control panel. Dashed line extends from marker to background display boundary. Marker and line turn amber when airplane descends below selected minimum altitude. Reset with the RST switch on the EFIS control panel.

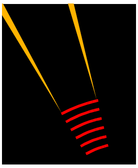
SYMBOL	NAME	REMARKS
	Decision gates (W, A)	Indicates suggested points where airplane should be path and speed stable on approach. Gates are placed on the 3 Degree Reference Line or FMC Approach Glide path Angle Line: • at 1000 feet above field elevation (W). • at 500 feet above field elevation (A). Decision gates that are below the missed approach waypoint altitude will not be displayed.
	Flight path vector (W)	Fixed length line indicates current flight path angle and rotates about the point of the triangle. Angle of the line is dependent on the vertical speed and ground speed of the airplane.
	MCP selected vertical speed vector (M)	Dashed line indicates the selected vertical speed as a target angle when the MCP V/S mode is selected. Extends to the edge of the background display and rotates about the point of the triangle.
	Range to target speed dot (G)	Indicates where the airplane will achieve the FMC or MCP target speed. If the airplane is within 5 knots of the target speed the dot will be blanked. If the airplane increases 10 knots or more faster than the target speed the dot will reappear. Displayed at the end of the Flight Path Vector as an unfilled dot if the target speed will not be achieved within the vector length.

SYMBOL	NAME	REMARKS
	Waypoint altitude constraint: active (M), inactive (W)	At Altitude example.
	Waypoint altitude constraint: active (M), inactive (W)	At or Above Altitude example.
	Waypoint altitude constraint: active (M), inactive (W)	At or Below Altitude example.
	Waypoint altitude constraint: active (M), inactive (W)	Block Altitude example.

Look-Ahead Terrain

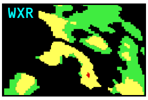
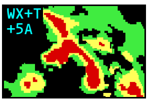
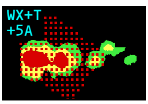
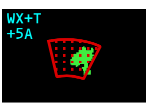
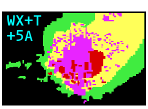
SYMBOL	NAME	MODE	REMARKS
	Terrain display (R, A, G, M)	MAP, MAP CTR, VOR, APP	Displays terrain data from the GPWS terrain data base. Color and density vary based on terrain height vs. airplane altitude. Refer to Chapter 15, Warning Systems.
TERR	Terrain mode annunciation (C)	MAP, MAP CTR, VOR, APP	Terrain display enabled (manual or automatic display).
TERR TEST	Terrain test mode annunciation (C)	All	GPWS operating in self-test mode.
TERRAIN	Terrain annunciation (R, A)	All	Look-ahead terrain caution alert active (A), look-ahead terrain warning alert active (R).
TERR FAIL	Terrain status annunciations (A)	All	Look-ahead terrain alerting and display have failed.
TERR POS	Terrain status annunciations (A)	All	Look-ahead terrain alerting and display unavailable due to position uncertainty.
TERR INHIBIT	Terrain status annunciations (A)	All	GPWS terrain inhibit switch in TERR INHIBIT position.
TERR RANGE DISAGREE	Terrain range status annunciations (A)	MAP, MAP CTR, VOR, APP	Terrain output range disagrees with selected EFIS control panel range.
MAP/TERR RANGE DISAGREE	Terrain range status annunciations (A)	MAP, MAP CTR	Terrain output range and map display output range disagree with selected EFIS control panel range.

Predictive Windshear

SYMBOL	NAME	ND MODE	REMARKS
	Predictive windshear symbol (R, B, A)	MAP, MAP CTR, VOR, APP	Displays windshear location and approximate geometric size (width and depth). Amber radials extend from predictive windshear symbol to help identify location of windshear event.
WINDSHEAR	Windshear annunciation (R, A)	All	Predictive windshear caution active (A). Predictive windshear warning active (R).
PWS FAIL	Predictive windshear status annunciation (A)	All	Predictive windshear alerting and display have failed.

Threat Assessment

[WXR V2.0]

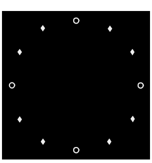
 	Core Threat Assessment (R, A, G, M)	MAP, MAP CTR, VOR, APP	Weather radar colors are adjusted to more accurately reflect the weather threat.
	Associated Threat Assessment (R)		Lightning or hail probability is indicated by red speckled pattern in black/green/amber areas above 25,000 ft, or green/amber areas below 25,000 ft.
	Predictive OverFlight (R)		Rapidly building cell below flight altitude is indicated by red speckled pattern with red outline. Indication is replaced by actual weather when cell reaches flight altitude.
	Two-level Turbulence (M)		Severe turbulence is displayed in solid magenta. Light-to-moderate turbulence is displayed in speckled magenta.

TCAS

SYMBOL	NAME	MODE	REMARKS
■ ↑ −03	TCAS resolution advisory (RA), relative altitude (R)	MAP, MAP CTR, VOR, APP	These symbols are displayed only when the EFIS control panel traffic (TFC) switch is selected on. Refer to Chapter 15, Warning Systems. The arrow indicates traffic climbing or descending at a rate >= 500 fpm. At rates < 500 fpm, the arrow is not displayed. The number and associated signs indicate altitude of traffic in hundreds of feet relative to the airplane. The number is below the traffic symbol when the traffic is below, and above the traffic symbol when the traffic is above the airplane. Absence of the number implies altitude unknown.
+02 ● ↓	TCAS traffic advisory (TA), relative altitude (A)		
♦ ↓ −05	TCAS proximate traffic, relative altitude (W)		
+09 ◊ ↑	TCAS other traffic, relative altitude (W)		
RA 5.3 +03 ↑ TA 8.9 −12 ↑	TCAS no bearing message (RA–R, TA–A)	MAP, MAP CTR, VOR, APP	Message provides traffic type, range in NM, altitude and vertical direction. TFC must be selected on.
TRAFFIC	TCAS traffic alert message (RA–R, TA–A)	All	Displayed whenever a TCAS RA or TA is active. EFIS control panel TFC switch does not have to be selected on.
OFFSCALE	TCAS off scale message (RA–R, TA–A)	MAP, MAP CTR, VOR, APP	Displayed whenever RA or TA traffic is outside the traffic area covered by the ND range. Displayed only if the EFIS control panel TFC switch is selected on.

SYMBOL	NAME	MODE	REMARKS
TFC	TCAS mode (C)	MAP, MAP CTR, VOR, APP	Indicates the ND TCAS display is active; the EFIS control panel TFC switch is selected on.
TA ONLY	TCAS mode (C)	All	Indicates TCAS computer is not computing RAs. Displayed whether the EFIS control panel TFC switch is selected on or off.
TCAS TEST	TCAS mode (C)	All	Indicates TCAS is operating in the test mode. Displayed whether EFIS control panel TFC switch is selected on or off.
TCAS OFF	TCAS mode (A)	All	Displayed when the TCAS/ATC mode switch is not in TA ONLY or TA/RA. Not displayed if TCAS is failed.
TCAS FAIL	TCAS mode (A)	All	Indicates TCAS failure, if traffic is selected.

[Option - 3NM TCAS range ring]

SYMBOL	NAME	MODE	REMARKS
	Range Ring (W)	MAP, MAP CTR, VOR, APP	Displayed when TFC selected on EFIS Control Panel. Shows 3 NM range ring oriented to aircraft heading. Displayed at ranges of 80 NM or less.

Flight Instruments, Displays — Chapter 10
PFD/ND – Navigation Displays — Section 41

Introduction

The NDs provide a mode–selectable color flight progress display. The modes are:

- MAP
- VOR
- APP (approach)
- PLN (plan)

The MAP, VOR, and APP modes can be switched between an expanded mode with a partial compass rose and a centered mode with a full compass rose.

Map Mode

The MAP mode is recommended for most phases of flight. This mode shows airplane position relative to the route of flight against a moving map background.

Displayed information can include:

- current track
- selected and current heading
- position trend vector
- range to selected altitude
- map range scale
- ground speed
- true airspeed
- wind direction and speed
- next waypoint distance
- waypoint estimated time of arrival
- selected navigation data points

Navigation Data Points

Additional navigation facility (STA), waypoint (WPT), airport (ARPT), route progress (DATA) and position (POS) data are available for display on the ND in both the expanded and center map modes.

VOR and Approach Modes

The VOR and APP modes are presented heading up. The VOR and APP modes display track, heading, and wind speed and direction with VOR navigation or approach information.

Plan Mode

The PLN mode is presented true north up. The active route may be viewed using the STEP prompt on the CDU LEGS pages.

ND Information

Heading

Heading is supplied by the FMC or air data inertial reference system (ADIRS). The ND compass rose can be referenced to magnetic north or true north.

Track

Track is supplied by the FMC during normal operation.

Traffic

Traffic information from the TCAS can be displayed on the ND. TCAS is described in Chapter 15, Warning Systems.

Weather Radar

Weather radar information can be displayed on the ND. The weather radar system is described in Chapter 11, Flight Management, Navigation.

Failure Flags and Messages

Failure flags are displayed for system failures or invalid information. Indications are blanked or replaced by dashes when source system information is not available.

The message EXCESS DATA is displayed if the amount of information sent to the ND exceeds the display capability. When this occurs, the system removes some information from the display. The message can be removed by:

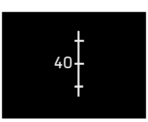
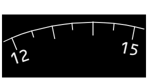
- reducing the amount of map information
- reducing range, or
- deselecting one or more of the EFIS control panel map switches (STA, WPT, ARPT, DATA, POS).

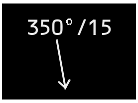
ND Symbology

The following symbols can be displayed on each ND, depending on EFIS control panel switch selections. Colors indicate the following:

- W (white) – present status, range scales
- G (green) – dynamic conditions
- M (magenta) – command information, pointers, symbols, fly–to condition
- C (cyan) – nonactive or background information
- A (amber) – cautions, faults, flags
- R (red) – warnings
- B (black) – blank area, off condition.

Heading, Track, and Speed

SYMBOL	NAME	MODE	REMARKS
	Selected heading bug (M)	All except PLN	Displays the MCP–selected heading. A dashed reference line (M) extends from the marker to the airplane symbol (VOR CTR and APP CTR do not display dashed line). In the MAP mode with LNAV or VORLOC engaged, the dashed line is removed 10 seconds after the selected heading bug is moved.
	Current heading pointer (W)	All except PLN	Points to current heading on the compass rose.
	Track line and range scale (W)	All except PLN	Indicates current track. Number indicates range (VOR CTR and APP CTR do not display range).
	Expanded compass (W)	MAP, VOR, APP	Displays 90 degrees of compass rose.
	Groundspeed (W)	All	Displays current groundspeed.

SYMBOL	NAME	MODE	REMARKS
	True airspeed (W)	All	Displays current true airspeed above 100 knots.
	Wind direction/ speed and wind arrow (W)	All	Indicates wind speed and direction, with respect to display orientation and heading/track reference. Displayed if wind magnitude is greater than 6 knots and blanked if wind magnitude becomes less than 4 knots. Blank until TAS is greater than 101 knots. PLN mode displays direction/speed without the arrow.

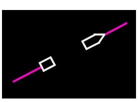
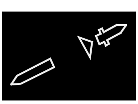
[Option - Track-up display]

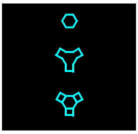
SYMBOL	NAME	MODE	REMARKS
	Track orientation (G), current track (W), track reference (G)	MAP, MAP CTR	Displays TRK as the orientation, the current track, and MAG or TRU as the reference, and points to the heading on the compass rose.
	Heading orientation (G), current heading (W), heading reference (G), heading pointer (W)	VOR, VOR CTR, APP, APP CTR	Displays HDG as the display orientation, current heading, MAG or TRU as the heading reference, and points to the heading on the compass rose.

[Option - Heading-up display]

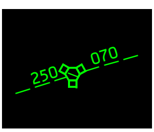
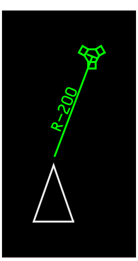
SYMBOL	NAME	MODE	REMARKS
	Heading orientation (G), current heading (W), heading reference (G), heading pointer (W)	All except PLN	Displays HDG as the display orientation, current heading, MAG or TRU as the heading reference, and points to the heading on the compass rose.

Radio Navigation

SYMBOL	NAME	MODE	REMARKS
116.80 OR SEA	ILS /VOR Reference receiver frequency or identifier display (W)	VOR, VOR CTR, APP, APP CTR	Located upper right corner. Frequency displayed before the identifier is decoded. The decoded identifier replaces the frequency. Medium size characters for VOR, small size characters for DME only.
CRS 135	Reference ILS or VOR course (W)	VOR, VOR CTR, APP, APP CTR	Located upper right corner. Indicates the VOR course or ILS localizer course.
DME 24.6	Reference VOR or ILS DME (W)	VOR, VOR CTR, APP, APP CTR	Located upper right corner. Indicates DME distance to the reference navaid.
DME 24.6	DME distance (G)	All except PLN	Located lower left or right corner. Indicates DME distance to navaid.
	Selected course pointer (W) and line (M)	VOR, APP	Displays selected course as set by the related MCP course selector.
	Selected course pointer (W) TO/FROM pointer (W)	APP CTR, VOR CTR	Displays selected course as set by the related MCP course selector. TO/FROM pointer is displayed when VOR navigation is being used.
TO FROM	To/from indication (W)	VOR, VOR CTR	Displays VOR to/from indication.

SYMBOL	NAME	MODE	REMARKS
	VOR (C, G), DME/TACAN (C, G), VORTAC (C, G)	MAP, MAP CTR, PLN	When the EFIS control panel STA map switch is selected on, appropriate navaids are displayed. All navaids contained in the FMC data base and within the MAP area are displayed when the selected range is 5, 10, 20 or 40 nm. Only high altitude navaids are displayed when the selected range is 80, 160, 320 or 640 nm. Nav aids not being used are displayed in cyan. Manually tuned VHF navaids are displayed in green, regardless of STA map switch selection.

[Option - VOR course lines displayed]

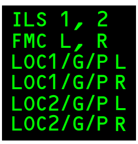
	Manually tuned VOR radials (G)	MAP, MAP CTR, PLN	When a navaid is manually tuned, the selected course and reciprocal are displayed.
	VOR/DME raw data radial and distance (G)	MAP, MAP CTR	When the POS map switch is selected on, the station radial extends to the airplane.
	System source annunciation (G)	VOR, VOR CTR, APP, APP CTR	Indicates the selected receiver as the display reference.

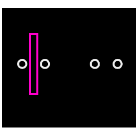
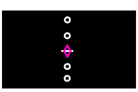
SYMBOL	NAME	MODE	REMARKS

[Option - GLS]

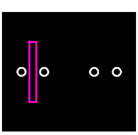
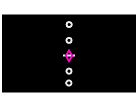
	System source annunciation (G)	VOR, VOR CTR, APP, APP CTR	Indicates the selected receiver as the display reference.

[Option - IAN

	IAN source annunciation (G)	APP, APP CTR	Indicates the selected source of the deviation displays.

	ILS localizer or VOR course deviation indication (M) and scale (W)	VOR, VOR CTR, APP, APP CTR	Displays LOC or VOR course deviation. Deviation indicator points in direction of VOR or ILS selected course. For ILS deviation, indicator fills (M) when less than 2 ½ dots from center.
	Glideslope pointer (M) and scale (W)	APP, APP CTR	Displays glideslope position and deviation.

[Option - IAN]

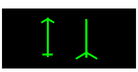
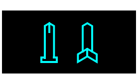
	ILS localizer, FMC IAN or VOR course deviation indication (M) and scale (W)	VOR, VOR CTR, APP, APP CTR	Displays LOC, FMC IAN or VOR course deviation. Deviation indicator points in direction selected course. For ILS and FMC IAN deviation, indicator fills (M) when less than 2 ½ dots from center.
	ILS Glideslope or FMC IAN Glide path pointer (M) and scale (W)	APP, APP CTR	Displays glideslope or glide path position and deviation.

SYMBOL	NAME	MODE	REMARKS

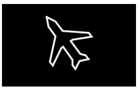
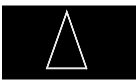
[Option - ADF]

SYMBOL	NAME	MODE	REMARKS
	VOR frequency or identifier (G), ADF frequency or identifier (C)	All except PLN	Located lower left or right corner. Frequency is displayed before identifier is decoded. Decoded identifier replaces the frequency. For VORs, small size characters indicate only DME information is being received.

[Option - Dual ADF]

SYMBOL	NAME	MODE	REMARKS
	VOR (G) or ADF (C) selection	All except PLN	Located lower left or right corner. Represents positions of the EFIS control panel VOR/ADF switches.
	VOR 1 (G) or ADF 1 (C) pointer head and tail	All except PLN	Indicates bearing to (head) or from (tail) the tuned station, if selected on the respective EFIS control panel.
	VOR 2 (G) or ADF 2 (C) pointer head and tail	All except PLN	Indicates bearing to (head) or from (tail) the tuned station, if selected on the respective EFIS control panel.

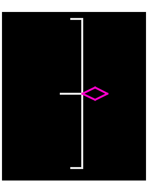
Map

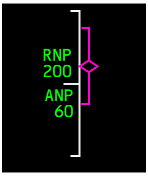
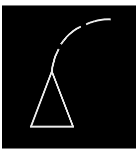
SYMBOL	NAME	MODE	REMARKS
	Airplane symbol (W)	VOR CTR, APP CTR	Current airplane position is at the center of the symbol.
	Airplane symbol (W)	PLN	Indicates actual position and track along the flight plan route. Inhibited north of 82N latitude and south of 82S latitude.
	Airplane symbol (W)	MAP, MAP CTR, VOR, APP	Current airplane position is at the apex of the triangle.

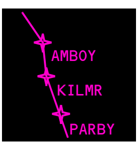
[Option - NPS]

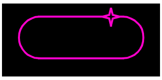
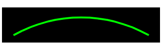
	Airplane symbol (W), Lateral ANP/RNP values (G)	MAP, MAP CTR, VOR, APP	Current airplane position is at the apex of the triangle. Displays lateral path deviation distance in MAP and MAP CTR mode only. Whenever ANP exceeds RNP, the ANP/RNP labels and values are displayed in amber.

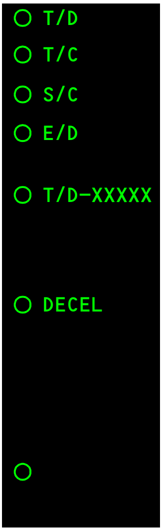
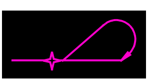
[Option - BP04/BP06]

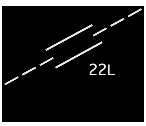
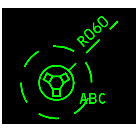
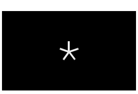
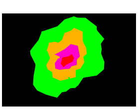
	VNAV path pointer (M) and deviation scale (W)	MAP, MAP CTR	Displays vertical deviation from selected VNAV PATH during descent only. Scale indicates ± 400 feet deviation. Digital display is provided when the pointer deviates more than ± 30 feet from center.

SYMBOL	NAME	MODE	REMARKS
[Option - NPS]			
	Path deviation band (M), Vertical ANP/RNP values (G)	MAP, MAP CTR	Path deviation band is symmetric about the pointer and represents vertical RNP. Whenever ANP exceeds RNP, the ANP/RNP labels and values are displayed in amber.
	Position trend vector (W) (dashed line)	MAP, MAP CTR	Predicts position at the end of 30, 60, and 90 second intervals. Each segment represents 30 seconds. Based on bank angle and ground speed. Selected range determines the number of segments displayed. For range: • > 20 NM, 3 segments • = 20 NM, 2 segments • < = 10 NM, 1 segment.
ABCDE	Active waypoint identifier (M)	MAP, MAP CTR, PLN	Indicates the active flight plan waypoint, the next waypoint on the route of flight.
124NM	Active waypoint distance (W)	MAP, MAP CTR, PLN	Distance to the active waypoint.
0835.4z	Active waypoint ETA (W)	MAP, MAP CTR, PLN	Indicates FMS–calculated ETA at the active waypoint.

SYMBOL	NAME	MODE	REMARKS
	Waypoint: active (M), modified (W), inactive (C)	MAP, MAP CTR, PLN	Active– represents the waypoint the airplane is currently navigating to. Modified – represents the waypoints on the active route that are being modified. Inactive – represents the waypoints on the active route.
	Off route waypoint (C)	MAP, MAP CTR, PLN	When the EFIS control panel WPT map switch is selected on, waypoints not on the selected route are displayed, for ranges of 5, 10, 20, or 40 NM.
	Flight plan route: active (M), modified (W), inactive (C), offset (M)	MAP, MAP CTR, PLN	The active route is displayed with a continuous line (M) between waypoints. Active route modifications are displayed with short dashes (W) between waypoints. Inactive routes are displayed with long dashes between waypoints. An offset route, selected through the FMC, is displayed with a dot–dash line (M) parallel to the active route.
	Route data: active (M), inactive (W)	MAP, MAP CTR, PLN	When the EFIS control panel DATA switch is selected on, entered or procedural altitude and ETAs for route waypoints are displayed.

SYMBOL	NAME	MODE	REMARKS
	Holding pattern: active (M), modified (W), inactive (C)	MAP, MAP CTR, PLN	A holding pattern appears when in the flight plan. The holding pattern appears as a fixed size if the selected range is greater than 80 NM. A scaled representation of the holding pattern is displayed when the selected range is 80 NM or less and the airplane is within 3 minutes of the holding fix.
	Altitude range arc (G)	MAP, MAP CTR	Based on vertical speed and groundspeed, indicates the approximate map position where the MCP altitude will be reached.
	Conditional waypoint: active (M), inactive (W)	MAP, MAP CTR, PLN	Active - represents the conditional waypoint event the airplane is currently navigating to. Inactive - represents the conditional waypoints on the route. Data within parentheses for conditional waypoints indicates type of conditional waypoint (ALTITUDE, COURSE INTERCEPT, etc.).

SYMBOL	NAME	MODE	REMARKS
	Altitude profile point and identifier (G)	MAP, MAP CTR, PLN	Indicates the approximate map position of the FMC–calculated T/C (top–of–climb), T/D (top–of–descent), S/C (step climb), and E/D (end of descent) points. Indicates intermediate T/D points for level flight path segments during descent. Level flight path segment altitude is displayed. Indicates the beginning of a deceleration segment resulting from deceleration to a holding pattern, a waypoint speed restriction or flaps up maneuvering speed. Indicates airport speed restriction deceleration point (no identifier).
	Procedure turn: active (M), modified (W), inactive (C)	MAP, MAP CTR, PLN	A procedure turn appears when in the flight plan. The procedure turn appears as a fixed size if the selected range is greater than 80 NM. A scaled representation of the procedure turn is displayed when the selected range is 80 NM or less and the airplane is within 3 minutes of the procedure turn.
	Airport and runway (W)	MAP, MAP CTR, PLN	Displayed when selected as the origin or destination and selected range is 80, 160, 320, or 640 NM.

SYMBOL	NAME	MODE	REMARKS
	Airport (C)	MAP, MAP CTR, PLN	Displayed if the EFIS control panel ARPT map switch is selected on. Origin and destination airports are always displayed, regardless of map switch selection.
	Airport and runway (W)	MAP, MAP CTR, PLN	Displayed when selected as the origin or destination and selected range is 5, 10, 20, or 40 NM. Dashed runway centerlines extend 14.2 NM.
	Selected reference point and bearing distance information (G)	MAP, MAP CTR, PLN	Displays the reference point selected on the CDU FIX page. Bearing and/or distance from the fix are displayed with dashes (G).
	GPS position (W)	MAP, MAP CTR	When the EFIS POS map switch is selected on, indicates GPS position relative to FMC position.
	ADIRU position (W)	MAP, MAP CTR	When the EFIS control panel POS map switch is selected on, the star indicates ADIRU position relative to FMC position.
	Weather radar returns (R, A, G, M)	MAP, MAP CTR, VOR, APP	The most intense areas are displayed in red, lesser intensity in amber, and lowest intensity green. Turbulence is displayed in magenta.
	Selected map options (C)	MAP, MAP CTR, PLN	Displays EFIS control panel selected map options.

SYMBOL	NAME	MODE	REMARKS

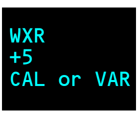
[Option - FMC Qty 1]

SYMBOL	NAME	MODE	REMARKS
	MAP source annunciation (G)	MAP, MAP CTR, PLN	Displays source of FMC data used by CDS for data presentation.

[Option - FMC Qty 2]

SYMBOL	NAME	MODE	REMARKS
	MAP source annunciation (G)	MAP, MAP CTR, PLN	Displays source of FMC data used by CDS for data presentation.

[Option - Range Arcs]

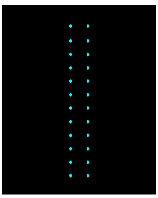
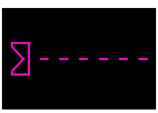
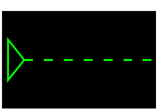
SYMBOL	NAME	MODE	REMARKS
	Range arcs (W)	MAP, VOR, APP	Displayed in MAP, APP and VOR modes when the WXR map, TERR map or TCAS TFC switches are selected.
	Weather radar annunciations: Mode (C), Tilt (C), Gain (C)	MAP, MAP CTR, VOR, APP	Annunciations vary with option selected.

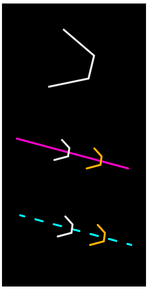
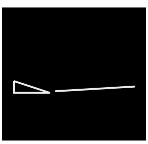
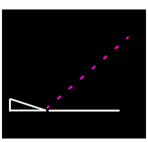
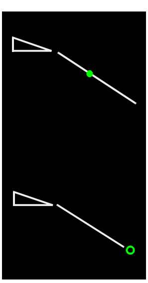
Vertical Situation Display (VSD)

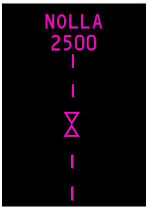
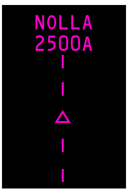
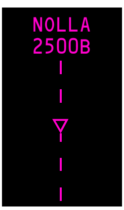
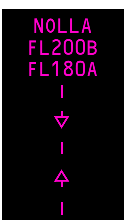
[Option VSD]

SYMBOL	NAME	REMARKS
	Airplane symbol (W)	Current airplane altitude is the bottom of the triangle. Current airplane lateral position relative to terrain is the point of the triangle.

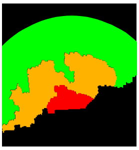
[Option - BP04/BP06]

	Enroute swath (C) (dashed line)	Indicates area of the map that is shown on the VSD. Display is inhibited both on takeoff and approach when the airplane is within 6 NM of the runway and less than 3000 feet above field elevation. During turns, the swath edge leading the turn opens in the direction of the turn.
	Selected altitude bug and line (M)	Bug indicates the altitude set in the MCP altitude window. When the selected altitude is off scale, the bug is parked at the top or bottom, with only one half the bug visible. Dashed line extends from bug to background display boundary. Line does not park.
	BARO minimums pointer and line (G)	Pointer indicates the barometric minimums selected on the EFIS control panel. Dashed line extends from pointer to background display boundary. Pointer and line turn amber when airplane descends below selected minimum altitude. Reset with the RST switch on the EFIS control panel.

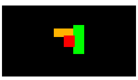
SYMBOL	NAME	REMARKS
	Decision gates (W, A)	Indicates suggested points where airplane should be path and speed stable on approach. Gates are placed on the 3 Degree Reference Line or FMC Approach Glide Path Angle Line: • at 1000 feet above field elevation (W). • at 500 feet above field elevation (A). Decision gates that are below the missed approach waypoint altitude will not be displayed.
	Flight path vector (W)	Fixed length line indicates current flight path angle and rotates about the point of the triangle. Angle of the line is dependent on the vertical speed and ground speed of the airplane.
	MCP selected vertical speed vector (M)	Dashed line indicates the selected vertical speed as a target angle when the MCP V/S mode is selected. Extends to the edge of the background display and rotates about the point of the triangle.
	Range to target speed dot (G)	Indicates where the airplane will achieve the FMC or MCP target speed. If the airplane is within 5 knots of the target speed the dot will be blanked. If the airplane increases 10 knots or more faster than the target speed the dot will reappear. Displayed at the end of the Flight Path Vector as an unfilled dot if the target speed will not be achieved within the vector length.

SYMBOL	NAME	REMARKS
	Waypoint altitude constraint: active (M), inactive (W)	At Altitude example.
	Waypoint altitude constraint: active (M), inactive (W)	At or Above Altitude example.
	Waypoint altitude constraint: active (M), inactive (W)	At or Below Altitude example.
	Waypoint altitude constraint: active (M), inactive (W)	Block Altitude example.

Look-Ahead Terrain

SYMBOL	NAME	MODE	REMARKS
	Terrain display (R, A, G, M)	MAP, MAP CTR, VOR, APP	Displays terrain data from the GPWS terrain data base. Color and density vary based on terrain height vs. airplane altitude. Refer to Chapter 15, Warning Systems.

[Option - Obstacles]

	Terrain obstacle (R, A, G)	MAP, MAP CTR, VOR, APP	Obstacles are displayed from the GPWS data base and use the same display criteria as the terrain display.
OBSTACLE	Obstacle annunciation (R, A)	All	Obstacle caution alert active (A), obstacle warning alert active (R).

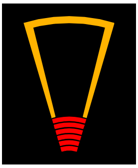
[Option - Peaks]

TERR 060 030	Terrain mode annunciation (C) Terrain elevation (R,A,G)	MAP, MAP CTR, VOR, APP	Terrain display enabled (manual or automatic display). Terrain elevation displayed in hundreds of feet showing highest and lowest displayed terrain. Colors correspond to terrain display. Terrain elevation not displayed when terrain data unavailable.

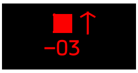
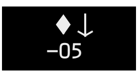
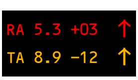
TERR TEST	Terrain test mode annunciation (C)	All	GPWS operating in self-test mode.
TERRAIN	Terrain annunciation (R, A)	All	Look-ahead terrain caution alert active (A), look-ahead terrain warning alert active (R).

SYMBOL	NAME	MODE	REMARKS
TERR FAIL	Terrain status annunciations (A)	All	Look-ahead terrain alerting and display have failed.
TERR POS	Terrain status annunciations (A)	All	Look-ahead terrain alerting and display unavailable due to position uncertainty.
TERR INHIBIT	Terrain status annunciations (A)	All	GPWS terrain inhibit switch in TERR INHIBIT position.
TERR RANGE DISAGREE	Terrain range status annunciations (A)	MAP, MAP CTR, VOR, APP	Terrain output range disagrees with selected EFIS control panel range.
MAP/TERR RANGE DISAGREE	Terrain range status annunciations (A)	MAP, MAP CTR	Terrain output range and map display output range disagree with selected EFIS control panel range.

Predictive Windshear

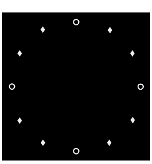
SYMBOL	NAME	MODE	REMARKS
	Predictive windshear symbol (R, B, A)	MAP, MAP CTR, VOR, APP	Displays windshear location and approximate geometric size (width and depth). Amber radials extend from predictive windshear symbol to help identify location of windshear event.
WINDSHEAR	Windshear annunciation (R, A)	All	Predictive windshear caution active (A). Predictive windshear warning active (R).
PWS FAIL	Predictive windshear status annunciation (A)	All	Predictive windshear alerting and display have failed.

TCAS

SYMBOL	NAME	MODE	REMARKS
	TCAS resolution advisory (RA), relative altitude (R)	MAP, MAP CTR, VOR, APP	These symbols are displayed only when the EFIS control panel traffic (TFC) switch is selected on. Refer to Chapter 15, Warning Systems. The arrow indicates traffic climbing or descending at a rate >= 500 fpm. At rates < 500 fpm, the arrow is not displayed. The number and associated signs indicate altitude of traffic in hundreds of feet relative to the airplane. The number is below the traffic symbol when the traffic is below, and above the traffic symbol when the traffic is above the airplane. Absence of the number implies altitude unknown.
	TCAS traffic advisory (TA), relative altitude (A)		
	TCAS proximate traffic, relative altitude (W)		
	TCAS other traffic, relative altitude (W)		
	TCAS no bearing message (RA–R, TA–A)	MAP, MAP CTR, VOR, APP	Message provides traffic type, range in NM, altitude and vertical direction. TFC must be selected on.
	TCAS traffic alert message (RA–R, TA–A)	All	Displayed whenever a TCAS RA or TA is active. EFIS control panel TFC switch does not have to be selected on.
	TCAS off scale message (RA–R, TA–A)	MAP, MAP CTR, VOR, APP	Displayed whenever RA or TA traffic is outside the traffic area covered by the ND range. Displayed only if the EFIS control panel TFC switch is selected on.

SYMBOL	NAME	MODE	REMARKS
TFC	TCAS mode (C)	MAP, MAP CTR, VOR, APP	Indicates the ND TCAS display is active; the EFIS control panel TFC switch is selected on.
TA ONLY	TCAS mode (C)	All	Indicates TCAS computer is not computing RAs. Displayed whether the EFIS control panel TFC switch is selected on or off.
TCAS TEST	TCAS mode (C)	All	Indicates TCAS is operating in the test mode. Displayed whether EFIS control panel TFC switch is selected on or off.
TCAS OFF	TCAS mode (A)	All	Displayed when the TCAS/ATC mode switch is not in TA ONLY or TA/RA. Not displayed if TCAS is failed.
TCAS FAIL	TCAS mode (A)	All	Indicates TCAS failure, if traffic is selected.

[Option - 3NM TCAS range ring]

SYMBOL	NAME	MODE	REMARKS
	Range Ring (W)	MAP, MAP CTR, VOR, APP	Displayed when TFC selected on EFIS Control Panel. Shows 3 NM range ring oriented to aircraft heading. Displayed at ranges of 80 NM or less.

RAAS

SYMBOL	NAME	MODE	REMARKS
[Option - RAAS Caution - SHORT RUNWAY (In Flight)]			
SHORT RUNWAY	Short Runway (in-flight)	MAP, MAP CTR, VOR, APP	Airplane is within 3NM of runway threshold, and runway available distance is less than operator defined minimum, and heading is within 20 degrees of runway heading, and within 200’ plus one runway width of the runway extended centerline, and between 450’ and 300’ AFE.
[Option - RAAS Caution - SHORT RUNWAY (On Ground)]			
SHORT RUNWAY	Short Runway (on ground - takeoff)	MAP, MAP CTR, VOR, APP	Airplane is on a runway with available takeoff distance less than operator defined minimum, and heading is within 20 degrees of runway heading, and ground speed is greater than 40 knots.
[Option - RAAS Caution ON TAXIWAY]			
ON TAXIWAY	On Taxiway	MAP, MAP CTR, VOR, APP	Airplane is on a surface other than a runway and ground speed is greater than 40 knots.

Flight Instruments, Displays — Chapter 10
Head-Up Display System, Symbology — Section 42

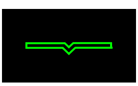
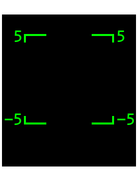
Introduction

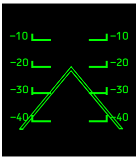
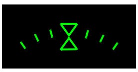
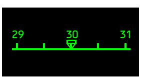
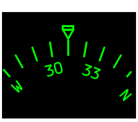
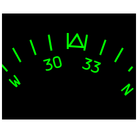
HUD symbology consists of green symbols projected on the combiner from the OHU. The PRI mode display symbols are similar to those on the CDS, and can be used for all phases of flight. The approach mode displays (AIII, IMC, VMC) are optimized to enhance aircraft control and situational awareness during final approach, flare, and touchdown.

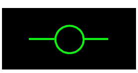
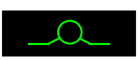
In addition to flight symbology, TCAS resolution advisories and HUD system failure flags and data source annunciations are displayed when active.

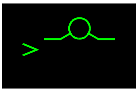
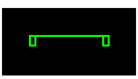
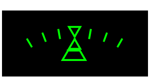
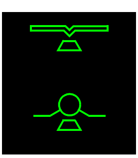
Head-Up Guidance Display Symbology

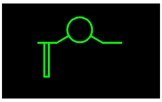
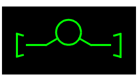
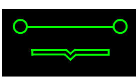
[Option - Model 4000]
The following symbols can be displayed on the combiner, depending on HUD and EFIS control panel switch selections.

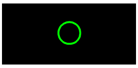
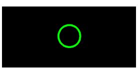
SYMBOL	NAME	MODE	REMARKS
	Airplane reference	All	Top center point of the symbol represents airplane projected centerline. The symbol is positioned at a fixed position 7° above the display's vertical center. Symbol is fixed at display center when the unusual attitude display is active.
	Horizon Line	All	Indicates the horizon relative to the airplane reference symbol. Position based on current airplane pitch and roll attitude.
	Pitch Scale	PRI in flight, AIII approach, IMC, VMC	Displays airplane pitch in five degree increments between -20° and +25°.

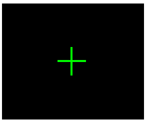
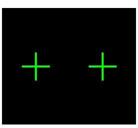
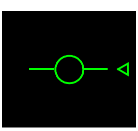
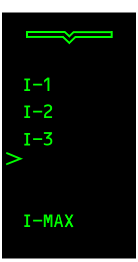
SYMBOL	NAME	MODE	REMARKS
	Compressed pitch scale	PRI in flight, AIII approach, IMC, VMC	Displays airplane pitch in ten degree increments between +/-30° and +/-90°. A chevron appears on the pitch scale at -20° and +30°.
	Bank Scale and Pointer	All	Displays the corresponding roll attitude in ten degree increments between 0° and +/-30°. Tic marks at +/-45° and +/-60° are added when the airplane exceeds +/-35° and +/-50° respectively.
	Horizon heading scale	All	Magnetic heading is displayed in five degree increments (and labeled every 10°) on the horizon line. A downward pointing triangle indicates current airplane magnetic heading.
	HSI heading scale	PRI in flight	Displays airplane magnetic heading in a 210° compass rose format.
	Heading pointer	PRI in flight	Indicates current heading.
	Drift angle pointer	PRI in flight	Indicates current drift angle or track.

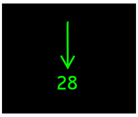
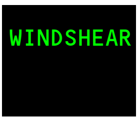
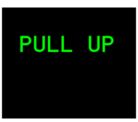
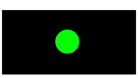
SYMBOL	NAME	MODE	REMARKS
	Selected heading bug	All	Displays selected heading on the horizon line and on the HSI (when in view). Not displayed if the selected heading is outside of the currently displayed heading scale.
	Digital selected heading	All	Displayed full time in PRI mode and for five seconds after selection in the IMC, VMC or AIII modes.
	Digital heading	All	Displays current magnetic heading directly below the roll scale pointer.
	Ground roll reference	PRI ground	Provides a reference for ground roll guidance during low visibility takeoff operations. Displayed on the horizon line until 3° of attitude is achieved.
	Flight path symbol	PRI in flight, AIII approach, IMC, VMC	Displays the actual flight path vector of the aircraft. Has display priority over all other symbols except the guidance cue and the FLARE command.

SYMBOL	NAME	MODE	REMARKS
	Flight path acceleration	All	Positioned left of the flight path vector; indicates sum of all forces affecting the airplane including thrust, drag, and wind. Positioned above flight path vector; airplane is accelerating. Positioned below flight path vector; airplane is decelerating. Removed from display when a decreasing performance low-level windshear is detected below 400 feet AGL.
	Pitch limit indication (also called angle of attack limit)	PRI in flight, AIII approach, IMC, VMC	Displayed whenever the airplane's angle of attack is within 5° of stick shaker, any time stick shaker is active, or whenever WINDSHEAR guidance cue is displayed.
	Slip/skid indicator	All	The bottom portion of the bank scale pointer moves laterally with respect to the top triangle portion of the pointer.
	Additional slip/skid indicators	PRI in flight, AIII approach, IMC, VMC	Positioned below the airplane reference and flight path symbols. Displayed during takeoff or low altitude go-around.

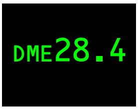
SYMBOL	NAME	MODE	REMARKS
	Speed error tape	PRI in flight, AIII approach, IMC, VMC	Displays the difference between indicated airspeed and the reference speed selected on the mode control panel. Tape length equal to the diameter of the flight path circle represents approximately 5 knots of error. Maximum tape length is limited to 15 knots of error.
	Bank warning	PRI in flight, AIII approach, IMC, VMC	Displayed if radio altitude is less than 100 feet and airplane roll angle exceeds 5°. Symbol remains until roll angle is less than 3° or radio altitude greater than 100 feet.
	Tail strike pitch limit	PRI ground	Tail strike may occur if this symbol meets the aircraft reference symbol. Displayed if the airplane pitch angle approaches the tail strike angle or the pitch rate is too excessive during takeoff rotation, below 10 feet AGL.
	Unusual attitude	PRI in flight, AIII approach, IMC, VMC	Automatically displayed when pitch exceeds -20°/+35° or roll exceeds 55°.

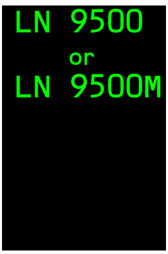
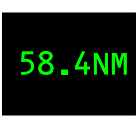
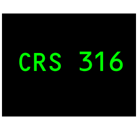
SYMBOL	NAME	MODE	REMARKS
	Flight director guidance cue	PRI in flight, IMC	Functions similar to the flight director, but is designed for control of flight path. Automatically displayed when within 2° of pitch command or radio altimeter indicates 50 feet. The objective is to capture the guidance cue inside the flight path vector circle.
	HUD guidance cue	PRI ground, AIII approach	Similar to flight director guidance cue, but driven by HUD computer. During low visibility takeoff, the cue provides localizer tracking. During AIII approach, the cue provides approach and flare commands. The objective is to capture the guidance cue inside the flight path vector or ground roll reference circle.
	TO/GA pitch target line	PRI in flight	Displayed when greater than 65 knots, AFDS TO/GA mode active and a valid pitch command input of greater than 10° is received. Symbol remains until TO/GA mode is exited. The objective is to place the airplane reference symbol on the target line.

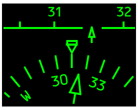
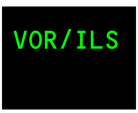
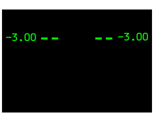
SYMBOL	NAME	MODE	REMARKS
	AIII flare command	AIII approach	Initially displayed 2-3° directly below the guidance cue at 105 feet above runway elevation. The symbol flashes for one second and rises toward the guidance cue at a rate proportional to the expected flare pitch rate. At an altitude between 45 and 55 feet, the flare command and guidance cue meet and continue rising to command the flare maneuver until touchdown.
	Flare cues	PRI in flight, IMC, VMC	Displayed on each side of the flight path symbol, indicating the flare maneuver must be accomplished. The cues flash continuously as the airplane descends through 55 feet radio altitude, until 10 feet radio altitude is reached.
	Rollout excessive deviation triangle	AIII rollout	Points in the direction of runway centerline during excessive deviation from the localizer on rollout.
	Ground deceleration scale	PRI ground, AIII rollout, IMC, VMC	Scale marks are labeled with autobrake settings. Displayed during all landings. Displayed during takeoff if deceleration is sensed when groundspeed above 50 knots. Removed when groundspeed below 25 knots, airplane is accelerating or after liftoff.

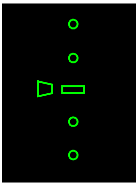
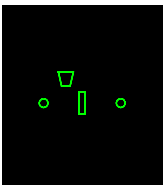
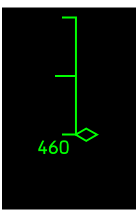
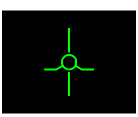
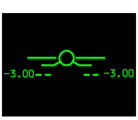
SYMBOL	NAME	MODE	REMARKS
	Wind speed and direction	PRI in flight, AIII approach, IMC,VMC	Indicates wind speed and direction, with respect to airplane magnetic heading. Displayed if wind magnitude is greater than 6 knots and blanked if wind magnitude becomes less than 4 knots.
	Windshear warning	PRI in flight, AIII approach, IMC,VMC	Displayed above the airplane reference symbol during a GPWS or PWS windshear warning.
	Ground proximity warning	PRI in flight, AIII approach, IMC,VMC	Displayed whenever the GPWS is activated.
	Windshear guidance cue	PRI in flight	During a windshear warning, and in TO/GA mode, the PRI mode is automatically selected and the guidance cue becomes a solid circle to provide guidance to exit windshear conditions.

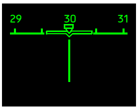
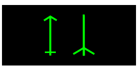
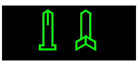
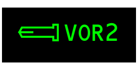
SYMBOL	NAME	MODE	REMARKS
250	Radio altitude	PRI in flight, AIII approach, IMC,VMC	Displayed below the flight path symbol, or relative to the airplane reference symbol if the flight path symbol is not displayed. The value is removed from the display at 1500 feet when ascending and again displayed at 1400 feet when descending. This value is displayed in ten foot increments between 50 and 1500 feet, five foot increments between 10 and 50 feet and one foot increments below 10 feet.
DH	Decision height	PRI in flight, AIII approach, IMC	Displayed left of radio altitude when selected decision height is reached. When decision height is reached, the message flashes for 3 seconds and then remains steady.
OM or MM or IM	Marker beacon	PRI in flight, AIII approach, IMC	Displayed below the airplane reference symbol for marker beacon passage.
210	Digital airspeed	AIII approach, AIII rollout, IMC, VMC	Displays airspeed next to the flight path symbol if it is displayed, and next to the airplane reference symbol if flight path is not displayed.
AS 210	Digital selected airspeed	All	Displays speed selected on the MCP.

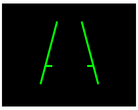
SYMBOL	NAME	MODE	REMARKS
	Digital ground speed	All	Displays digital ground speed.
	Digital mach	PRI in flight	Displays mach speed below airspeed scale when mach speed is above .400. Removed when below .380.
	Selected mach	All	Displays selected mach speed above airspeed scale (PFD/ND format only).
	Digital barometric altitude	AIII approach, AIII rollout, IMC, VMC	Displays barometric altitude relative to the flight path symbol if it is displayed, and relative to the airplane reference symbol if flight path is not displayed.
	Digital vertical speed	PRI in flight, AIII approach, IMC, VMC	In PRI mode, displayed in the lower right corner of the display. In all other modes, displayed to the right of the flight path symbol. Value displayed in 50 feet/minute increments.
	DME distance	PRI in flight, AIII approach, IMC, VMC	Indicates DME distance to the reference navaid.

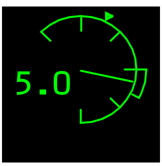
SYMBOL	NAME	MODE	REMARKS
	Digital runway elevation	AIII approach	Displays runway elevation entered on the HUD control panel for 5 seconds: • after AIII mode selected, or • runway elevation value changed during an AIII mode approach.
	Digital runway length in feet. Digital runway length in meters.	AIII approach, AIII rollout	Displays runway length entered on the HUD control panel for 5 seconds: • after AIII mode selected, or • runway length value changed during an AIII mode approach. When AIII mode active and above 500 feet AGL, display flashes when runway length entered is outside of rollout guidance capability.
	Digital runway remaining in feet Digital runway remaining in meters	PRI ground, AIII rollout	Displays the length of runway remaining between airplane and end of runway based on runway length entered on the HUD control panel.
	Distance to go	PRI in flight, IMC	Distance to next waypoint.
	Selected course (digital)	All	Displayed full time in PRI mode and for five seconds after selection in the IMC, VMC or AIII modes.

SYMBOL	NAME	MODE	REMARKS
	Selected course pointer	All	Displays MCP selected course below the horizon line and on the HSI (PRI mode only). The horizon line pointer is surrounded by a 3° gap in the horizon line.
	System source annunciation	PRI in flight, PRI ground, AIII approach, AIII rollout IMC	Indicates the selected receiver as the display source.
			Indicates source cannot be determined.
	FMC source annunciation	All	Indicates the selected FMC as the system source.
	Glideslope reference line	AIII approach, IMC, VMC	Displays the glideslope value entered on the HUD control panel. Positioning the flight path symbol over the glideslope reference line results in a descent angle equal to the value entered.
	ILS localizer or VOR deviation indication and scale	PRI in flight	Displays LOC or VOR course deviation on the HSI. With excessive localizer deviation during an ILS approach, the symbol will flash until the excessive deviation is no longer present.

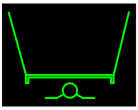
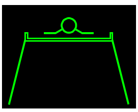
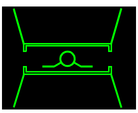
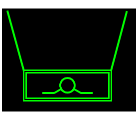
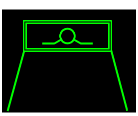
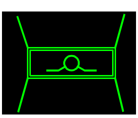
SYMBOL	NAME	MODE	REMARKS
	Glideslope pointer and deviation scale	PRI in flight	Displays glideslope position and deviation during ILS approach. With excessive glideslope deviation, the pointer will flash until the excessive deviation is no longer present.
	Ground localizer pointer and deviation scale	PRI ground, AIII rollout	Displays airplane lateral deviation relative to the runway centerline.
	Vertical deviation pointer and scale	PRI in flight, IMC	Full scale represents 400 feet of vertical deviation. When the deviation is off scale, the pointer is parked at the top or bottom of the tape, and the digital value is displayed at the appropriate end of the scale.
	Lateral deviation line	AIII approach, IMC	Displayed as vertical lines referenced to the selected course. In IMC mode, the line will flash during excessive localizer deviation.
	Glideslope deviation line	AIII approach, IMC	Displayed as horizontal lines referenced to the glideslope reference line. In IMC mode, the line will flash during excessive glideslope deviation. The line is removed below 70 feet radio altitude.

SYMBOL	NAME	MODE	REMARKS
	Ground localizer line	PRI ground, AIII rollout, IMC	Displays localizer deviation as a vertical line below the airplane reference symbol and is referenced to the selected course.
 	VOR1/ADF 1 pointer head and tail VOR2/ADF 2 pointer head and tail	PRI in flight	Indicates bearing to (head) or from (tail) the tuned station.
 	Bearing source annunciations	PRI in flight	Indicates pointer source.
	To/from pointer	PRI in flight, PRI ground	A triangle pointing in the same direction as the selected course indicates a “to” condition. Pointing away from the selected course indicates a “from” condition.
	TO/FROM annunciation	AIII approach, IMC	Displayed below the VOR system source annunciation. Indicates movement to or from a VOR station.
	Runway elevation	AIII approach	Indicates entered runway elevation for 5 seconds after AIII mode is selected or if elevation value is changed during AIII mode operation.

SYMBOL	NAME	MODE	REMARKS
	Runway edge lines	AIII approach	Displayed between 300 and 60 feet radio altitude. The lines are scaled to a width of 200 feet and a length of 8000 feet. Tic marks are displayed at the touchdown aimpoint representing 1050 feet from the runway threshold.
IDLE	IDLE message	AIII approach	Displayed below the radio altitude when flare guidance commands a thrust reduction to idle for touchdown. Message is displayed between 25 to 5 feet radio altitude, depending on airspeed.
ALIGN HUD	ALIGN HUD message	IMC, VMC	Indicates the combiner is not properly aligned with the OHU.
IMC or VMC or AIII	HUD system mode	AIII approach, AIII rollout, IMC, VMC	Indicates current HUD system mode. The PRI mode is not indicated as it is uniquely identifiable by the airspeed and altitude tapes.
AIII	AIII approach status	PRI in flight	A flashing “AIII” indicates availability of AIII approach mode.
AIII or NO AIII		AIII approach	Indicates AIII mode selection once all AIII approach requirements have been satisfied. If AIII capability is lost, the “NO AIII” status message is displayed.

SYMBOL	NAME	MODE	REMARKS
	Approach warning	AIII approach	Displayed below 500 feet if approach monitoring tolerances are exceeded or AIII capability is lost.
	Tail strike warning	PRI in flight, AIII approach, IMC, VMC	Displayed when a tail strike is likely during landing. Tail strike monitoring is active below 100 feet AGL.
	Angle of attack scale and indicator	PRI in flight, AIII approach, IMC, VMC	Displays current angle of attack, stick shaker trip point and approach reference band. Tic marks every 5°. Approach reference band is displayed when flaps are in a landing configuration (15, 30, 40).

TCAS Resolution Advisory

SYMBOL	NAME	MODE	REMARKS
	Down preventive	PRI in flight, AIII approach, IMC, VMC	Area(s) inside the lines indicate the pitch region(s) to avoid in order to resolve the traffic conflict. The flight path symbol should be positioned outside the pitch command area(s) to ensure traffic avoidance. A double-lined box indicates a corrective action is required, and represents TCAS maneuver guidance to maintain or increase separation from the traffic.
	Up preventive		
	Up and down preventive		
	Descend corrective		
	Climb corrective		
	Combined corrective		

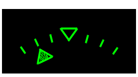
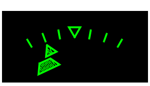
Overrun Warnings

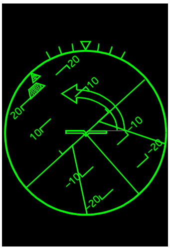
SYMBOL	NAME	MODE	REMARKS
	On-Ground Overrun Warning	PRI in ground, AIII rollout, IMC, VMC	The On-Ground Overrun Warning provides an alert when a runway overrun is likely to occur unless additional deceleration is applied. Refer to Chapter 15, Warning Systems.

SYMBOL	NAME	MODE	REMARKS
GO AROUND	In-Air Overrun Warning	PRI in flight, AIII approach, IMC, VMC	The In-Air Overrun Warning provides an alert when a runway overrun is likely to occur if the approach is continued. Refer to Chapter 15, Warning Systems.
SPEEDBRAKE	Speedbrake warning	PRI in ground, AIII rollout, IMC, VMC	The SPEEDBRAKE warning provides an alert when speedbrakes are not deployed during a landing or rejected takeoff. Refer to Chapter 15, Warning Systems.

Roll Alerting

SYMBOL	NAME	MODE	REMARKS
	Roll/Yaw Asymmetry	PRI in flight, AIII approach, IMC, VMC	Autopilot is engaged in single channel and requires more than 75% of the autopilot roll authority due to unusual asymmetric forces acting on the airplane's longitudinal axis. The ROLL/YAW ASYMMETRY alert: • replaces the active autopilot status annunciation • is replaced with ROLL AUTHORITY when 100% of the autopilot roll authority is required • is replaced by the active autopilot status annunciation when less than 50% of the autopilot roll authority is required

SYMBOL	NAME	MODE	REMARKS
	Roll Authority Alert	PRI in flight, AIII approach, IMC, VMC	Autopilot is engaged in single channel and requires 100% of the autopilot roll authority due to unusual asymmetric forces acting on the airplane's longitudinal axis. The ROLL AUTHORITY alert: • replaces the active autopilot status annunciation • is replaced by the active autopilot status annunciation when less than 100% of the autopilot roll authority is required
	Bank Pointer	PRI in flight, AIII approach, IMC, VMC	With ROLL AUTHORITY alert active the bank pointer will fill if bank angle exceeds 15 degrees.
	Slip/Skid Indicator	PRI in flight, AIII approach, IMC, VMC	With ROLL/YAW ASYMMETRY or ROLL AUTHORITY alert active, slip/skid indication will fill if deflected greater than 25% of its width.

SYMBOL	NAME	MODE	REMARKS
	Roll Command Arrow	PRI in flight, AIII approach, IMC, VMC	The unusual attitude will automatically display when the roll command arrow is shown. The roll command arrow points in the shortest direction to wings level. If the bank angle passes 180 degrees the roll command arrow points in the new shortest direction to wings level. The roll command arrow is shown when bank angle exceeds: • 45 degrees if the pitch attitude is 25 degrees or less • 65 degrees if the pitch attitude is greater than 25 degrees The roll command arrow is removed: • When the bank angle is less than 35 degrees for 2 seconds, or; • Immediately if the bangle is less than 10 degrees

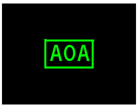
Failure Flags and Data Source Annunciations

SYMBOL	NAME	MODE	REMARKS
ATT	IRS attitude flag	All	IRS pitch or roll attitude has failed.
PITCH	Pitch miscompare flag	All	Indicates a pitch miscompare of greater than 5° for more than 1.5 seconds.
ROLL	Roll miscompare flag	All	Indicates a roll miscompare of greater than 5° for more than 1.5 seconds.
HDG	Heading flag	All	Heading data has failed.
H ---	No heading	All	IRU heading has no computed data.
S P D	Airspeed flag	All	Airspeed information has failed. In PRI mode, if airspeed has no computed data, airspeed data is removed and no failure flag is displayed. The boxed characters are positioned vertically in the PRI mode or horizontally in the AIII, IMC or VMC modes.

SYMBOL	NAME	MODE	REMARKS
ALT	Altitude flag	All	Altitude information has failed. In PRI mode, if altitude has no computed data, altitude data is removed and no failure flag is displayed. The boxed characters are positioned vertically in the PRI mode or horizontally in the AIII, IMC or VMC modes.
NO V SPD	Decision speed flag	PRI ground	V1 decision speed or VR rotation speed has not been entered or is invalid.
SPD LIM	Speed limit flag	PRI in flight, PRI ground	Maximum operating speed data has failed.
MACH	Mach flag	PRI in flight, PRI ground	MACH airspeed has failed.
VS	Vertical speed flag	All	Vertical speed has failed. In AIII, IMC or VMC modes, may also show for no computed data.
--- VS	Vertical speed	PRI in flight	Vertical speed has no computed data.
SEL ALT	Selected altitude flag	PRI in flight, PRI ground	Selected altitude has failed.

SYMBOL	NAME	MODE	REMARKS
SEL SPD	Selected airspeed flag	All	Selected speed has failed.
RA	Radio altitude flag	All	Radio altitude has failed.
LOC CMP	Localizer miscompare flag	PRI in flight PRI ground; AIII rollout	Localizer miscompare has occurred during low visibility takeoff or rollout.
V T K	Vertical deviation flag	PRI in flight, IMC	FMC vertical track data is invalid. Vertical deviation pointer is removed if there is no computed data.
DME	DME flag	All	DME has failed.
DME ---	DME	All	DME has no computed data.
FD	Flight director flag	PRI in flight, PRI ground, IMC	Flight director has failed.
TCAS FAIL	TCAS fault	PRI in flight, AIII approach, IMC, VMC	TCAS has a fault.

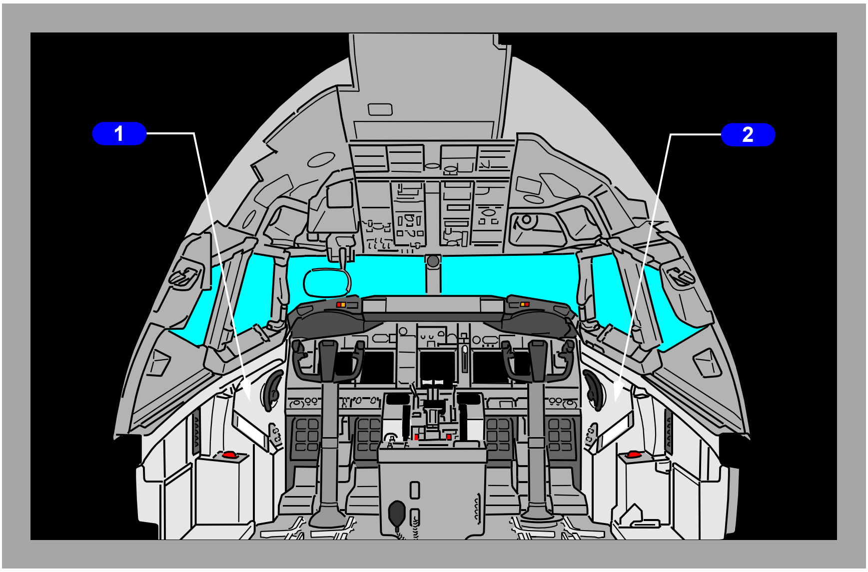
SYMBOL	NAME	MODE	REMARKS
ATT2	Right (#2) IRS source	All	All IRS information used or displayed by the HUD is taken from the right (#2) IRS.
G/S	Glideslope flag	PRI in flight, AIII approach, IMC	ILS has failed.
---	Ground speed	All	Ground speed has no computed data.
LOC	Lateral deviation fault	PRI in flight, PRI ground	ILS has failed.
--- NM	Distance to next waypoint	PRI in flight, AIII approach, IMC, VMC	Distance to next waypoint has no computed data.
DH	Decision height flag	PRI in flight, AIII approach, IMC	Decision height data has failed. Displayed below 1500 feet radio altitude.
VOR	VOR failure flag	PRI in flight, AIII approach, IMC	VOR has failed.

SYMBOL	NAME	MODE	REMARKS
	Angle of attack fault	PRI in flight, AIII approach, IMC, VMC	Loss of valid angle of attack data.

Flight Instruments, Displays — Chapter 10
Electronic Flight Bag (EFB) — Section 65

[Option]

System Components



1 Captain Display Unit

Used for input and display of captain’s pertinent flight information.

2 First Officer Display Unit

Used for input and display of first officer’s pertinent flight information.

System Description

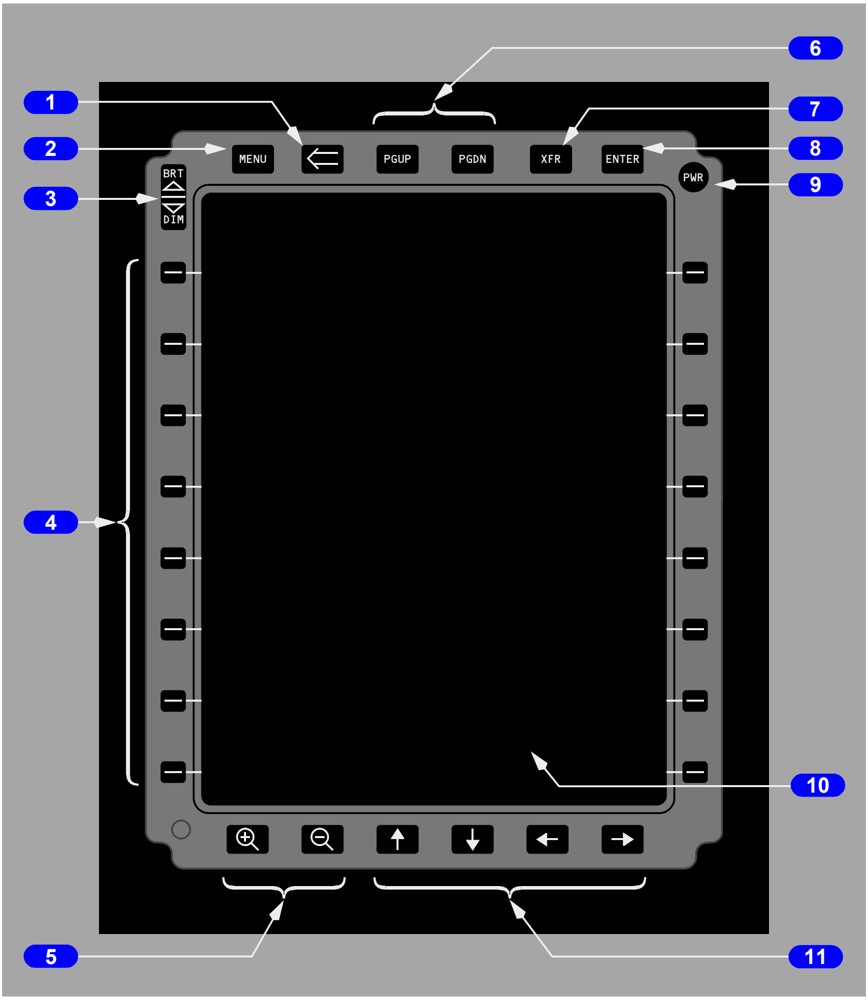
The Electronic Flight Bag (EFB) is a suite of applications designed to assist the flight crew with routine tasks and reduce the reliance on paper documents. The EFB allows flight crews to view pertinent flight data available through interactive display units located on the side panels.

Under typical flight conditions, the pilots manipulate Line Select Keys or the touch screen on a display unit to display data.

The suite of applications available to the flight crew may be customized by airlines. User modifiable portions of each application may be further customized. These customizing options include assigning applications to input keys, revising application names, defining the order in which applications appear, and choosing different colors, fonts, icons and cursors. Descriptions and illustrations provided in this section are examples of a typical Boeing Class 3 Electronic Flight Bag with the standard suite of applications installed, plus Electronic Log Book (ELB), and may not reflect the exact installed configuration.

Note: Line select keys and compass roses are company selectable. Key functions and map orientations may not always match those shown in this manual.

Display Unit



1 Back Key

Returns to the previous level.

2 Main Menu (MENU) key

Displays MAIN MENU.

- Cancels transfer mode [XFR].

3 Bright (BRT) Dim (DIM) Control

Rocker switch, upper portion brighter, lower portion dimmer.

4 Line Select Keys

Selects item next to key.

5 Zoom Keys

Left key is zoom in, right is zoom out. Repeated selection increases or decreases the zoom level.

6 Page Up (PGUP)/Page Down (PGDN) Keys

Moves up or down within an application where the display exceeds one display screen in length.

7 Transfer (XFR) Key

- View other pilot's EFB display on this display
- XFR displays in green text on upper right
- Selections made off-side are seen on the on-side display in real time
- XFR key (second push) exits transfer and returns display to last view prior to selecting XFR
- MENU key exits transfer and displays the MAIN MENU
- While XFR is selected, all other keys/switches are non-functional except PWR and MENU.

8 Enter (ENTER) Key

Activates a high-lighted item when applicable.

9 Power (PWR) Switch

Turns the display backlight on or off.

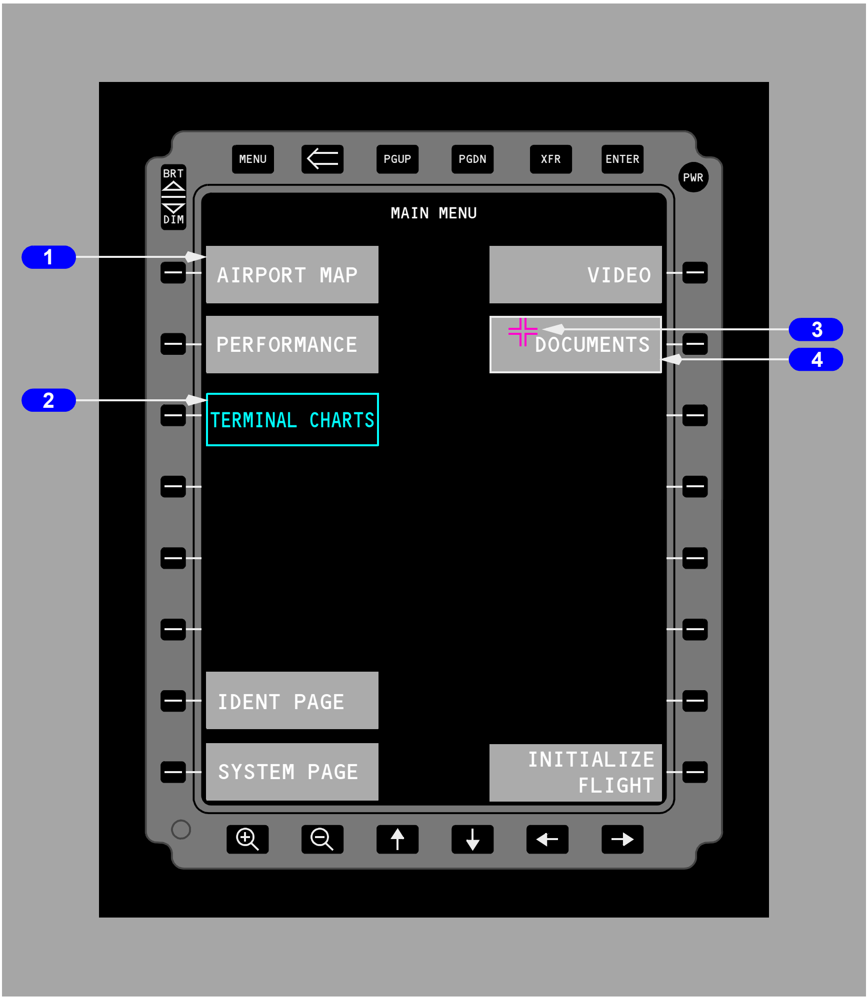
10 Touch sensitive screen

Enables direct selection on the display screen, and in some applications panning and scrolling.

11 Arrow Keys

Moves the viewing window over the display in the direction of the selected arrow.

Display Description



1 Selectable Applications (Soft Keys)

Menu items for selectable applications display in white text with gray background. Items may be selected using the Line Select Keys (Hard Keys) or touch screen (Soft Keys).

2 Applications not selectable

Menu items for applications that are installed but are not selectable display in cyan text in a cyan box. An application may be initializing and may become selectable later.

3 Cursor

A magenta cursor appears on the display when the SIDE switch is selected on a cursor control device.

4 High-light Box

A white high-light box displays around a selectable application when:

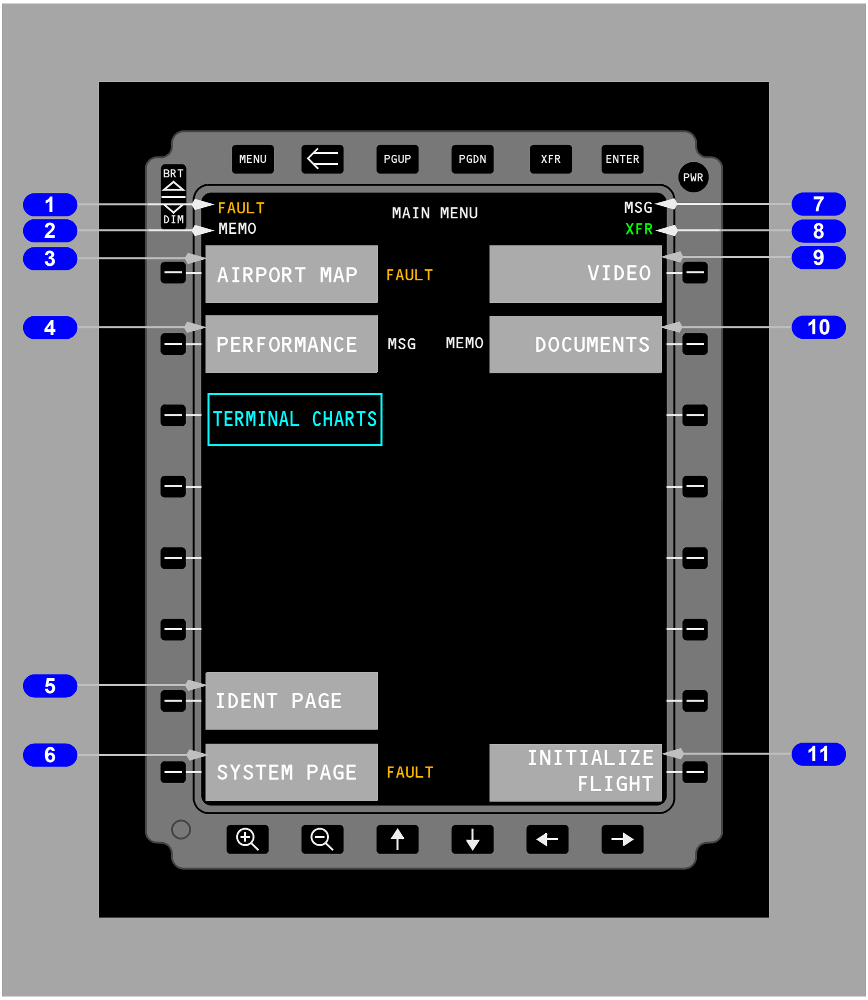
- The cursor is moved over the menu item
- The selectable menu item is touched
- The associated line select key is selected.

A selectable application is selected when:

- It is high-lighted with the cursor and the cursor select switch is pushed
- A menu item is touched and released
- The associated line select key is selected.

The menu item for a selected application displays a green background momentarily and then the selection displays.

Main Menu



1 FAULT

Displayed (amber) -

- A fault has occurred within an application
- Displays in the header regardless of the application displayed
- Displays next to the affected application on the MAIN MENU
- Removed from header upon selection of the SYSTEM page and the fault is acknowledged.

Only one message at a time may display next to an application. FAULT takes priority over MEMO and MSG. MEMO or MSG display as applicable after the fault is cleared.

2 MEMO

Displayed (white) -

- One or more applications need attention
- Displays in the header regardless of the application displayed
- Displays next to the affected application on the MAIN MENU.

3 AIRPORT MAP Application

Selects the AIRPORT MAP application.

- After flight initialization, displays the departure airport in HDG-UP (heading up) mode when on the ground at the departure airport
- Displays the destination airport NORTH UP when in the air.

3 AIRPORT MAP Application

Selects the AIRPORT MAP application.

- After flight initialization, displays the departure airport in TRK-UP (track up) mode when on the ground at the departure airport
- Displays the destination airport NORTH UP when not on the ground.

4 PERFORMANCE Application

Selects the PERFORMANCE application.

- After flight initialization, displays the takeoff performance page
- Computes takeoff and landing performance based on user inputs
- Subsequent selections of the application display the selection that was in view when the application was last exited.

5 IDENT PAGE

Displays the IDENT page.

6 SYSTEM PAGE

Displays the SYSTEM page.

7 MSG

Displayed (white) -

- One or more applications has an uplink available
- Displays in the header regardless of the application displayed
- Displays next to the affected application on the main menu. Takes priority over MEMO.

8 **XFR**

Displayed (green) -

- The display is in transfer mode
- No line select keys/switches except MENU, PWR, and XFR are enabled.

9 **VIDEO Application**

Displays views from surveillance cameras.

10 **DOCUMENTS Application**

Selects the DOCUMENTS application

- After flight initialization, displays the documents library
- Subsequent selections of the application display the selection that was in view when the application was last exited.

11 **INITIALIZE FLIGHT/CLOSE FLIGHT**

Initializes all the installed applications for flight

- Performs cyclic redundancy checks of the hardware and software and shows EFB readiness for flight. If a fault was noted on the MAIN MENU, the reason will be displayed on the SYSTEM PAGE
- Clears search results of all previous searches in all applications
- All applications and functions restored to default settings
- Cross loads from FMC applicable data if it has been entered in the FMC
- Menu changes to CLOSE FLIGHT
- CLOSE FLIGHT is not selectable (cyan) during flight.

At the completion of the flight, the crew should close the EFB and prepare it for use by the next crew.

Select the CLOSE FLIGHT key from the MAIN MENU. This action cleans up the application data, effectively deleting all flight specific information from EFB memory. This includes all airport specific information, CHART CLIP data, and performance entries.

Close flight removes the following flight specific information from the EFB:

- ROUTE SETUP page
- CHART CLIP
- Performance pages
- History
- Bookmarks

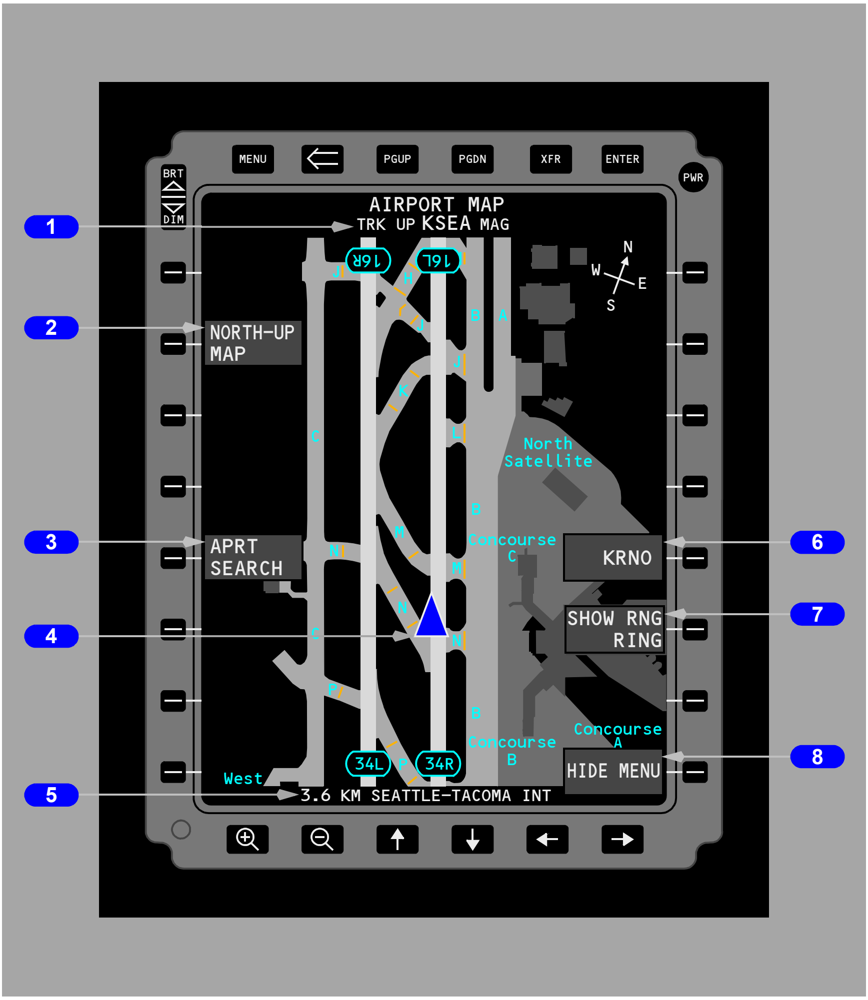
Note: If you do not see CLOSE FLIGHT on the MAIN MENU page, someone has already closed out the flight in the EFB.

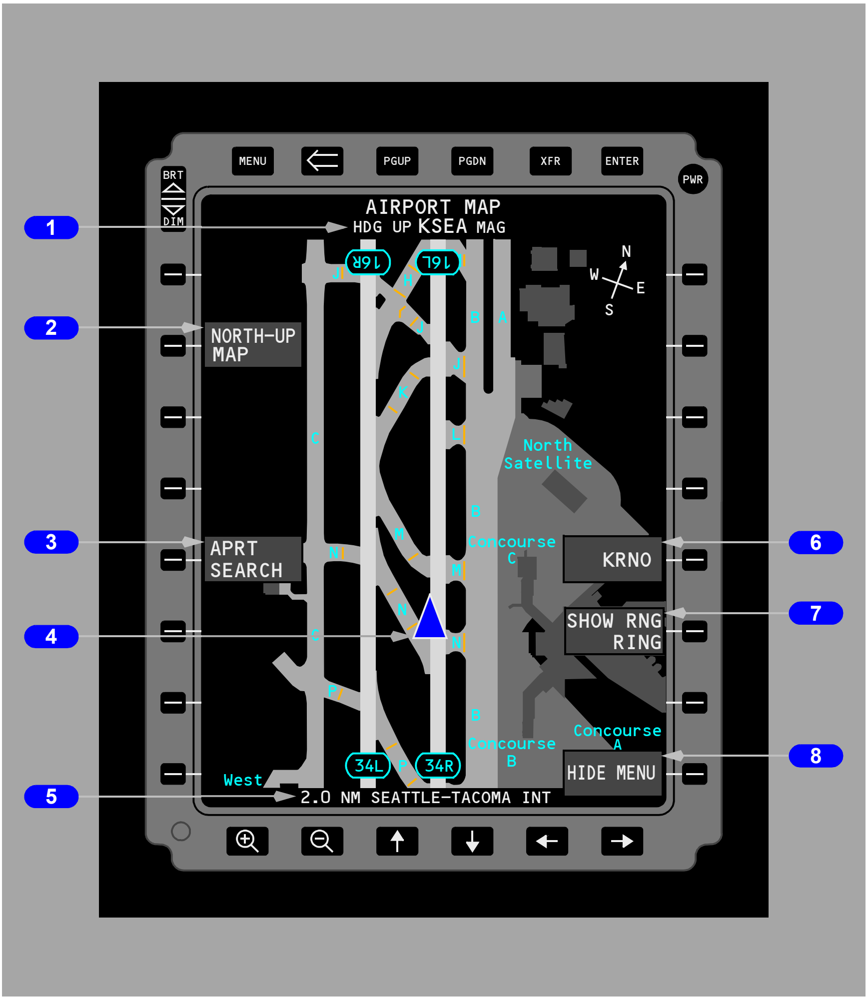
Airport Maps (Typical)

The maps are based on precise survey of airport geometry by satellite and other means. There may be differences between the electronic airport map and the airport diagrams that are part of the terminal charts, since these charts are derived from different survey methods.

Airport Track Up and Heading Up (moving) Maps

The airplane symbol remains stationary and the map moves to provide the location and orientation of the airplane relative to the map.




MENU
PGUP
PGDN
XFR
ENTER
BRT
DIM
PWR
AIRPORT MAP
HDG UP KSEA MAG
NORTH-UP
MAP
APRT
SEARCH
KRNO
SHOW RNG
RING
HIDE MENU
2.0 NM SEATTLE-TACOMA INT
16R
16L
34L
34R
North
Satellite
Concourse
C
Concourse
B
Concourse
A
West
N
W
E
S
1
2
3
4
5
6
7
8

1 Map Reference

Displays the map reference.

- HDG-UP (heading up) and MAG (magnetic).
- TRK-UP (track up) and MAG (magnetic).

2 NORTH-UP MAP

Selects north up (static) map display.

3 Airport (APRT) SEARCH

Allows searching the database for other airport maps.

4 Airplane symbol

Displays when airplane is on the ground at the displayed airport and groundspeed is less than 40 knots.

5 Display range

Indicates the map range from top to bottom of the display.

6 Airport Identifier

When departure airport is displayed, identifier is destination airport if entered in FMC.

- Selection displays the destination airport in HDG-UP (moving map) mode when on the ground at the destination airport
- Selection displays the destination airport in TRK-UP (moving map) mode when on the ground at the destination airport
- Displays the destination airport in NORTH UP (static) mode when in the air.

When destination airport is displayed, identifier is departure airport.

7 SHOW/HIDE Range (RNG) RING

Displays or removes a 300 meter radius range ring around the airplane symbol.

7 SHOW/HIDE Range (RNG) RING

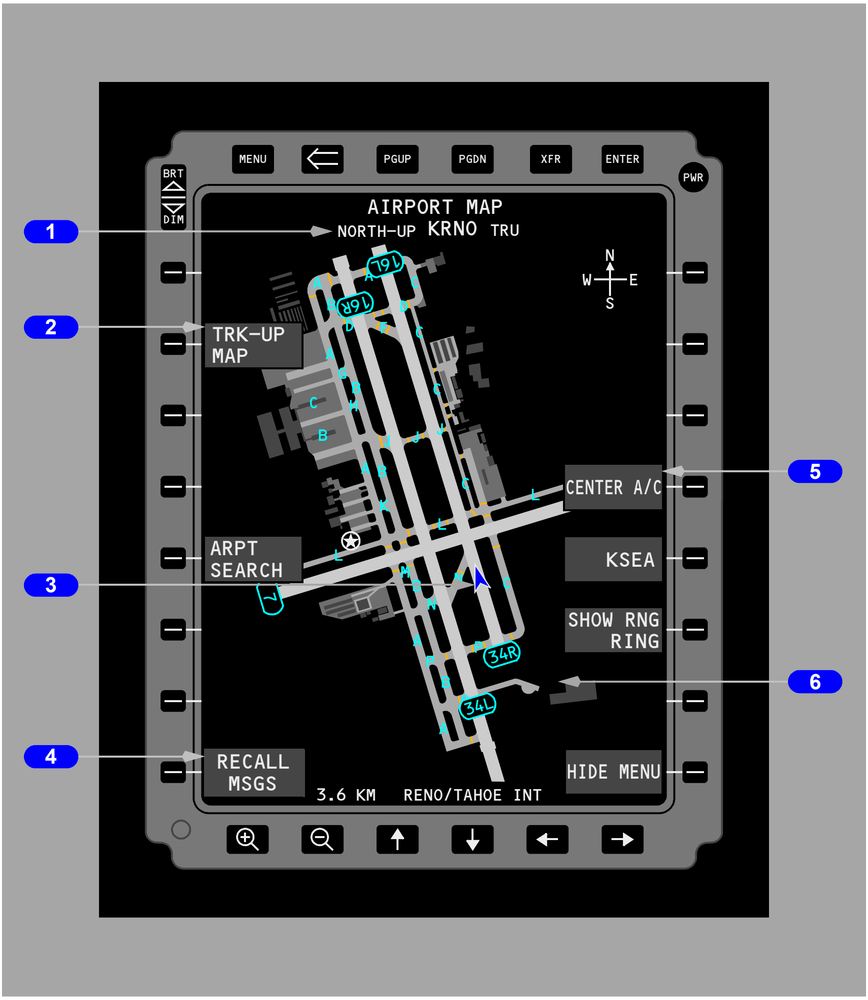
Displays or removes a 1000 foot radius range ring around the airplane symbol.

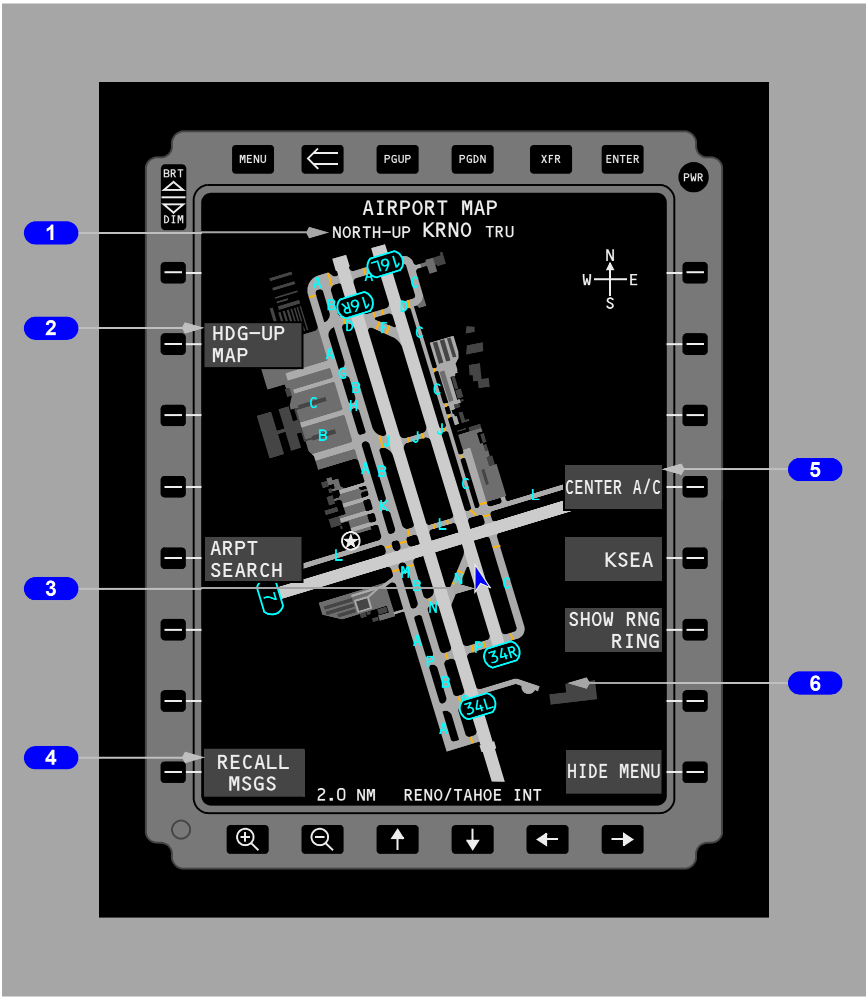
8 SHOW/HIDE MENU

Displays or hides all other menu selections.

Airport North Up (static) Map

The airplane symbol moves on a stationary map showing the airplanes general location and orientation on the ground at the selected airport. Using the touch screen to “touch and drag”, or using the arrow keys, the map may be repositioned on the display.




MENU
PGUP
PGDN
XFR
ENTER
PWR
BRT
DIM
AIRPORT MAP
NORTH-UP KRNO TRU
HDG-UP
MAP
ARPT
SEARCH
RECALL
MSGS
CENTER A/C
KSEA
SHOW RNG
RING
HIDE MENU
2.0 NM RENO/TAHOE INT
16L
16R
34R
34L
N
W
E
S
1
2
3
4
5
6

1 Map reference

Displays the map reference

- NORTH UP
- TRU (true) heading.

2 HDG-UP MAP

Selects heading up moving map display.

2 TRK-UP MAP

Selects track up moving map display.

3 Airplane Symbol

Displays when airplane is on the ground at the displayed airport and groundspeed is less than 40 knots.

4 CANCEL/RECALL MSGS (Messages)

Toggles between Cancel and Recall when map faults exist

- CANCEL removes fault messages from the display
- RECALL re-displays fault messages.

The menu item is inhibited when there are no faults to display.

5 CENTER A/C

Centers airplane symbol horizontally and vertically on the display.

6 Map fault message display area

Amber fault messages display in this area. More than one message may display at a time.

Faults may appear on both NORTH-UP and HDG-UP displays.

Faults may appear on both NORTH-UP and TRK-UP displays.

Fault	NORTH-UP	HDG-UP
ADIRU DATA (ADIRU data is lost or invalid.)	Airplane symbol is removed.	Airplane symbol is removed. Map freezes on position and last known heading.
GPS DATA (GPS position data is lost or invalid.)	Airplane symbol is removed.	Airplane symbol is removed. Map freezes on heading and last known position.
UNABLE POS ACCURACY (GPS position accuracy limits are exceeded. Inhibited by GPS DATA and when in flight.)	Airplane symbol is removed.	Airplane symbol is removed. Map freezes on heading and position

Fault	NORTH-UP	TRK-UP
ADIRU DATA (ADIRU data is lost or invalid.)	Airplane symbol is removed.	Airplane symbol is removed. Map freezes on position and last known heading.
GPS DATA (GPS position data is lost or invalid.)	Airplane symbol is removed.	Airplane symbol is removed. Map freezes on heading and last known position.
UNABLE POS ACCURACY (GPS position accuracy limits are exceeded. Inhibited by GPS DATA and when in flight.)	Airplane symbol is removed.	Airplane symbol is removed. Map freezes on heading and position

Airport Search

Airport search allows the search and display of other airport maps. Keypad operation for entering, clearing, and deleting characters is the same as with the FMS CDU. All EFB applications that have a search function use an identical keypad and scratchpad in the lower half of the respective search display.

1 SEARCH IDENT

Initiates a search of the ident data base using the scratchpad entry.

2 SEARCH ALL

Initiates a search of the data base using the scratchpad entry.

3 Scratchpad

4 SYMB/NUM key

Alternates between SYMB and NUM.

- SYMB displays symbols on the keypad
- NUM displays numbers on the keypad.

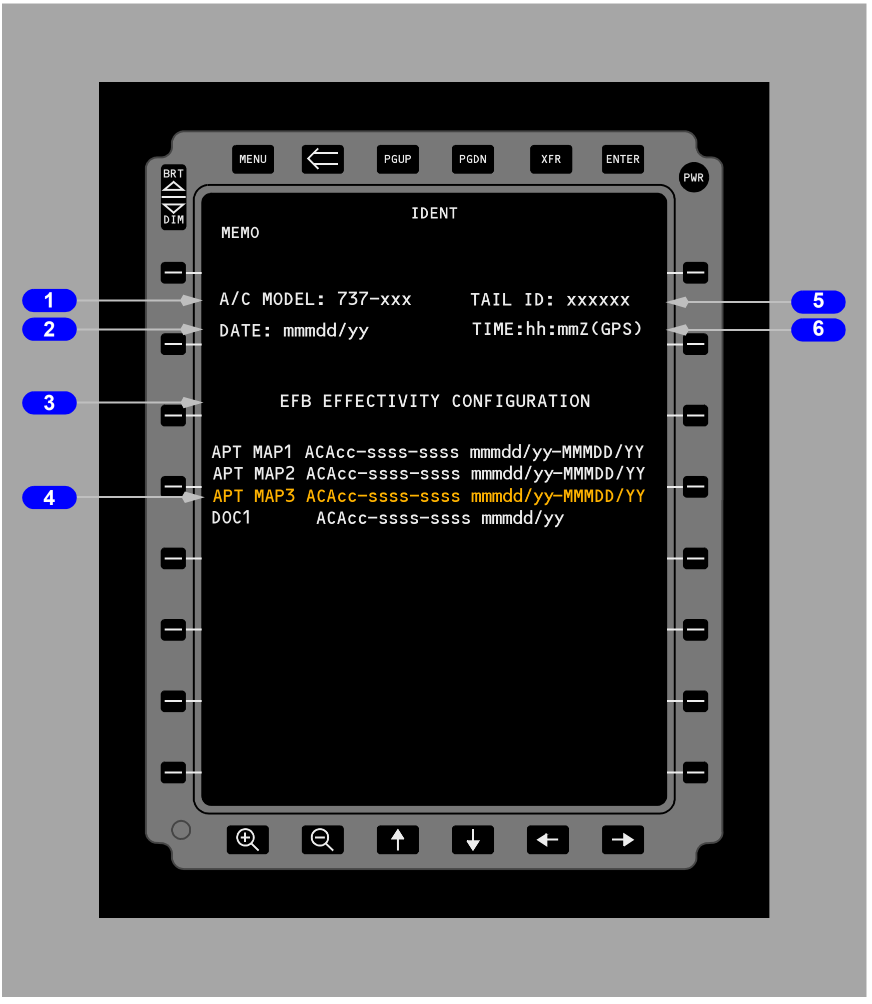
5 SHIFT key

Changes letter keys between upper case and lower case.

6 Airport Identifier

The results of the airport search are displayed here. Selecting the airport displays the airport map in North Up mode.

IDENT page


MENU
PGUP
PGDN
XFR
ENTER
PWR
BRT
DIM
IDENT
MEMO
A/C MODEL: 737-xxx
TAIL ID: xxxxxx
DATE: mmmdd/yy
TIME:hh:mmZ(GPS)
EFB EFFECTIVITY CONFIGURATION
APT MAP1 ACAcc-ssss-ssss mmmdd/yy-MMMDD/YY
APT MAP2 ACAcc-ssss-ssss mmmdd/yy-MMMDD/YY
APT MAP3 ACAcc-ssss-ssss mmmdd/yy-MMMDD/YY
DOC1 ACAcc-ssss-ssss mmmdd/yy
1
2
3
4
5
6

1 A/C MODEL

Display of aircraft model.

2 DATE

Display of current date.

3 EFB EFFECTIVITY CONFIGURATION

Display of effectivity dates for loaded databases.

4 Out of date data base (amber)

An out of date database displays in amber. MEMO displays in the header on all pages and next to affected applications on the Main Menu page.

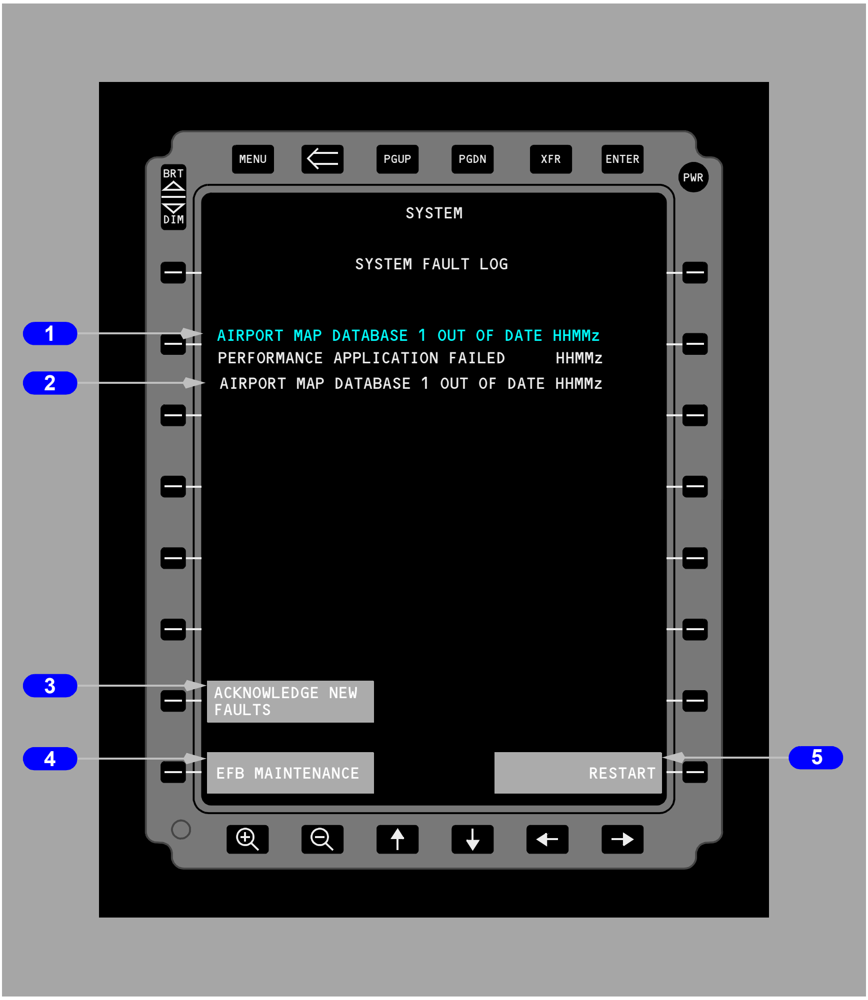
5 TAIL ID

Display of tail identification number.

6 TIME

Display of time and source of time.

SYSTEM page


MENU
PGUP
PGDN
XFR
ENTER
PWR
BRT
DIM
SYSTEM
SYSTEM FAULT LOG
AIRPORT MAP DATABASE 1 OUT OF DATE HHMMz
PERFORMANCE APPLICATION FAILED HHMMz
AIRPORT MAP DATABASE 1 OUT OF DATE HHMMz
ACKNOWLEDGE NEW FAULTS
EFB MAINTENANCE
RESTART
1
2
3
4
5

1 Acknowledged fault

Fault information is displayed in cyan.

2 Un-acknowledged fault

Fault information is displayed in white.

3 ACKNOWLEDGE NEW FAULTS

- Becomes selectable when there are un-acknowledged faults
- Selection acknowledges all new faults
- Selection removes FAULT on MAIN MENU next to SYSTEM.

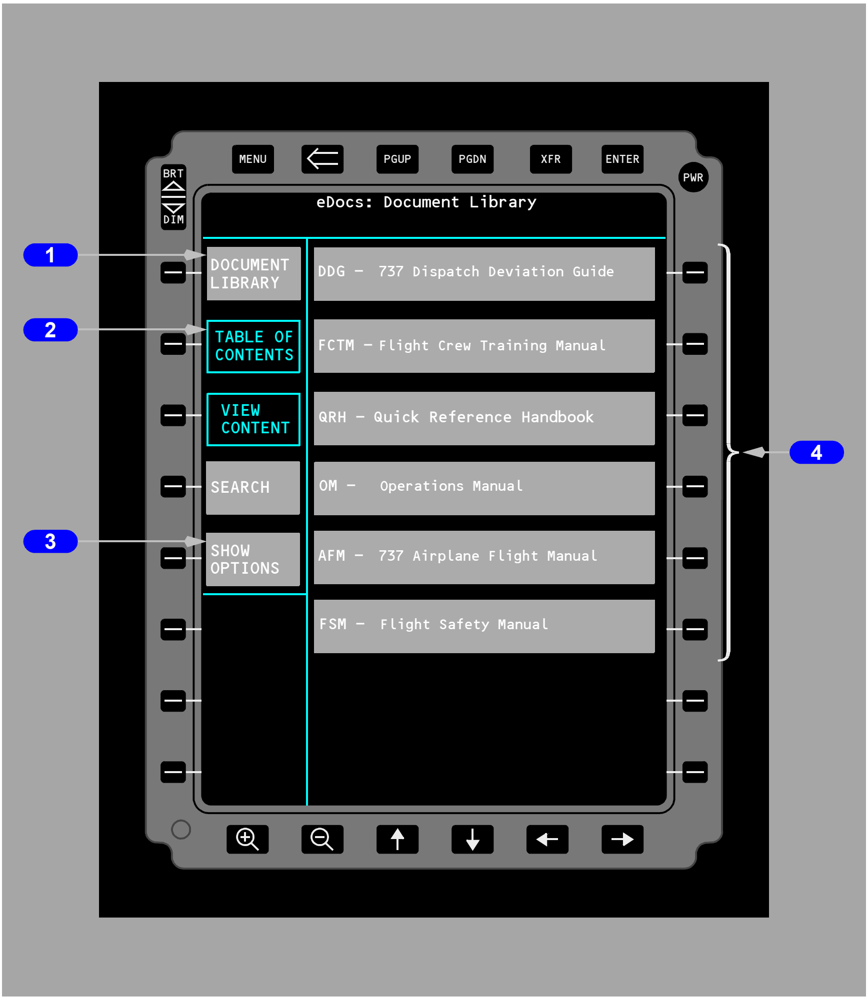
4 EFB MAINTENANCE

Provides access to the maintenance menu page.

5 RESTART

Re-initializes Windows applications.

Documents (Typical)



1 Application functions

- Functions for this application display along the left side
- Selectable functions display with gray background.

2 Functions not selectable

Functions that are not selectable display in cyan. In this example the TABLE OF CONTENTS function is not selectable because no document is selected. Once a document is selected, the function turns white with gray background and is selectable.

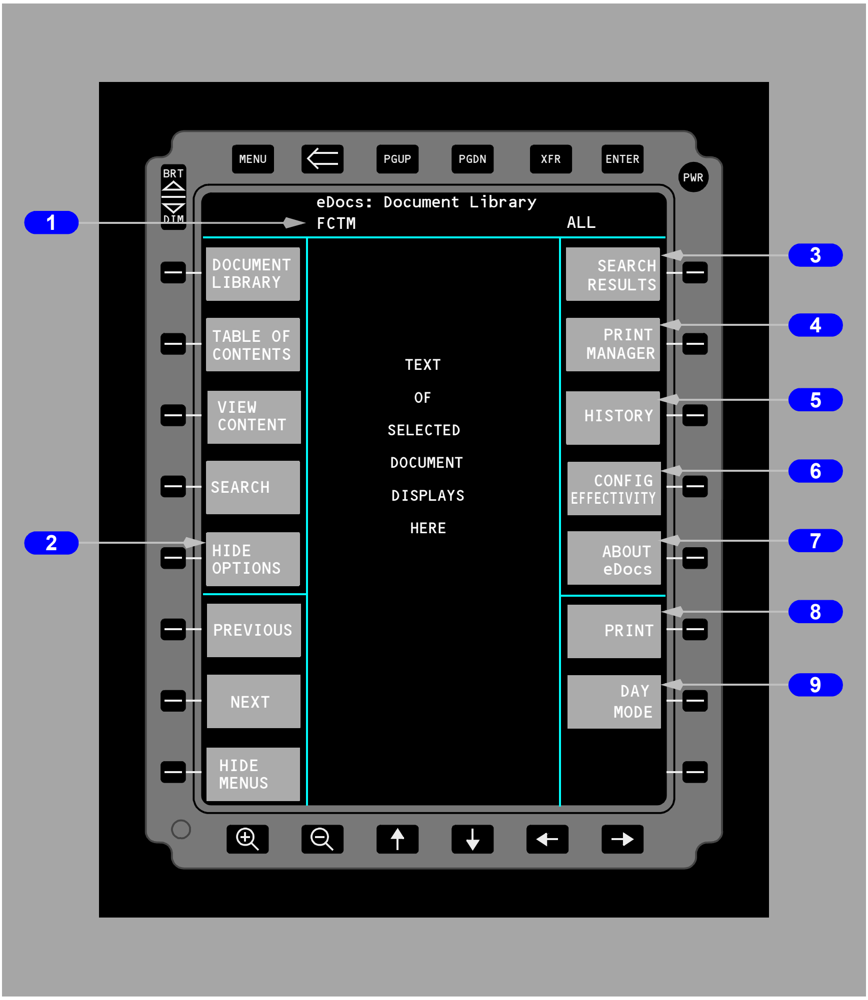
3 SHOW OPTIONS

- Displays a list of options along the right side of the display
- Menu changes to HIDE OPTIONS.

4 Selectable documents

Displays a list of the installed and selectable documents.

FCTM (Selected document)



1 Selected document

Selected documents display their acronym in the header below the application title. The area is blank when no document is selected.

2 HIDE OPTIONS

- Removes the list of options from the right side of the display
- Menu is replaced with SHOW OPTIONS.

3 SEARCH RESULTS

Displays a list of results as links, based on a search of a particular manual.

4 PRINT MANAGER

Displays all pending print jobs.

5 HISTORY

Displays a list of entries as links for information previously displayed in the VIEW CONTENTS screen.

6 CONFIG EFFECTIVITY

A selectable list of all the configurations supported by the manual (if applicable).

7 ABOUT eDocs

Contains the latest application version information.

8 PRINT

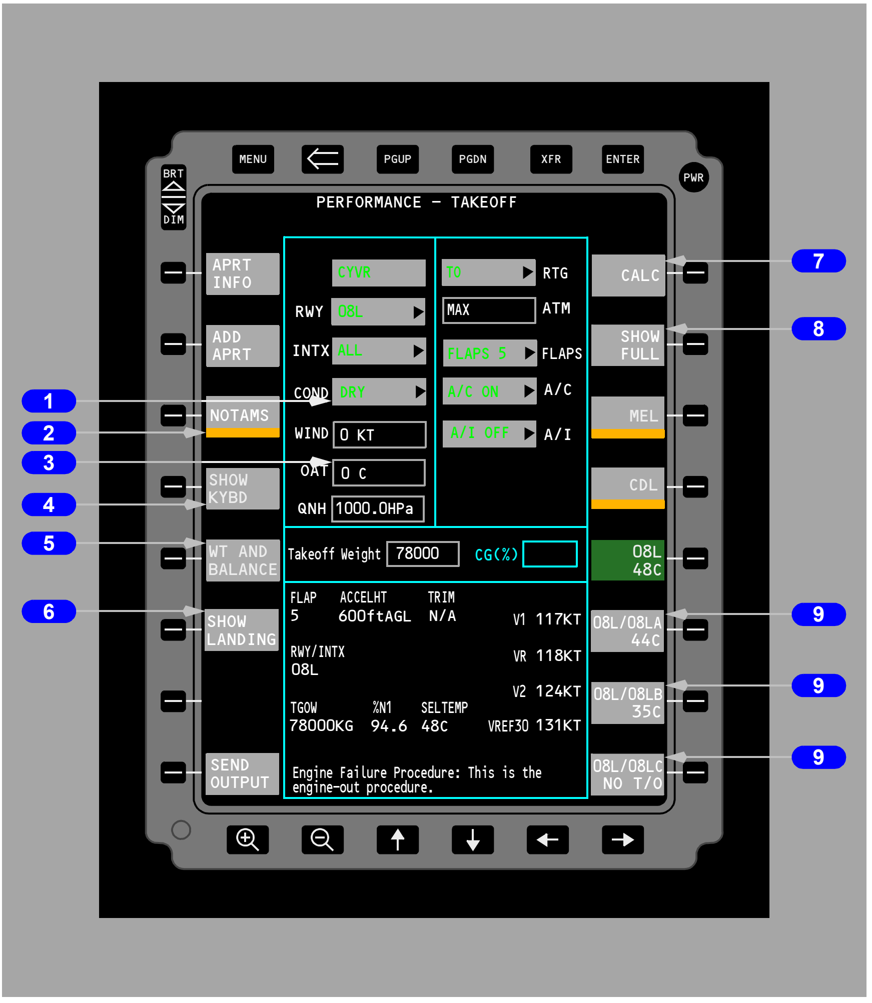
Information displayed in the VIEW CONTENTS screen is printed on the flight deck printer (if applicable).

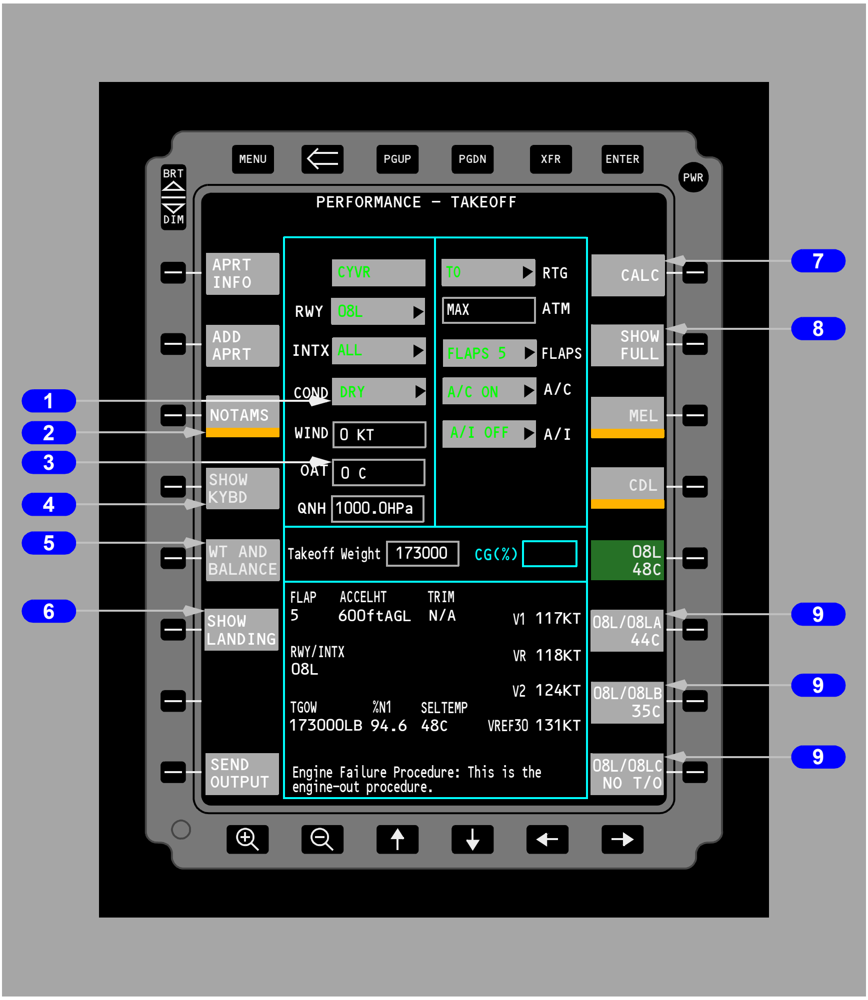
9 DAY/NIGHT MODE

Selects either day or night mode.

- DAY - dark text on a light background
- NIGHT - light text on a dark background.

Performance (Typical)




MENU
PGUP
PGDN
XFR
ENTER
BRT
DIM
PWR
PERFORMANCE – TAKEOFF
APRT INFO
ADD APRT
NOTAMS
SHOW KYBD
WT AND BALANCE
SHOW LANDING
SEND OUTPUT
CYVR
RWY 08L
INTX ALL
COND DRY
WIND 0 KT
OAT 0 C
QNH 1000.0HPa
TO RTG
MAX ATM
FLAPS 5 FLAPS
A/C ON A/C
A/I OFF A/I
CALC
SHOW FULL
MEL
CDL
08L 48C
Takeoff Weight 173000 CG(%)
FLAP 5
ACCELHT 600ftAGL
TRIM N/A
V1 117KT
RWY/INTX 08L
VR 118KT
V2 124KT
TGOW 173000LB
%N1 94.6
SELTEMP 48C
VREF30 131KT
Engine Failure Procedure: This is the engine-out procedure.
08L/08LA 44C
08L/08LB 35C
08L/08LC NO T/O
1
2
3
4
5
6
7
8
9
9
9

1 DRY (green)

- DRY has been selected for the runway condition
- Triangle in right side of menu indicates a list of options exists
- Selection display the options.

2 NOTAMS

- May be used to enter temporary data
- Amber bar displays across menu when data has been entered.

3 Data field

Boxes display for fields that require data entry.

4 SHOW KYBD (Keyboard)

Displays a touch sensitive keyboard at the bottom of the page that is used for data entry.

5 WT (Weight) AND BALANCE

Displays the weight and balance page.

6 SHOW LANDING

Displays the landing page.

7 CALC (Calculate)

- Cyan - data has not been entered in all required fields
- White - all required fields have data.

Selection initiates the calculation of takeoff data.

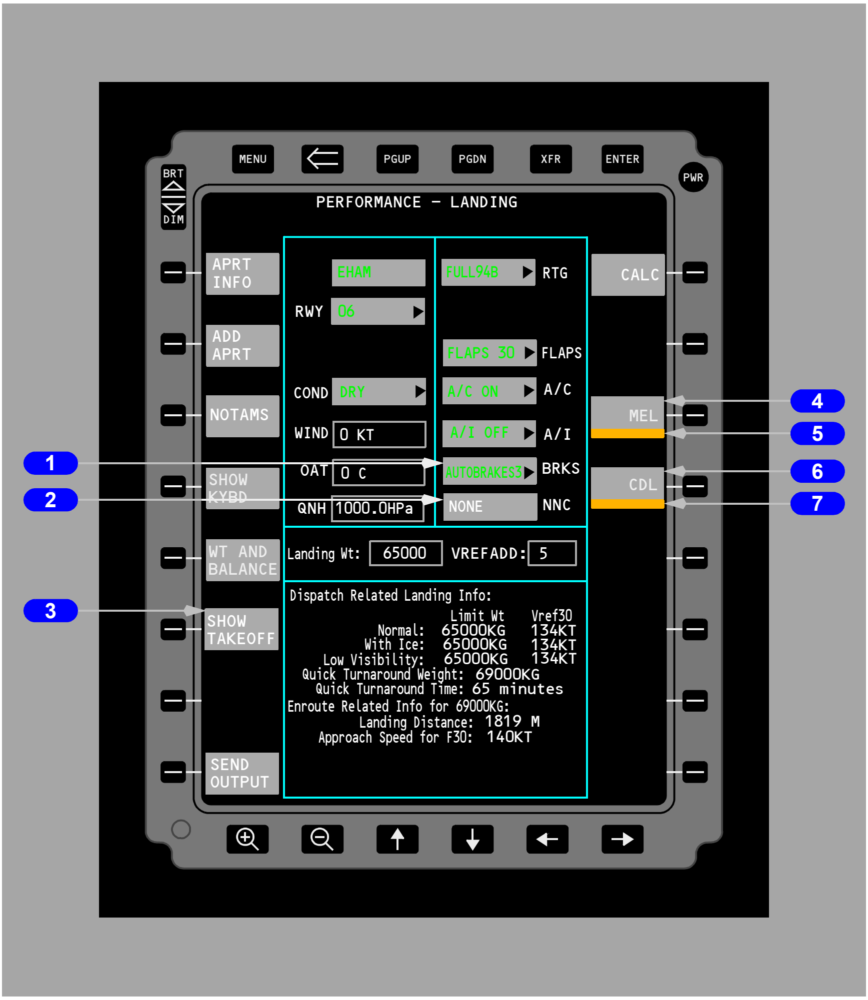
8 SHOW FULL

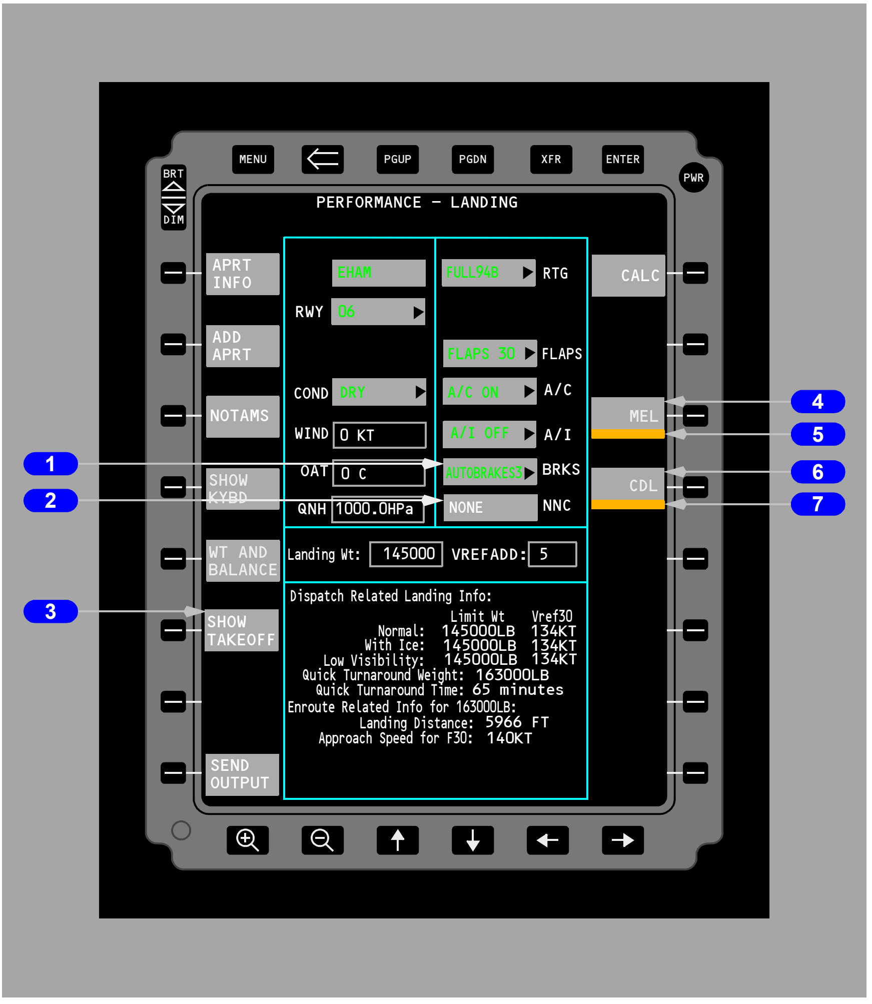
Selection displays full thrust data for the airport/runway entered.

9 Intersection Takeoff Options

- Intersection takeoff options display on the right side when ALL is selected for INTX (intersection)
- Selection displays takeoff data for the selected intersection.

Landing


MENU
PGUP
PGDN
XFR
ENTER
PWR
BRT
DIM
PERFORMANCE - LANDING
APRT INFO
ADD APRT
NOTAMS
SHOW KYBD
WT AND BALANCE
SHOW TAKEOFF
SEND OUTPUT
EHAM
RWY 06
COND DRY
WIND 0 KT
OAT 0 C
QNH 1000.0HPa
FULL94B RTG
FLAPS 30 FLAPS
A/C ON A/C
A/I OFF A/I
AUTOBRAKES3 BRKS
NONE NNC
CALC
MEL
CDL
Landing Wt: 65000
VREFADD: 5
Dispatch Related Landing Info:
Limit Wt Vref30
Normal: 65000KG 134KT
With Ice: 65000KG 134KT
Low Visibility: 65000KG 134KT
Quick Turnaround Weight: 69000KG
Quick Turnaround Time: 65 minutes
Enroute Related Info for 69000KG:
Landing Distance: 1819 M
Approach Speed for F30: 140KT
1
2
3
4
5
6
7


MENU
PGUP
PGDN
XFR
ENTER
BRT
DIM
PWR
PERFORMANCE - LANDING
APRT INFO
ADD APRT
NOTAMS
SHOW KYBD
WT AND BALANCE
SHOW TAKEOFF
SEND OUTPUT
EHAM
RWY 06
COND DRY
WIND 0 KT
OAT 0 C
QNH 1000.0HPa
FULL94B RTG
FLAPS 30 FLAPS
A/C ON A/C
A/I OFF A/I
AUTOBRAKES3 BRKS
NONE NNC
CALC
MEL
CDL
Landing Wt: 145000 VREFADD: 5
Dispatch Related Landing Info:
Limit Wt Vref30
Normal: 145000LB 134KT
With Ice: 145000LB 134KT
Low Visibility: 145000LB 134KT
Quick Turnaround Weight: 163000LB
Quick Turnaround Time: 65 minutes
Enroute Related Info for 163000LB:
Landing Distance: 5966 FT
Approach Speed for F30: 140KT
1
2
3
4
5
6
7

1 BRKS (Brakes)

Selection of a brake setting is required for in-flight landing calculations, not dispatch calculations.

2 NNC

Selection is required for in-flight calculations, not dispatch calculations.

3 SHOW TAKEOFF

Displays the takeoff page.

4 MEL

Displays MEL page.

5 Amber bar

Indicates an active MEL item exists that will be considered in the calculations.

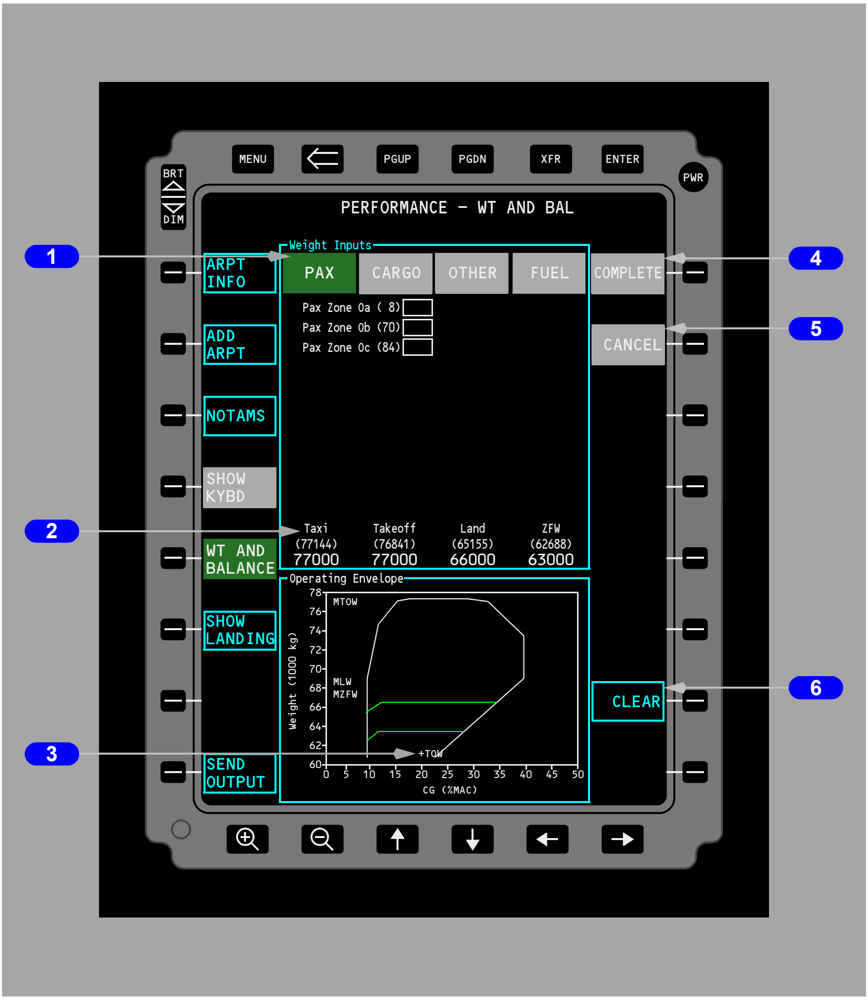
6 CDL

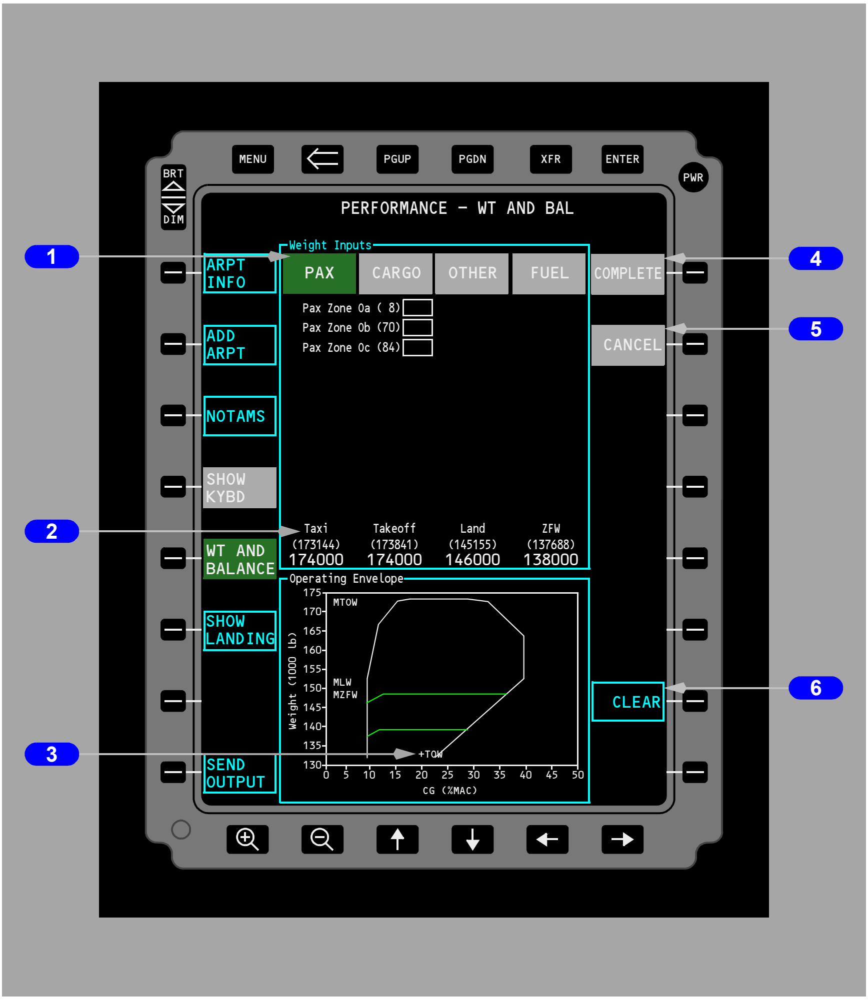
Displays the CDL page.

7 Amber bar

Indicates an active CDL item exists that will be considered in the calculations.

Weight and Balance




MENU
PGUP
PGDN
XFR
ENTER
PWR
BRT
DIM
PERFORMANCE - WT AND BAL
Weight Inputs
ARPT INFO
PAX
CARGO
OTHER
FUEL
COMPLETE
Pax Zone 0a (8)
Pax Zone 0b (70)
Pax Zone 0c (84)
ADD ARPT
CANCEL
NOTAMS
SHOW KYBD
Taxi
Takeoff
Land
ZFW
(173144)
(173841)
(145155)
(137688)
174000
174000
146000
138000
WT AND BALANCE
Operating Envelope
SHOW LANDING
MTOW
MLW
MZFW
Weight (1000 lb)
CLEAR
SEND OUTPUT
+TOW
CG (%MAC)
1
2
3
4
5
6

1 PAX/CARGO/OTHER/FUEL

Displays applicable input screen.

2 Aircraft weights

- Initially displays airplane operating empty weight
- Updates as data fields are filled.

3 +TOW

Symbol displays airplane CG relative to the CG limits.

4 COMPLETE

Selection loads the takeoff page with the calculated takeoff gross weight and CG.

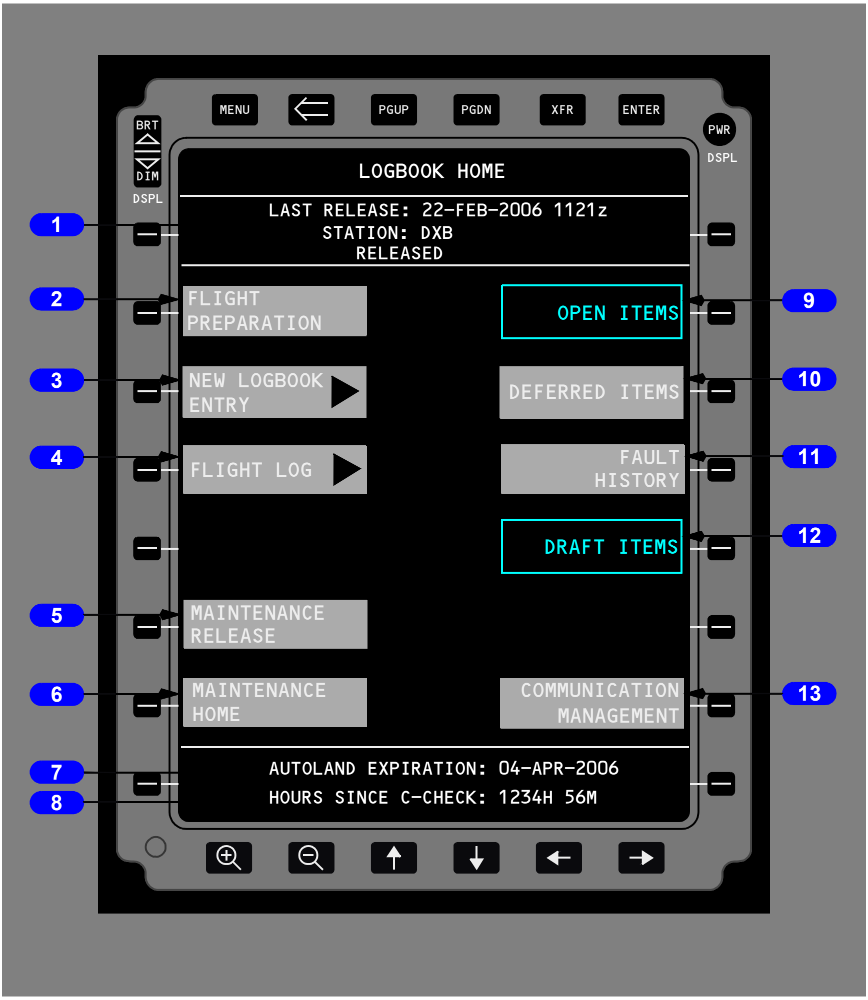
5 CANCEL

Clears all entries and returns to the takeoff page.

6 CLEAR

Clears all entries.

Electronic Log Book (ELB Typical)
LOGBOOK page



1 Release Information

- Date and time of last release for flight
- Station where the last release occurred
- Current state of the airplane.

2 FLIGHT PREPARATION

Starts a guided process that prepares a flight log to document the upcoming flight. This function is intended to be used prior to flight.

3 NEW LOGBOOK ENTRY

Documents observed faults into the logbook. Uses a graphical fault finder tool that navigates through a series of images to identify selection of a fault. The purpose is to find the appropriate fault description and have it associated with the respective Fault Reporting Manual (FRM) fault code.

4 FLIGHT LOG

Displays the flight log for the current flight.

5 MAINTENANCE RELEASE

The maintenance release form has 2 pages plus a summary page. The first page includes information such as comments and release date. The second page allows the maintenance crew to document any restrictions associated with this release. Before a release can be signed, the user is required to review the summary page 3 contents of the maintenance release.

6 MAINTENANCE HOME

The purpose of the maintenance home page is to provide maintenance crews a summary of the maintenance status of the airplane (release status, open & deferred item counts) and quick access to the maintenance functions. This page is accessible only when the airplane is in ground mode.

7 AUTOLAND EXPIRATION

Displays the date and time the autoland currency expires.

8 HOURS SINCE C-CHECK

Displays the hours and minutes since the last C-check was accomplished.

9 OPEN ITEMS

Displays all open faults that have been documented for this airplane. It also includes any expired deferrals.

10 DEFERRED ITEMS

Displays all deferred faults reported for the airplane. On this page the user can view a brief description, the expiration of the deferral and an indication if any Maintenance (M) or Operational (O) procedures related to this deferral exist.

11 FAULT HISTORY

Lists all fault reports for the aircraft. It provides a description of the fault report plus the time it was reported and the current status. This list is organized by the DATE/TIME field.

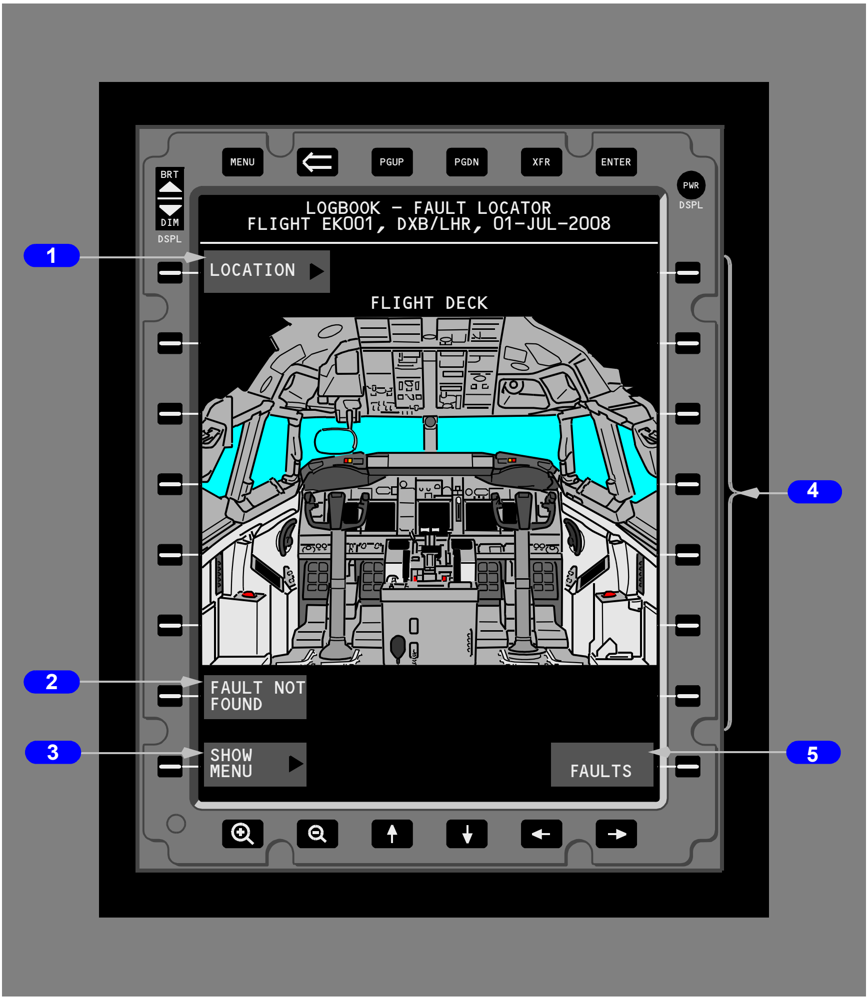
12 DRAFT ITEMS

Provides the user with a view of all fault reports that have been created but not signed for official entry into the logbook. If a record has not been signed the user will have a choice of either signing the report to make it an official record, modify, or delete.

13 COMMUNICATION MANAGEMENT

Select to receive and send messages to the ground databases. All messages are sent over a secure link to ensure the integrity of the information.

Electronic Log Book (Fault Locator)



1 **LOCATION**

Displays a list of airplane areas (Flight Deck, Engine, Exterior, etc.) for use in locating an area where a fault has occurred.

2 **FAULT NOT FOUND**

Displays a blank fault report form for the user to complete. This is required when a fault can not be found in the selected area.

3 **SHOW/HIDE MENU**

Toggle button to either show or hide the extended menu selections.

4 **Panel Selection Area**

Selection of line select keys within the brackets navigates through a series of images to help identify a fault. The purpose is to narrow the search area to find the appropriate fault code.

5 **VIEW FAULTS**

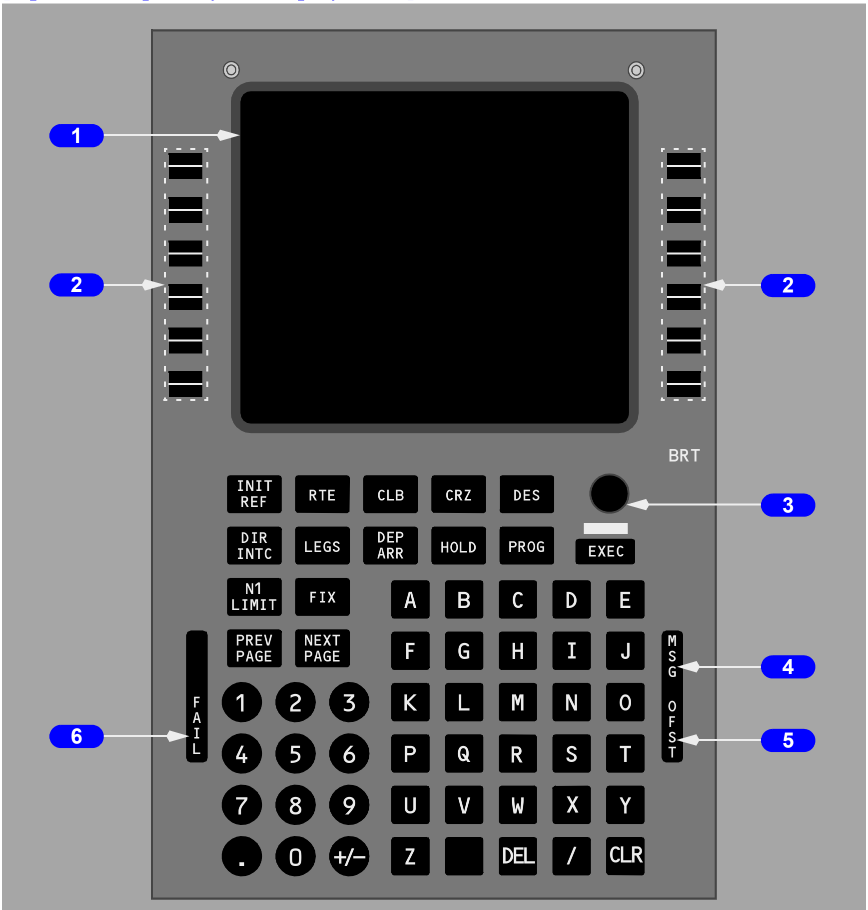
Displays a list of all faults associated with the region displayed. The more the region is narrowed by selecting specific areas within a graphic, the fewer faults are returned.

Intentionally
Blank

Flight Management, Navigation — Chapter 11
Table of Contents — Section TOC

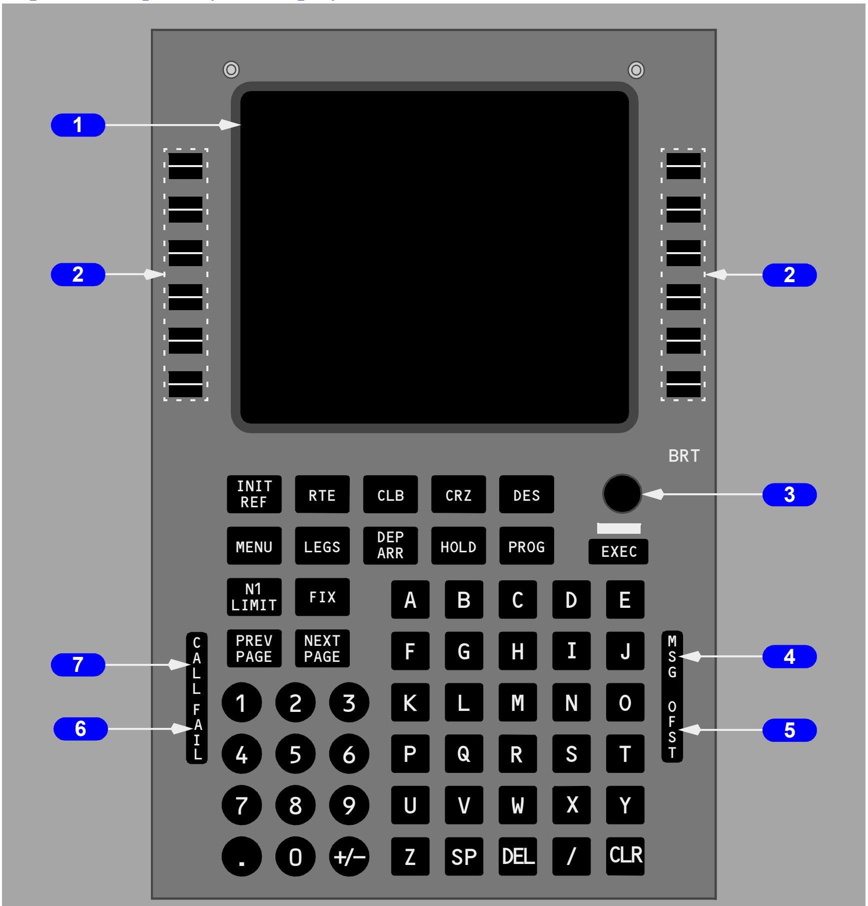
Flight Management System Control Display Unit (CDU)

[Option – Liquid crystal display CDU]



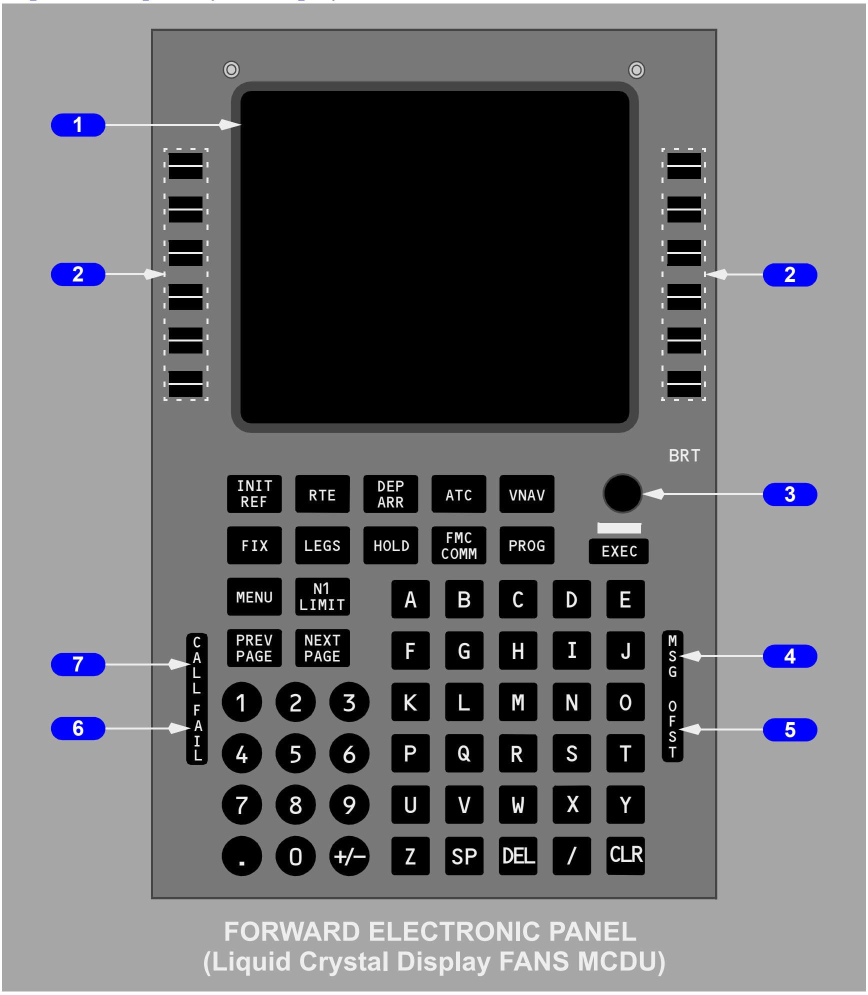
FORWARD ELECTRONIC PANEL
(Liquid Crystal Display CDU)

[Option – Liquid crystal display MCDU]



FORWARD ELECTRONIC PANEL
(Liquid Crystal Display MCDU))

[Option – Liquid crystal display FANS MCDU]



1 **Control Display Unit (CDU) Display**

Shows FMS data pages.

2 **Line Select Keys**

Push –

- moves data from scratchpad to selected line
- moves data from selected line to scratchpad
- selects page, procedure, or performance mode as applicable
- deletes data from selected line when DELETE is shown in scratchpad.

3 Brightness Control

Rotate – controls display brightness.

4 Message (MSG) Light

Illuminated (white) – scratchpad message is shown.

5 Offset (OFST) Light

Illuminated (white) – LNAV gives guidance for lateral route offset.

[Option – CDU with single FMC]
6 FAIL Light

Illuminated (amber) – the FMC has failed.

[Option – MCDU]
6 FAIL Light

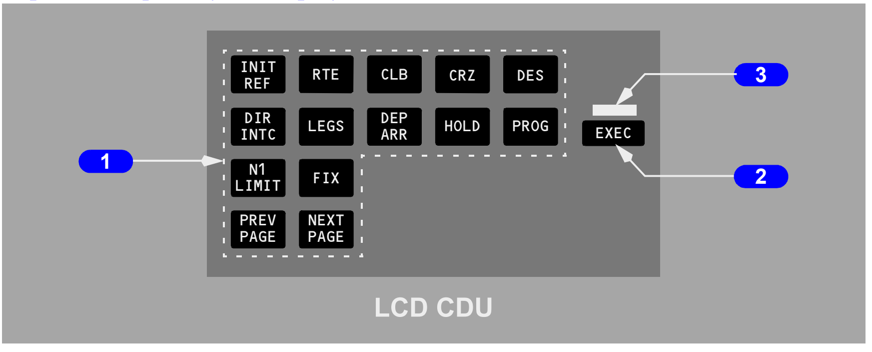
Illuminated (amber) for test purposes only. The MCDU FAIL lamp will not illuminate for an FMC failure.

[Option – MCDU]
7 CALL Light

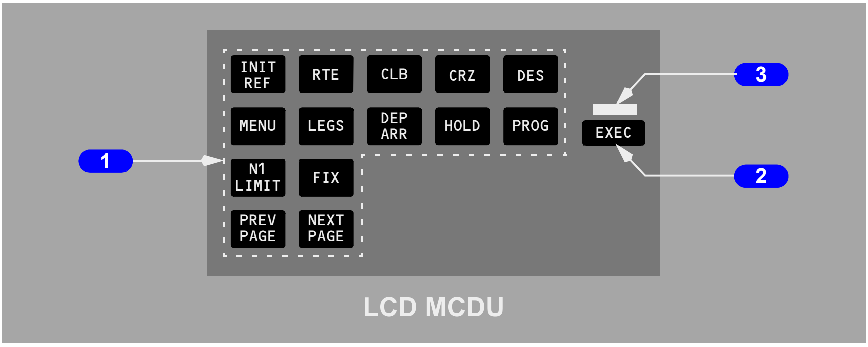
Illuminated (white) – a subsystem other than the FMC is requesting control of the CDU.

Function and Execute Keys

[Option – Liquid crystal display CDU]



[Option – Liquid crystal display MCDU]



1 CDU Function Keys

Push –

- INIT REF – shows page for data initialization or for reference data
- RTE – shows page to input or change origin, destination, or route
- CLB – shows page to view or change climb data
- CRZ – shows page to view or change cruise data
- DES – shows page to view or change descent data

[Option – CDU]

- DIR INTC – shows page to modify route to fly directly from present position to any waypoint or to intercept any course to any waypoint

[Option – MCDU]

- MENU – shows page to choose subsystems controlled by CDU
- LEGS –
  - shows page to evaluate or modify lateral and vertical data
  - shows page to control PLAN mode display
- DEP ARR – shows page to input or change departure and arrival procedures
- HOLD – shows page to create holding patterns and show holding pattern data
- PROG – shows page to view dynamic flight and navigation data, including waypoint and destination ETAs, fuel remaining, and arrival estimates
- N1 LIMIT – shows page to view or change N1 thrust limits
- FIX – shows page to create reference points on map display
- PREV PAGE – shows previous page of related pages (for example, LEGS pages)
- NEXT PAGE – shows next page of related pages.

2 Execute (EXEC) Key

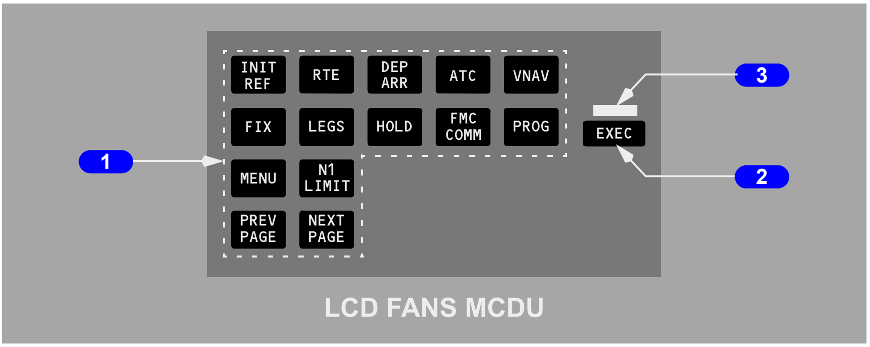
Push –

- makes data modification(s) active
- extinguishes execute light.

3 Execute Light

Illuminated (white) – active data is modified but not executed.

[Option – Liquid crystal display FANS MCDU]



1 CDU Function Keys

Push –

- INIT REF – shows page for data initialization or for reference data
- RTE – shows page to input or change origin, destination, or route
- DEP ARR – shows page to input or change departure and arrival procedures
- ATC – inoperative (scratchpad message KEY/FUNCTION INOP displayed)

[Option – With ATC data link]
- ATC – displays appropriate ATC page.
- VNAV –
  - shows currently active performance page (CLB, CRZ, DES)
  - CLB page is displayed if no active phase exists
- FIX – shows page to create reference points on map display
- LEGS –
  - shows page to evaluate or modify lateral and vertical route data
  - shows page to control PLAN mode display
- HOLD – shows page to create holding patterns and show holding pattern data

- FMC COMM – inoperative (scratchpad message KEY/FUNCTION INOP displayed)

[Option – With AOC data link]
- FMC COMM – displays FMC COMM status page.
- PROG – shows page to view dynamic flight and navigation data, including waypoint and destination ETAs, fuel remaining, and arrival estimates
- MENU – shows page to choose subsystems controlled by CDU
- N1 LIMIT – shows page to view or change N1 thrust limits
- PREV PAGE – shows previous page of related pages (for example, LEGS pages)
- NEXT PAGE – shows next page of related pages.

2 Execute (EXEC) Key

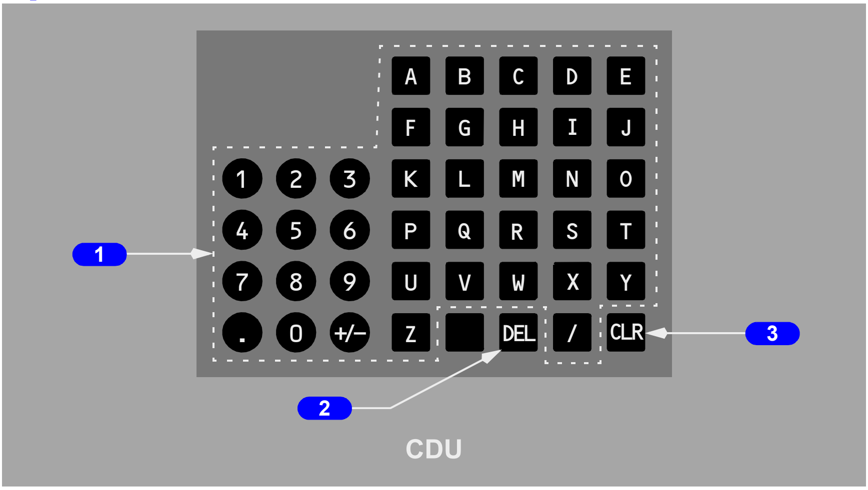
Push –
- makes data modification(s) active
- extinguishes execute light.

3 Execute Light

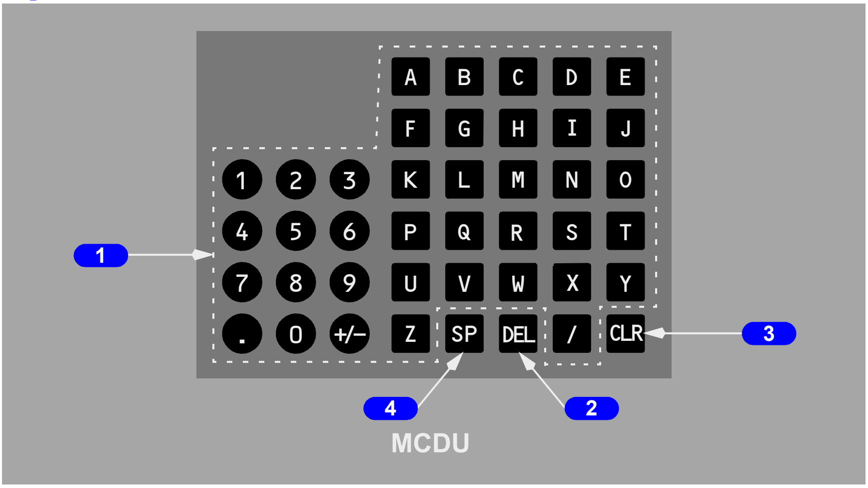
Illuminated (white) – active data is modified but not executed.

Alpha/Numeric and Miscellaneous Keys

[Option – CDU]



[Option – MCDU]



1 Alpha/Numeric Keys

Push –

- puts selected character in scratchpad
- Slash (/) key – puts "/" in scratchpad
- Plus Minus (+/–) key – first push puts "–" in scratchpad. Subsequent pushes alternate between "+" and "–".

2 Delete (DEL) Key

Push – puts DELETE in scratchpad.

3 Clear (CLR) Key

Push –

- clears the last scratchpad character
- clears scratchpad message.

Push and hold – clears all scratchpad data.

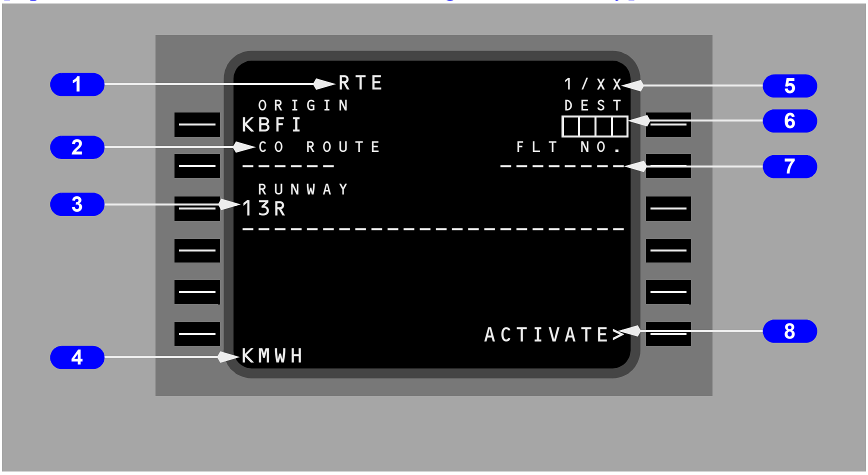
[Option – MCDU]

4 Space (SP) Key

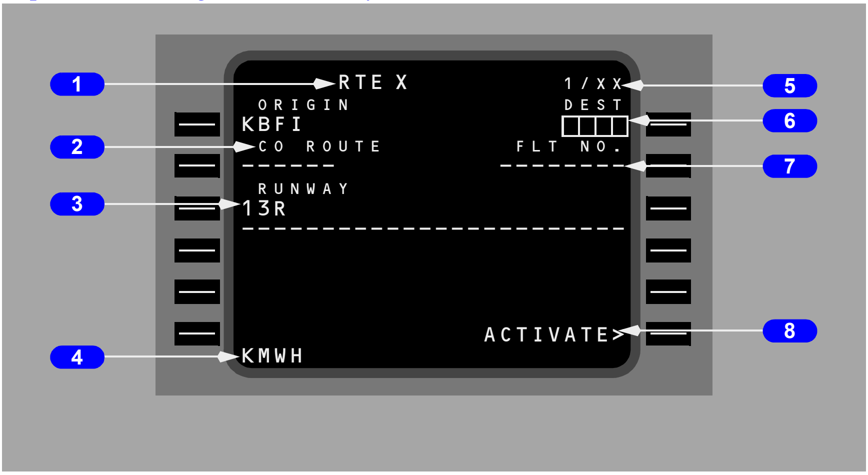
Push – puts space in scratchpad.

CDU Page Components

[Option – FMC U10.3 to U10.8A with flight number entry]



[Option – With flight number entry]



1 Page Title

Subject or name of data shown on page.

ACT (active) or MOD (modified) shows whether page contains active or modified data.

2 Line Title

Title of data on line below.

3 Line

Shows –

- prompts
- selections
- options
- data.

4 Scratchpad

Shows messages, alpha–numeric entries or line selected data.

5 Page Number

Left number is page number. Right number is total number of related pages.

6 Boxes

Data input is mandatory.

7 Dashes

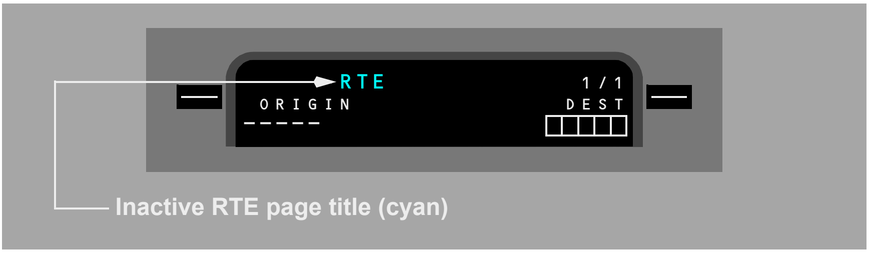
Data input is optional. The data is not mandatory.

8 Prompts

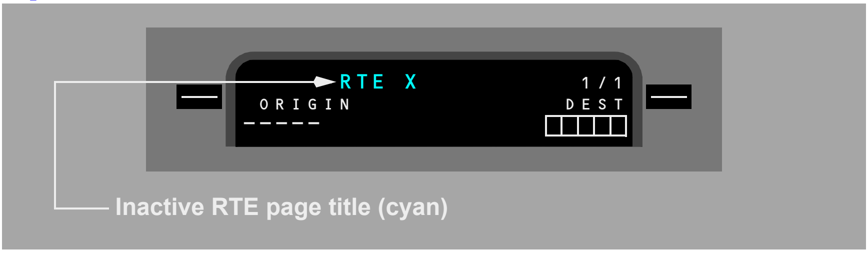
Show pages, select modes, and control displays. Caret “<” or “>” is before or after prompt.

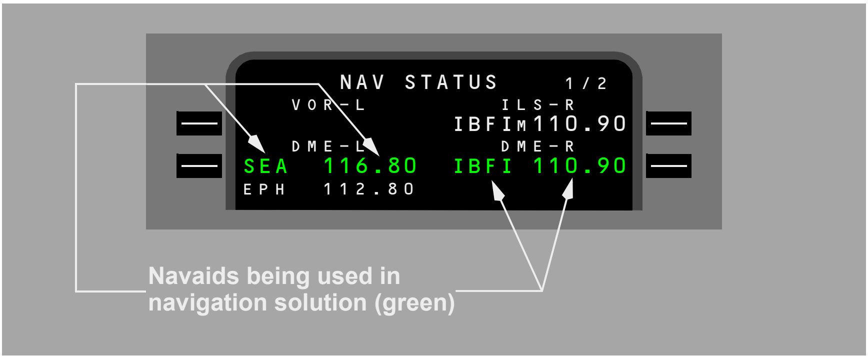
CDU Page Color

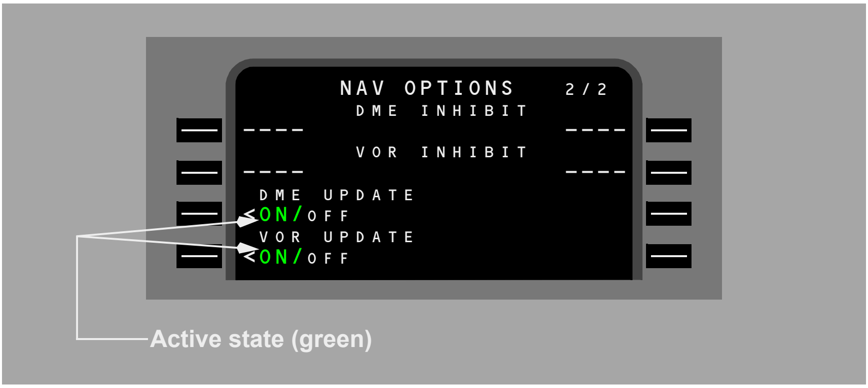
[Option]

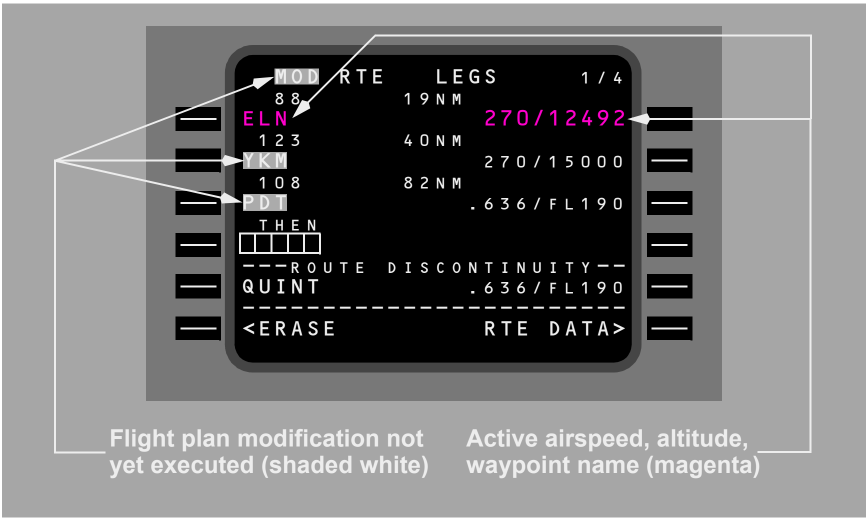


[Option – FMC U11.0 and later]

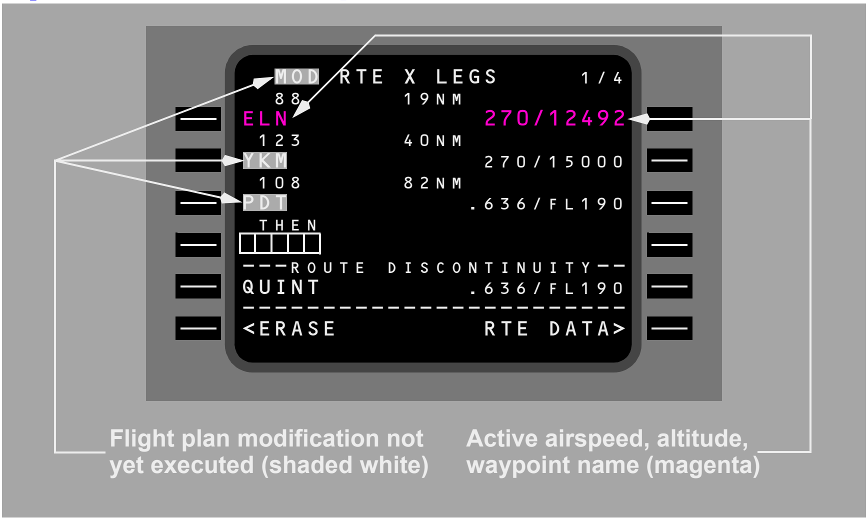




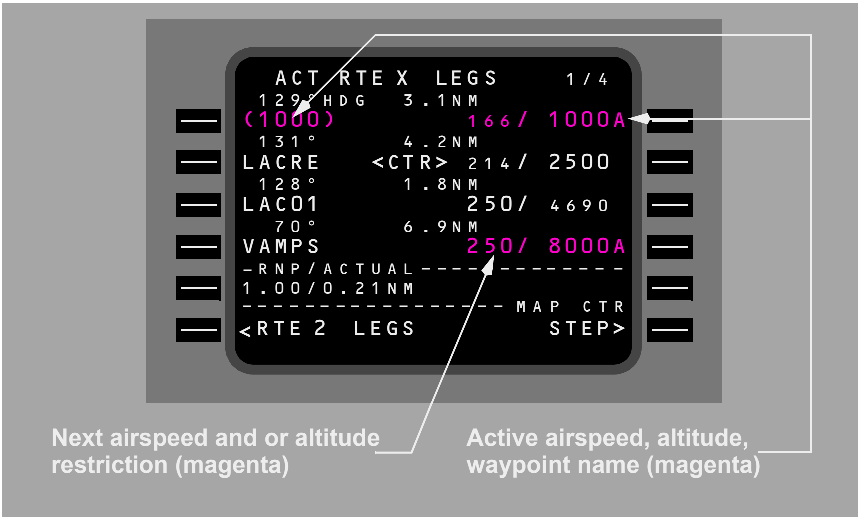


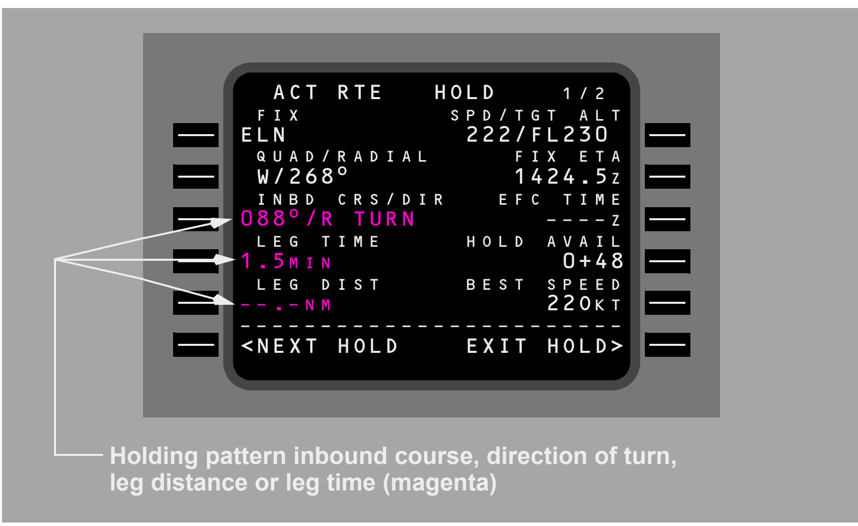


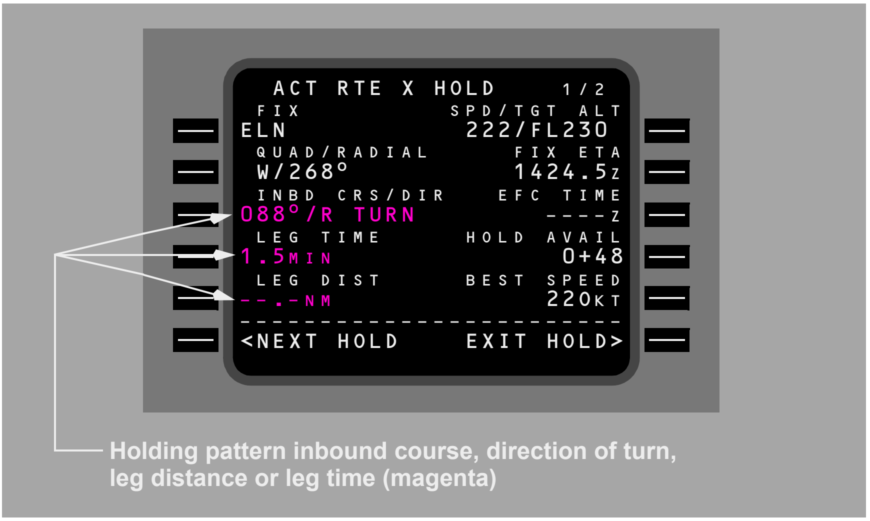
[Option – FMC U11.0 and later]



[Option – FMC U11.0 and later]







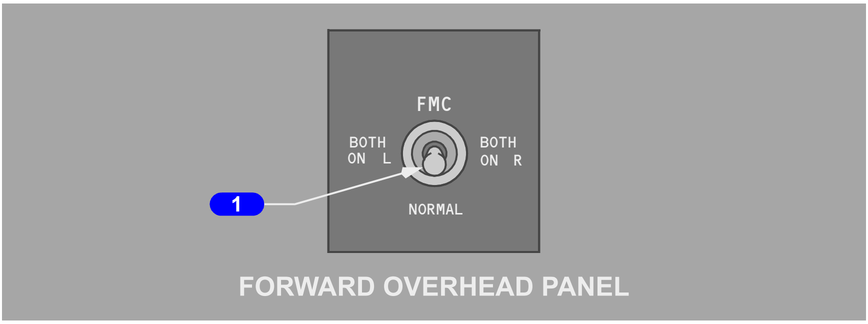
Color is used as follows:

- black – background color of page
- cyan –
  - inactive RTE, RTE LEGS and RTE HOLD page titles
- green –
  - actively tuned VOR, ILS, or DME data (frequency, station ID, course)
  - active state of two–position and three–position selectors.
- magenta – data used by FMC for lateral and vertical flight commands
  - active waypoint
  - active airspeed
  - active altitude
  - holding pattern inbound course, direction of turn, and leg time or leg distance

  [Option – FMC U11.0 and later]
  - speed and or altitude restrictions targeted next, restriction may be several waypoints down the route from the active waypoint
- shaded white –
  - modifications
  - MOD precedes page titles of modified pages
- white – most data

FMC Source Select Switch

[Option – Dual FMC]



1 FMC Source Select Switch

BOTH ON L –

- selects left FMC for all FMC operations
- right map will annunciate “FMC L.”

NORMAL –

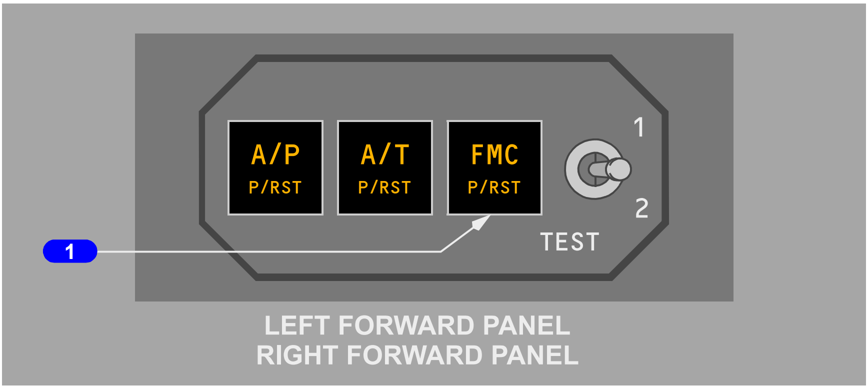
- left FMC controls CDUs and provides input to the autothrottle system
- right FMC operates in synchronization with left FMC
- maps display composite information from both FMCs

BOTH ON R –

- selects right FMC for all FMC operations
- left map will annunciate “FMC R.”

Note: Moving the source select switch will cause LNAV and VNAV to disengage.

FMC Alert Light



1 FMC Alert Light

Illuminated (amber) –

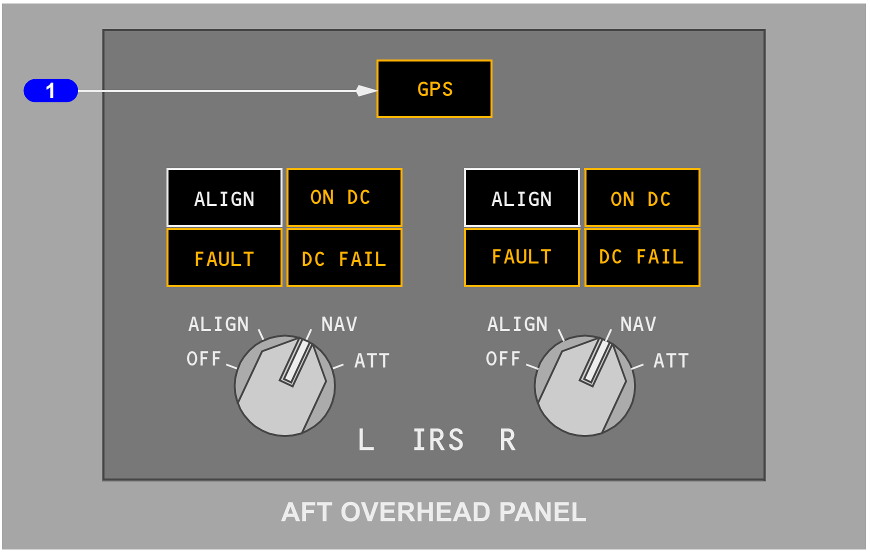
[Option – CDU]
- the FAIL light on CDU(s) is illuminated, or
- an alerting message exists for both CDUs, or
- test switch is in position 1 or 2.

[Removed FMC U14 requirement]
- when "INSUFFICIENT FUEL" alerting message displayed on the CDU scratchpad.

Push – both pilots' FMC alert lights extinguish.

Global Positioning System (GPS) Light

[Option – With GPS]

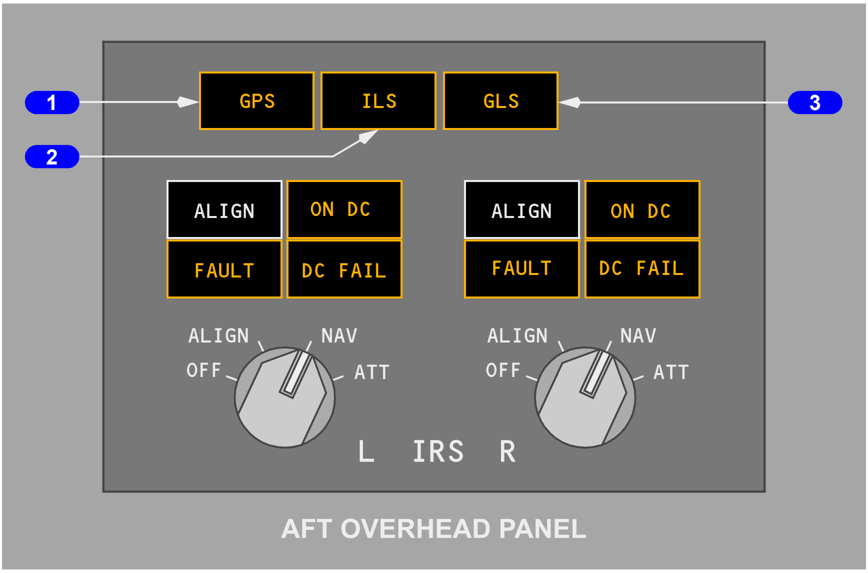


1 Global Positioning System (GPS) Light

Illuminated (amber) –
- indicates failure of both GPS sensor units
- indicates failure of a single GPS sensor unit when either system annunciator panel is pushed to initiate a recall

Landing System Lights

[Option – With GLS]



1 Global Positioning System (GPS) Light

Illuminated (amber) –

- indicates failure of both GPS sensor units
- indicates failure of a single GPS sensor unit when either system annunciator panel is pushed to initiate a recall

2 Instrument Landing System (ILS) Light

Illuminated (amber) –

- indicates failure of both ILS sensor units
- indicates failure of a single ILS sensor unit when either system annunciator panel is pushed to initiate a recall
- with single ILS sensor failure, light extinguishes when the system recall is reset.

[Option – FAA Rules]

3 GNSS Landing System (GLS) Light

Illuminated (amber) –

- indicates failure of both GLS sensor units.
- indicates failure of a single GLS sensor unit when either system annunciator panel is pushed to initiate a recall.
- with single GLS sensor failure, light extinguishes when the system recall is reset.

[Option – ICAO Rules]

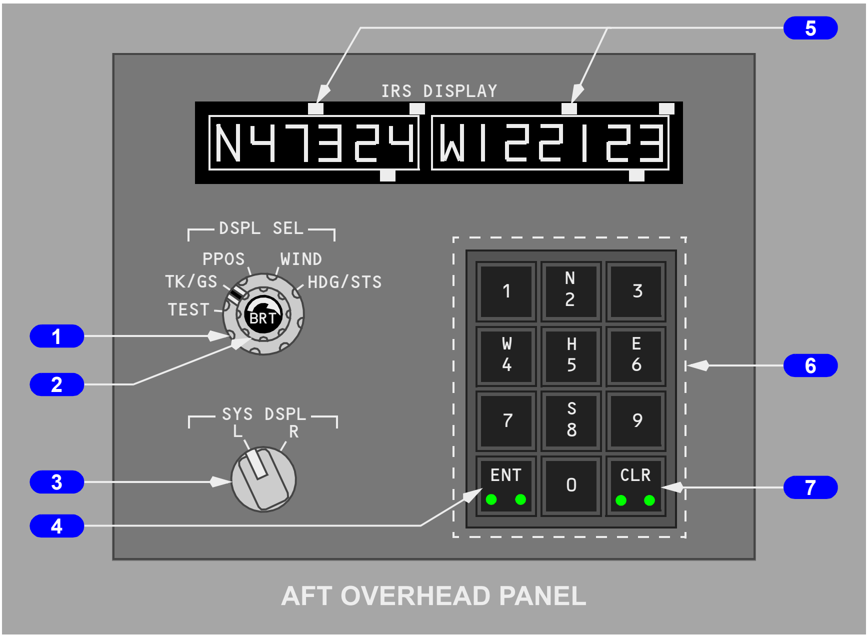
3 GBAS Landing System (GLS) Light

Illuminated (amber) –

- indicates failure of both GLS sensor units
- indicates failure of a single GLS sensor unit when either system annunciator panel is pushed to initiate a recall
- with single GLS sensor failure, light extinguishes when the system recall is reset.

Inertial System

IRS Display Unit (ISDU)



1 Display Selector (DSPL SEL)

TEST (spring–loaded to TK/GS) –

- all lights in data displays and on the mode selector unit momentarily illuminate, followed by a 10 second self–test
- use only during alignment.

TK/GS –

- left window displays true track (course)
- right window displays present ground speed (knots).

PPOS –

- left window displays present latitude
- right window displays present longitude.

WIND –

- left window displays present inflight true wind direction
- right window displays present inflight wind speed (knots).

HDG/STS –

- left window displays present true heading
- right window displays any applicable maintenance status codes
- during alignment, right window displays minutes remaining until alignment is complete. For alignments greater than 15 minutes, the window displays 15 until the time remaining reaches 14 minutes. The display then counts down in one minute intervals.

2 Brightness (BRT) Control

Rotate – adjusts brightness of the data displays.

3 System Display (SYS DSPL) Selector

L – selects left IRS for the data displays.

R – selects right IRS for the data displays.

4 Enter (ENT) Key

Illuminated (white) – N, S, E, W, or H entries are being keyed.

Push – keyed data is entered into IRS following completion of valid self–test for reasonableness.

5 Data Displays

Two windows display data for the IRS selected with the system display selector

- type of data displayed is normally determined by the display selector
- keyboard entry of present position or magnetic heading overrides the selected display
- last digit of each window is for a decimal place (tenths).

6 Keyboard

Push –

- alpha keys:
  - data displays are controlled by the keyboard when the N, S, E, W (latitude/longitude) or H (heading) keys are pushed
  - pushing an alpha key arms the keyboard for numeric entries.
- numeric keys:
  - permit manual entry of present position when ALIGN light is illuminated
  - permit manual entry of magnetic heading when either mode selector is in ATT.

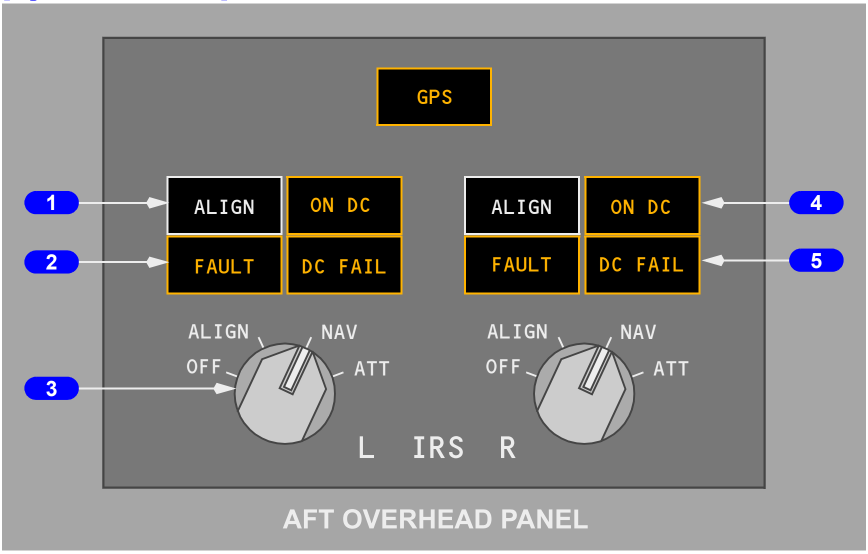
7 Clear (CLR) Key

Illuminated (white) – an ENT attempt has failed (entry not accepted by IRS).

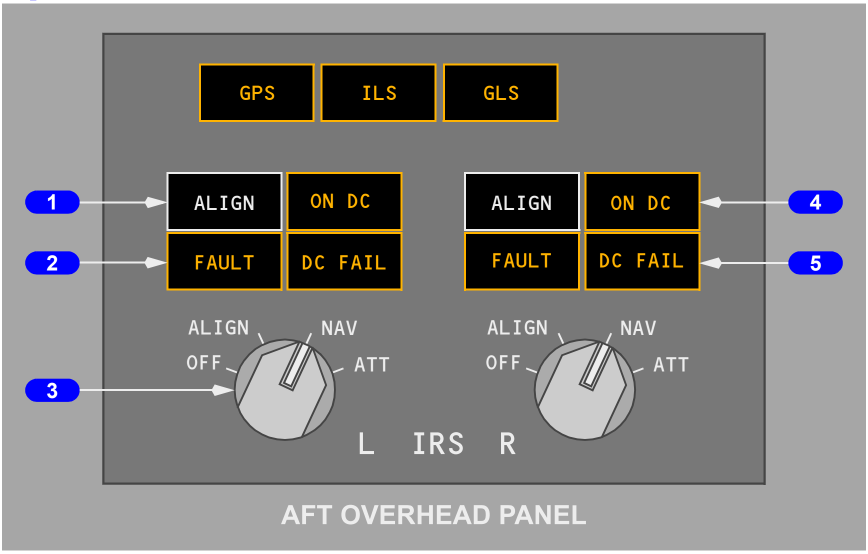
Push – clears data display of any data not yet entered or accepted. If illuminated, cue lights extinguish.

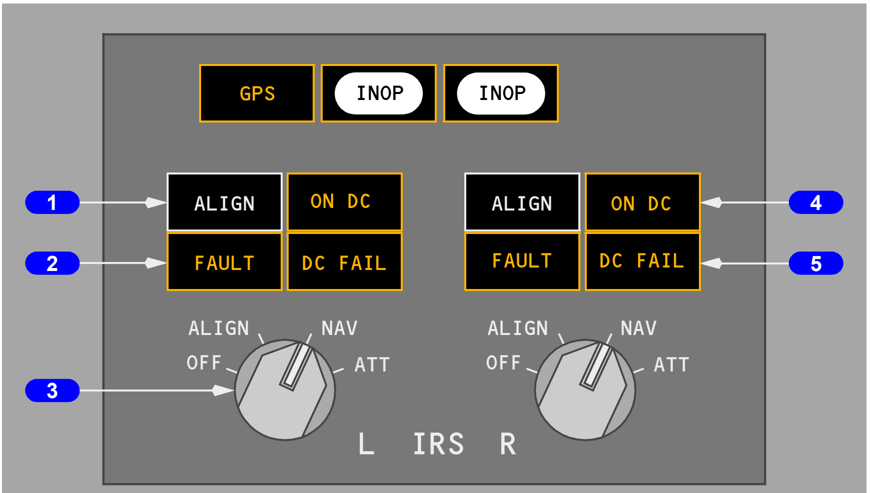
IRS Mode Selector Unit

[Option – With GPS]



[Option – With GLS]





AFT OVERHEAD PANEL
(INOP Placard Installed)

1 ALIGN Light

Illuminated (white) –

- steady – the related IRS is operating in the ALIGN mode, the initial ATT mode, or the shutdown cycle
- flashing – alignment cannot be completed due to IRS detection of:
  - significant difference between previous and entered positions or an unreasonable present position entry
  - no present position entry.

Extinguished –

- IRS not in ALIGN mode
- with mode selector in NAV, alignment is complete, and all IRS information is available
- with mode selector in ATT, attitude information is available. Heading information is available following entry of initial magnetic heading.

2 FAULT Light

Illuminated (amber) – a system fault affecting the related IRS ATT and/or NAV modes has been detected.

3 Inertial Reference System (IRS) Mode Selector

OFF –

- alignment is lost
- all electrical power is removed from the system after a 30 second shutdown cycle.

ALIGN –

- rotating the selector from OFF to ALIGN initiates the alignment cycle
- rotating the selector from NAV to ALIGN automatically updates alignment and zeroes ground speed error.

NAV (detent position) –

- system enters the NAV mode after completion of the alignment cycle and entry of present position
- in NAV mode, all IRS information is available to airplane systems for normal operations.

ATT – provides only attitude and heading information:

- attitude information is invalid (attitude flag in view) until ALIGN light is extinguished
- heading information is invalid (heading flags in view) until the actual magnetic heading is manually entered after the ALIGN light is extinguished
- position and ground speed information is not available until the IRS is aligned on the ground
- the selector must be cycled to OFF before reselecting ALIGN or NAV.

4 ON DC Light

Illuminated (amber) –

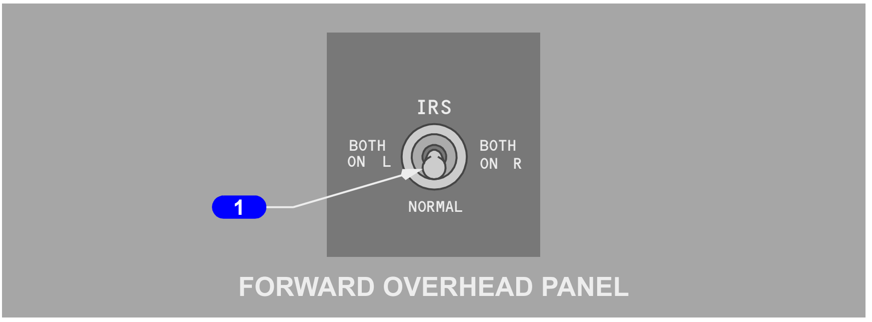
- the related IRS is operating on DC power from the switched hot battery bus (AC power not normal)
- if on the ground, the ground–call horn in the nose wheel well sounds, providing an alert that a battery drain condition exists
- momentary illumination is normal during alignment self–test.

5 DC FAIL Light

Illuminated (amber) –

- DC power for the related IRS is not normal
- if the other lights are extinguished, the IRS is operating normally on AC power.

IRS Transfer Switch



1 Inertial Reference System (IRS) Transfer Switch

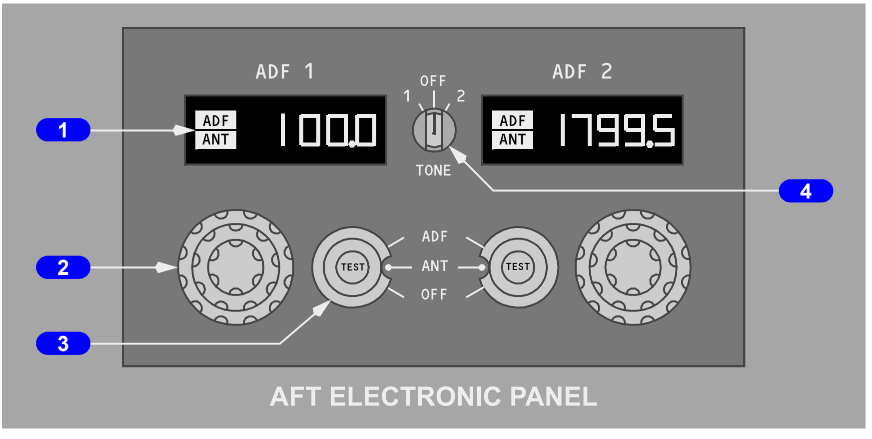
BOTH ON L – switches the flight instruments attitude and heading source to left IRS.

NORMAL – flight instruments attitude and heading source is from default IRS.

BOTH ON R – switches the flight instruments attitude and heading source to right IRS.

Radio Navigation Systems
Automatic Direction Finding (ADF) Control

[Option – Gables G7403-03]



1 Frequency Indicator

Shows the frequency selected with the related frequency selector.

Shows if the system is in the ADF or antenna (ANT) mode.

2 Frequency Selector

Rotate –

- outer knob sets the hundreds number
- middle knob sets the tens number
- inner knob sets the tenths and ones number.

3 Mode Selector Switch

ADF –

- audio reception possible
- ADF bearing sent to the DUs and the standby radio magnetic indicator.

ANT –

- audio reception optimized
- no ADF bearing data available.

OFF – removes power from selected receiver.

TEST – tests related ADF bearing pointers and warning flags on the DUs and the standby radio magnetic indicator.

- DU ADF indications:
  - show ADF fail flag and ADF bearing pointer goes out of view
  - ADF fail flag goes out of view and ADF bearing pointer remains out of view
  - ADF bearing pointer slews to 135 degrees relative bearing.
- Standby radio magnetic indicator:
  - shows ADF fail flag
  - ADF fail flag goes out of view and ADF bearing pointer stays at its last position before test
  - ADF bearing pointer slews to 135 degrees relative bearing.

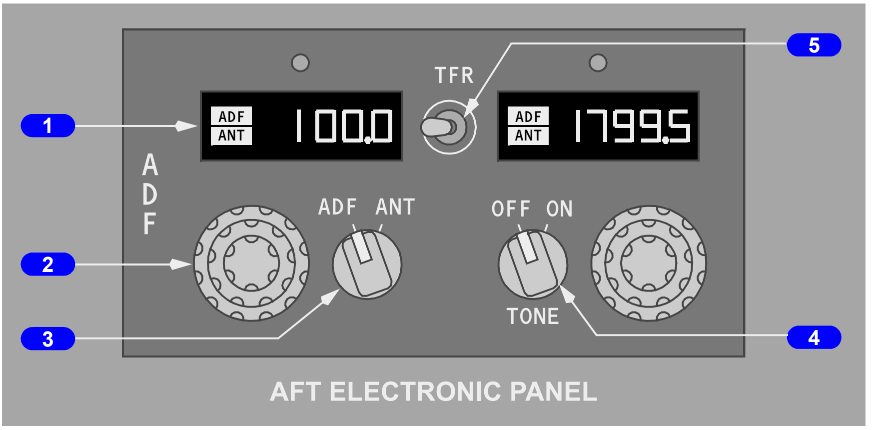
4 TONE Switch

1 – adds tone to ADF receiver No. 1 audio.

2 – adds tone to ADF receiver No. 2 audio.

OFF – disables tones.

[Option – Gables G7402-02, -05]



1 **Frequency Indicator**

Shows the frequency selected with the related frequency selector.

Shows if the system is in the ADF or antenna (ANT) mode.

2 **Frequency Selector**

Rotate –

- outer knob sets the hundreds number
- middle knob sets the tens number
- inner knob sets the tenths and ones number.

3 **Mode Selector**

ADF –

- audio reception possible
- ADF bearing sent to the DUs and the standby radio magnetic indicator.

ANT –

- audio reception optimized
- no ADF bearing data available.

4 **TONE Switch**

OFF – disables tones.

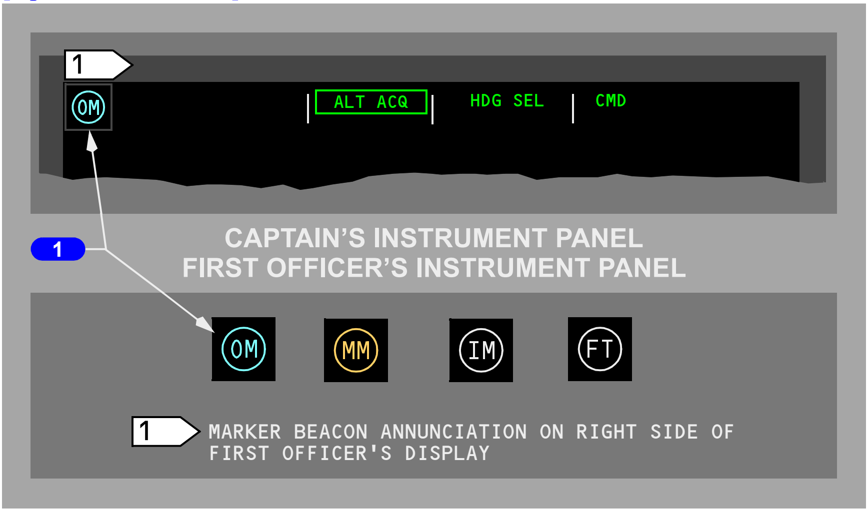
ON – adds tone to selected ADF receiver audio.

5 **Transfer (TFR) Switch**

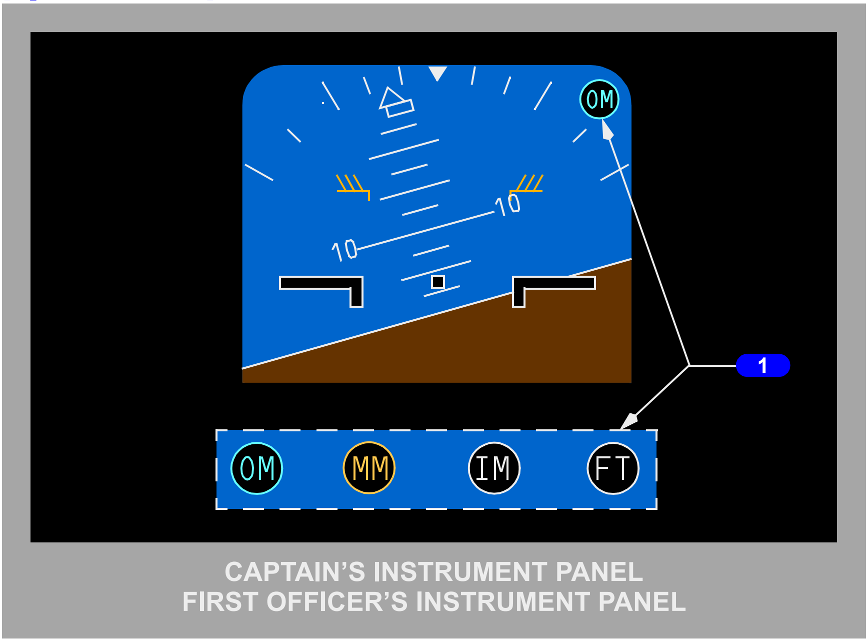
Selects ADF for display.

Marker Beacon Annunciations

[Option – EFIS/MAP]



[Option – PFD/ND]



1 Marker Beacon Lights

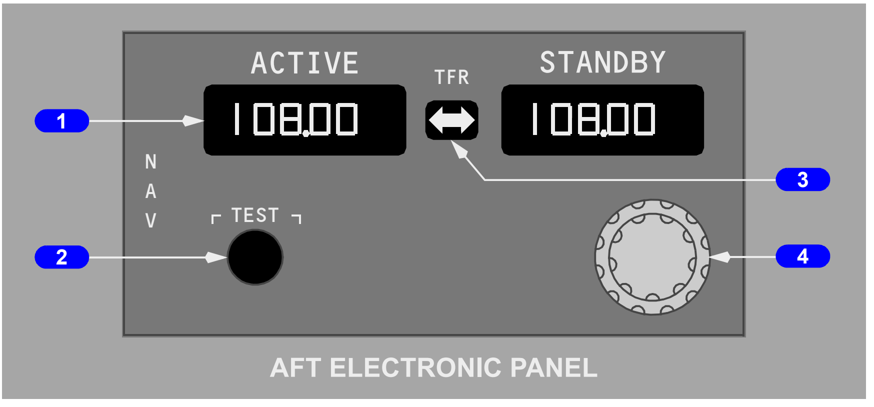
OM (cyan) – illuminates over an outer marker beacon.

MM (amber) – illuminates over a middle marker beacon.

IM (white) – illuminates over an inner marker beacon.

FT (white) – illuminates during self-test.

VHF Navigation Control



1 Frequency Indicator

Indicates the frequency selected by the frequency selector

- tuned frequency displayed in STANDBY display
- TFR switch moves STANDBY frequency to ACTIVE frequency.

2 TEST Switch

With a VOR frequency tuned and a course of 000 selected:

- shows VOR fail flag
- deviation bar biases out of view and then returns to centered position
- bearing pointer slews to 180 degrees
- DME displays:
  - DME fail flag
  - dashes
  - normal DME distance.

With ILS frequency tuned and a course within 90 degrees of airplane heading:

- pointers disappear and LOC and G/S flags appear momentarily
- pointers appear and display one dot up and one dot left
- pointers then display one dot low and one dot right
- pointers then return to normal display

- DME displays:
  - DME fail flag
  - dashes
  - normal DME distance.

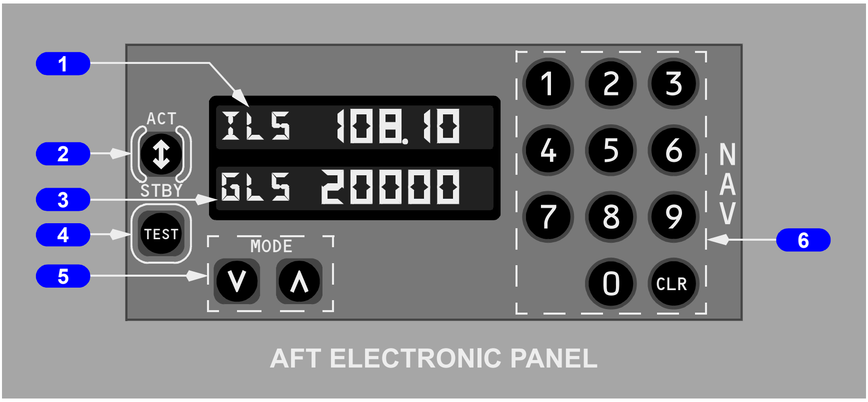
3 Transfer (TFR) Switch

TFR – STANDBY frequency moved to ACTIVE frequency; ACTIVE frequency moved to STANDBY frequency.

4 Frequency Selector

Rotate – manually selects the standby frequency.

Multi-Mode Navigation Control



1 Active (ACT) Mode and Frequency Indicator

Indicates the active mode and frequency.

2 Transfer Switch

Push – standby mode and frequency moved to active indicator window; active mode and frequency moved to standby indicator window.

3 Standby (STBY) Mode and Frequency Indicator

Indicates the standby mode and frequency.

4 TEST Switch

With a VOR frequency tuned and a course of 000 selected:

- shows VOR fail flag
- deviation bar biases out of view and then returns to centered position

- bearing pointer slews to 180 degrees
- DME displays:
  - DME fail flag
  - dashes
  - normal DME distance.

With an ILS frequency tuned and a course within 90 degrees of airplane heading:

- pointers disappear and LOC and G/S flags appear momentarily
- pointers appear and display one dot up and one dot left
- pointers then display one dot low and one dot right
- pointers then return to normal display
- DME displays:
  - DME fail flag
  - dashes
  - normal DME distance.

With a GLS frequency tuned and a course within 90 degrees of airplane heading:

- pointers disappear and LOC and G/S flags appear momentarily
- pointers appear and display one dot up and one dot left
- pointers then display one dot low and one dot right
- pointers then return to normal display.

Note: DME is not tested with GLS and no indications will be displayed.

5 Mode Switches

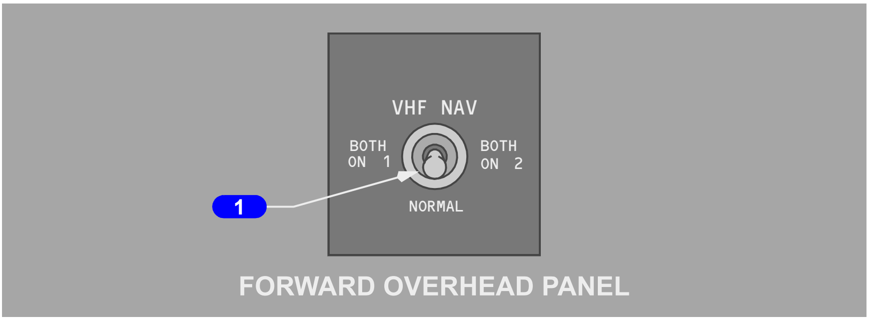
Push – manually inserts ILS, VOR or GLS into the standby indicator window.

6 Frequency Selection Keypad

Push – manually selects the standby frequency.

CLR – clears the standby frequency.

VHF NAV Transfer Switch



1 VHF NAV Transfer Switch

The VHF NAV transfer switch changes the source of the data that the DEUs use for the navigation displays. The switch transfers the following data: DME, ILS/GLS, VOR, and MCP course.

BOTH ON 1 – the DEUs use Multimode Receiver 1 as the source for the captain's display and first officers display.

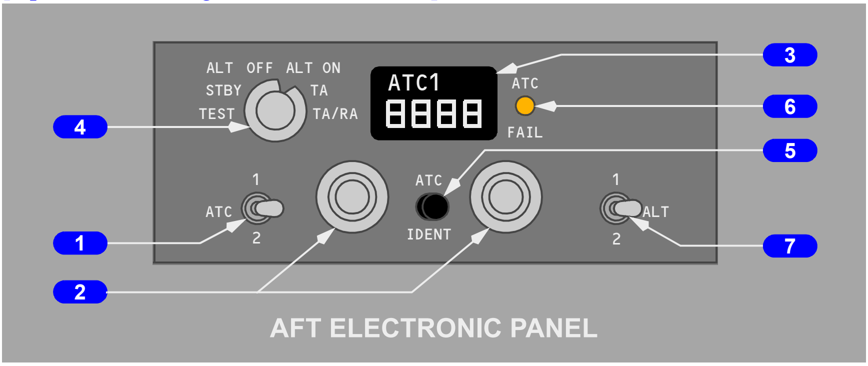
NORMAL – Multimode Receiver 1 supplies data for the captain's display and Multimode Receiver 2 supplies data for the first officers display.

BOTH ON 2 – the DEUs use Multimode Receiver 2 as the source for the captain's display and first officers display.

Note: The Digital Flight Control System cannot use VOR/ILS data that is not shown on the displays. Thus, when the Autopilot (A/P) system is engaged the VHF Navigation Control must match the primary Autopilot system that is ENGAGED for proper ILS/VOR operations; i.e. (CMD A uses VHF NAV 1 for control and CMD B uses VHF NAV 2 for control).

Transponder Panel

[Option – AlliedSignal 071-01503-2601]



1 Transponder (ATC) Selector

1 – selects transponder No. 1.

2 – selects transponder No. 2.

2 Air Traffic Control (ATC) Code Selector

Rotate – sets transponder code in transponder.

3 Air Traffic Control (ATC) Code Indicator

Shows transponder code.

Shows operating transponder (1 or 2).

4 **Transponder Mode Selector**

TEST – starts ATC transponder functional test.

STBY (standby) – does not transmit.

ALT (altitude reporting) OFF – transponder operates without altitude reporting.

ALT (altitude reporting) ON – transponder operates with altitude reporting.

TA (traffic advisory) and TA/RA (traffic advisory/resolution advisory) – Refer to Chapter 15, Warning Systems.

5 **Identification (IDENT) Switch**

Push – transmits an identification signal.

6 **Transponder (ATC) FAIL Light**

Illuminated (amber):

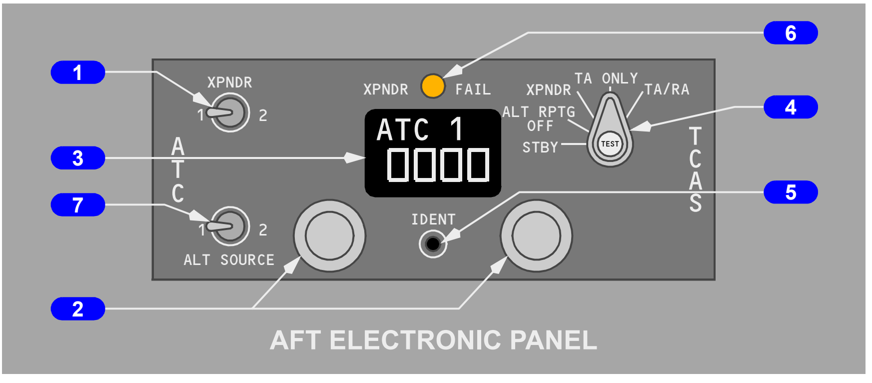
- indicates transponder malfunction or
- ADS-B (if installed) inoperative.

7 **Altitude (ALT) Selector**

1 – enables altitude reporting from air data computer No. 1.

2 – enables altitude reporting from air data computer No. 2.

[Option – Gables G6992-02]



1 **Transponder (XPNDR) Selector**

1 – selects transponder No. 1.

2 – selects transponder No. 2.

2 Air Traffic Control (ATC) Code Selector

Rotate – sets transponder code in transponder.

3 Air Traffic Control (ATC) Code Indicator

Shows transponder code.

Shows operating transponder (1 or 2).

4 Transponder Mode Selector

TEST – starts ATC transponder functional test.

STBY (standby) – does not transmit.

ALT RPTG (altitude reporting) OFF – transponder operates without altitude reporting.

XPNDR (transponder) – transponder operates with altitude reporting.

TA (traffic advisory) ONLY, and TA/RA (traffic advisory/resolution advisory) – Refer to Chapter 15, Warning Systems.

5 Identification (IDENT) Switch

Push – transmits an identification signal.

6 Transponder (XPNDR) FAIL Light

Illuminated (amber):

- indicates transponder malfunction or
- ADS-B (if installed) inoperative.

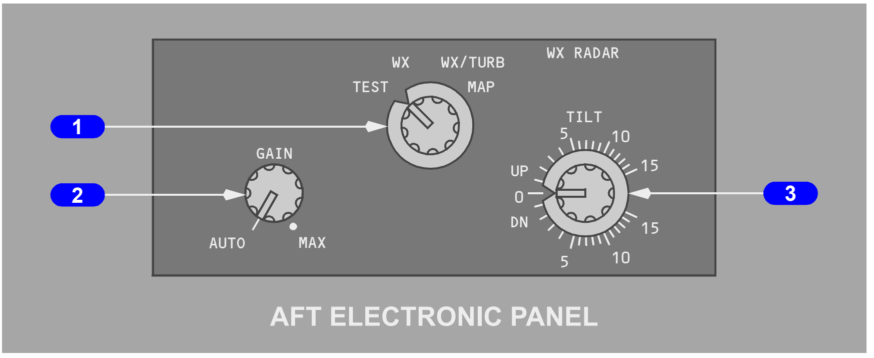
7 Altitude (ALT) SOURCE Selector

1 – enables altitude reporting from air data computer No. 1.

2 – enables altitude reporting from air data computer No. 2.

Weather Radar Panel

[Option – AlliedSignal 2041223-0414]



1 Mode Selector Switch

Rotate – selects mode.

TEST –

- tests weather radar system operation
- shows test pattern and any fault messages on navigation display MAP, center MAP, VOR, and APP modes, with WXR selected.

[Option – With predictive windshear]

Note: If the airplane is on the ground and the thrust levers are not advanced for takeoff, WXR tests the predictive windshear system (PWS) indications. These include PWS caution, PWS FAIL, and PWS warning. Deactivating WXR on the EFIS control panel will discontinue the test. The PWS test lasts approximately 15 to 60 seconds.

WX (weather) – shows weather radar returns at selected gain level.

WX/TURB (turbulence) –

- shows weather radar returns
- shows turbulence within 40 miles.

Note: Turbulence detection requires presence of detectable precipitation. Clear air turbulence cannot be detected by radar.

MAP – shows ground returns.

2 GAIN Control

Rotate – sets receiver sensitivity in WX, WX/TURB, and MAP modes.

AUTO (automatic) – maintains optimum receiver sensitivity.

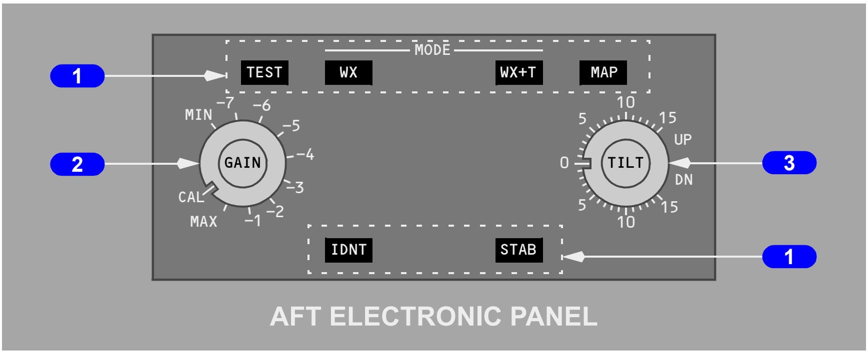
MAX (maximum) – gain control at MAXimum sensitivity.

3 TILT Control

Rotate clockwise– radar antenna tilts up to selected degrees above horizon.

Rotate counterclockwise– radar antenna tilts down to selected degrees below horizon.

[Option – Collins 622-5129-105]



1 Mode Switches

Push – selects mode.

TEST –

- tests weather radar system operation without transmitting
- shows test pattern and any fault messages on navigation display MAP, center MAP, VOR, and APP modes, with WXR selected.

[Option – With predictive windshear]

Note: If the airplane is on the ground and the thrust levers are not advanced for takeoff, WXR tests the predictive windshear system (PWS) indications. These include PWS caution, PWS FAIL, and PWS warning. Deactivating WXR on the EFIS control panel will discontinue the test. The PWS test lasts approximately 15 seconds.

WX (weather) – shows weather radar returns at selected gain level.

WX+T (turbulence) –

- shows weather radar returns
- shows turbulence within 50 miles.

Note: Turbulence detection requires presence of detectable precipitation. Clear air turbulence cannot be detected by radar.

MAP – shows ground returns.

IDNT – suppresses ground return in WX and WX+T modes.

STAB – antenna tilt automatically adjusts to correct for airplane attitude changes.

2 **GAIN Control**

Rotate – sets receiver sensitivity in WX, WX+T, and MAP modes.

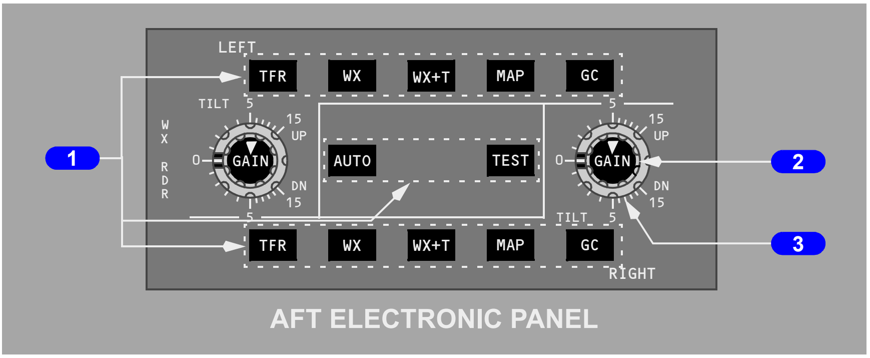
CAL (calibrated) – presets an optimum receiver sensitivity for best weather radar display.

3 **TILT Control**

Rotate clockwise – radar antenna tilts up to selected degrees above horizon.

Rotate counterclockwise – radar antenna tilts down to selected degrees below horizon.

[Option – Collins 622-5129-802]



1 **Weather Radar Mode Switches**

Push – selects mode. "LEFT" mode switches control the Captain's radar display, "RIGHT" mode switches control the First Officer's radar display.

- TFR (transfer) – transfers other radar display selections to related map.

  Note: Selecting both TFR switches at the same time results in the TEST mode test pattern being displayed until one of the TFR switches is deselected.

  [Option - WXR V2.0]
- WX – displays weather radar returns without threat information.

[Option - WXR V2.0]

- WX+T (threat) – displays: weather radar returns and turbulence in manual mode and weather radar returns and threats in auto mode. Turbulence is displayed out to 40 nm for all selected ranges.

  Note: The WX+T switch must be selected and the WXR set to (AUTO) mode to show core, associated and path threat assessment, as well as level 2 turbulence and predictive overflight protection.

  Note: Turbulence detection requires presence of detectable precipitation. Clear air turbulence cannot be detected by radar.

- MAP – displays both ground and weather returns without turbulence information.
- GC – temporarily displays ground clutter when radar is in auto mode.
- AUTO – activates the weather radar in multiscan mode:
  - both Captain's and First Officer's displays are updated simultaneously
  - tilt is automatically controlled
  - ground clutter may be temporarily displayed by pushing the GC switch
  - the weather radar automatically increases gain as outside air temperature decreases
  - significantly more gain is available in AUTO than in MAN, if the GAIN knob is turned to MAX while in AUTO mode the weather radar will use an additional amount of gain that is not available in MAN mode.
- TEST –
  - activates test mode for both left and right displays
  - transmitter is enabled for less than one second and then muted for the remainder of test
  - displays test pattern and any fault messages on navigation display MAP, center MAP, VOR, and APP modes, with WXR selected.

    Note: If the airplane is on the ground and the thrust levers are not advanced for takeoff, WXR tests the predictive windshear system (PWS) indications. These include PWS caution, PWS FAIL, and PWS warning. Deactivating WXR on the EFIS control panel will discontinue the test. The PWS test lasts approximately 15 seconds and a system fault is indicated with an oral notification.

2 GAIN Control

CAL (calibrated) gain – is selected when the triangle is at the 12 o'clock position.

Rotate clockwise – from the CAL position increases gain in WX, WX+T and MAP modes.

Rotate counterclockwise – from the CAL position decreases gain in WX, WX+T and MAP modes.

There is no EFIS indication for CAL gain because CAL gain is the standard gain setting. The EFIS will display "VAR" when gain is moved above or below the CAL gain position.

During automatic operation, the MultiScan radar provides Gain PLUS, which includes: (Refer to Section 11.20 for expanded description)

- conventional increase and decrease of receiver sensitivity
- the weather radar automatically increasing gain as outside air temperature decreases
- Path Attenuation Compensation (PAC) Alert
- Oceanic Weather Reflectivity Compensation
- OverFlight Protection

[Option - WXR V2.0]
During automatic operation, the Version 2 MultiScan radar provides these additional Gain PLUS functions: (Refer to Section 11.20 for expanded description)

- Predictive OverFlight (With WX+T selected)
- Associated Threat Function (With WX+T selected)
- Core Threat Adjustment (With WX+T selected)
- Two-Level Turbulence Detection (With WX+T selected)
- Flight Path/Descent Assessment

3 TILT Control

During Automatic mode operation, the TILT controls are not active.

When AUTO is selected, an A shows on the EFIS by the tilt angle. When operating in Manual mode M shows.

Rotate clockwise – radar antenna tilts up to selected degrees from horizon.

Rotate counterclockwise – radar antenna tilts down to selected degrees from horizon.

Note: When the WXR system is first powered up (either through initial airplane power, WXR circuit breaker closure or following an extended power interrupt) the indicated tilt will temporarily show the manual tilt setting or zero Auto “0A”. This is a normal condition while the system goes through initial power up built in test (PBIT) and determines the appropriate tilt angle based on current location, altitude and flight path.

Introduction

[Option – With GPS]
Navigation systems include the flight management system (FMS); global positioning system (GPS); air data inertial reference system (ADIRS); radio navigation systems (ADF, DME, ILS, marker beacons, and VOR); transponder; and weather radar.

[Option – HUD]
Many of the flight instrument display symbols listed in this chapter also appear on the Heads Up Display (HUD) System. Refer to Chapter 10, Flight Instruments, for HUD system display symbol descriptions.

Flight Management System

The flight management system (FMS) is comprised of the following components:

- flight management computer system (FMCS)
- autopilot/flight director system (AFDS)
- autothrottle (A/T)
- inertial reference systems (IRS)
- global positioning system (GPS).

Each of these components is an independent system, and each can be used independently or in various combinations. The term FMS refers to the concept of joining these independent components together into one integrated system which provides continuous automatic navigation, guidance, and performance management.

The integrated FMS provides centralized flight deck control of the airplane's flight path and performance parameters. The flight management computer, or FMC, is the heart of the system, performing navigational and performance computations and providing control and guidance commands.

[Option – Dual FMC]
The primary flight deck controls are the AFDS MCP, two control display units (CDU's), two electronic flight instrument system (EFIS) control panels, and an FMC source selector switch. The primary displays are the CDUs, outboard display units, inboard display units, and upper display unit.

[Option – Single FMC]
The primary flight deck controls are the AFDS MCP, two control display units (CDU's), two electronic flight instrument system (EFIS) control panels. The primary displays are the CDUs, outboard display units, inboard display units, and upper display unit.

The FMC uses crew entered flight plan information, airplane systems data, and data from the FMC navigation database and performance database to calculate airplane present position, and pitch, roll, and thrust commands required to fly an optimum flight profile. The FMC sends these commands to the autothrottle, autopilot, and flight director. Map and route information are sent to the respective pilot's navigation displays. The EFIS control panels are used to select the desired information for navigation display. The mode control panel is used to select the autothrottle, autopilot, and flight director operating modes.

Global Positioning System (GPS)

[Option]
Two GPS receivers receive GPS satellite positioning signals. The left and right GPS receivers are independent and each provides an accurate airplane geographical position to the FMC and other aircraft systems. GPS operation is automatic.

GPS Displays

POS REF page 2/3 shows the left and right GPS latitude and longitude position. POS SHIFT page 3/3 shows the left and right GPS position relative to the FMC position. NAV STATUS page 1/2 shows the GPS currently in use by the FMC for position calculation.

[Option – EFIS/MAP]
When the navigation display plan mode is selected and POS SHIFT page 3/3 is displayed, the navigation display shows the left and right GPS symbols. The GPS symbols are identical and show as a single symbol when the GPS receivers calculate the same position.

[Option – PFD/ND]
When the POS (position) switch on the EFIS control panel is selected, the navigation display shows the left and right GPS symbols. The GPS symbols are identical and show as a single symbol when the GPS receivers calculate the same position.

An amber GPS light illuminates to indicate a failure of both GPS sensor units. Failure of a single GPS sensor causes the light to illuminate when either system annunciator panel is pushed.

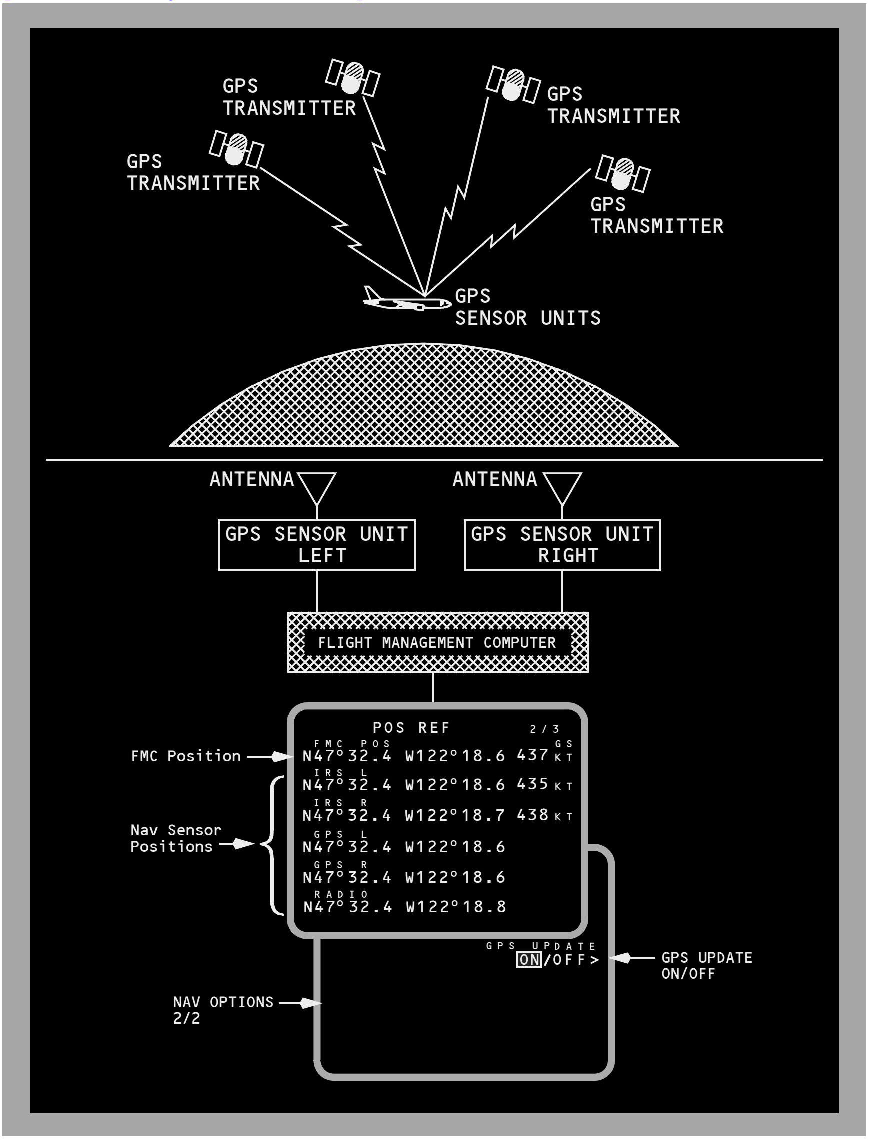
GPS Data

FMC logic selects the position from one of the GPS sensor units as the primary update to the FMC position. When GPS position data is available, radio updating can also occur. If all GPS data becomes unavailable, the FMC position will be determined by radio or inertial (IRS) updating.

GPS navigational information can be manually deselected on the NAV OPTIONS page 2/2. No other controls are provided because the operation of the GPS is completely automatic.

GPS System Schematic

[Generic GPS system schematics]



Inertial System

The inertial system computes airplane position, ground speed, and attitude data for the DUs, flight management system, autoflight system, and other systems. The major components of the inertial system are the air data inertial reference units (ADIRU), an inertial system display unit (ISDU), IRS mode select unit (MSU), and an IRS transfer switch. For information about the air data part of the system, see chapter 10. The ADIRUs provide inertial position and track data to the FMC, and attitude, altitude, and airspeed data to the CDS. Each ADIRU has an IRS section and an air data section.

Inertial Reference System

Two independent IRSs are installed. Each IRS has three sets of laser gyros and accelerometers. The IRSs are the airplane’s sole source of attitude and heading information, except for the standby attitude indicator and standby magnetic compass.

In their normal navigation mode, the IRSs provide attitude, true and magnetic heading, acceleration, vertical speed, ground speed, track, present position, and wind data to appropriate airplane systems. IRS outputs are independent of external navigation aids.

IRS Alignment

An IRS must be aligned and initialized with airplane present position before it can enter the navigation mode. The present position is normally entered through the FMC CDU. If the present position cannot be entered through the FMC CDU, it may be entered through the ISDU keyboard. The airplane must remain stationary during alignment.

Normal alignment between 78 degrees 15 minutes North or South is initiated by rotating the MSU switch from OFF to NAV. The IRS performs a short power test, during which the ON DC light illuminates. When the ON DC light extinguishes and the ALIGN light illuminates, the alignment process begins. Airplane present position should be entered at this time. Alignment time varies from five minutes to seventeen minutes depending on airplane latitude.

Magnetic variation between 82 degrees north and 82 degrees south is stored in each IRS memory. The data corresponding to the present position are combined with the true heading to determine magnetic heading.

If the latitude/longitude position is not within 4 NM of the origin airport, the CDU scratchpad message VERIFY POSITION is displayed. If the entered latitude/longitude position does not pass the IRS internal comparison tests, the scratchpad message ENTER IRS POSITION is displayed.

The flashing ALIGN light alerts the crew that the position entered does not pass one of the two internal comparison tests and should be checked for accuracy. If the entered position does not agree with the last stored position, the first internal test is failed, and the ALIGN light will flash. If the same position is reentered, the IRS will accept the position and continue the alignment process. A second internal position test compares the entered latitude with the system-computed latitude. If this test is failed, the ALIGN light will again flash. If two consecutive entries of the same position do not pass the second internal position test, the FAULT light will illuminate. If the test is passed, the IRS will proceed to complete the alignment process and enter NAV mode.

During transit or through–flight stops with brief ground times, a thirty second fast realignment and zeroing of ground speed error may be performed by selecting ALIGN while the airplane is parked. Present position should be simultaneously updated by manually entering latitude and longitude prior to selecting NAV.

Note: If the airplane is moved during alignment or fast realignment, the IRS automatically begins the full alignment process.

Loss of Alignment

If an IRS loses both AC and DC power, the alignment is lost. Alignment can be lost if the MSU switch is moved out of the NAV position.

If alignment is lost in–flight, the navigation mode (including present position and ground speed outputs) is inoperative for the remainder of the flight. However, selecting ATT allows the attitude mode to be used to relevel the system and provide an attitude reference. The attitude mode requires approximately thirty seconds of straight and level unaccelerated flight to complete releveling. Some attitude errors may occur during acceleration, but will be slowly removed after acceleration stops.

The attitude mode can also provide heading information, but to establish compass synchronization the crew must manually enter the initial magnetic heading. Drift of up to 15 degrees per hour can occur in the IRS heading. Therefore, when in attitude mode, an operating compass system must be periodically cross–checked and an updated magnetic heading entered in the IRS, as required.

IRS Entries

Manual IRS entries of present position or magnetic heading are normally accomplished on the POS INIT page of the FMC/CDU. The ISDU may also be used.

IRS Power

The IRSs can operate on either AC or DC power. The left IRS is normally powered from the AC standby bus, and the right IRS from the AC transfer bus 2. If AC power is not normal, either or both systems automatically switch to backup DC power from the switched hot battery bus. Backup DC power to the right IRS is automatically terminated if AC power is not restored within five minutes.

Initial power–up requires battery bus power available and the IRS mode selector to be in ALIGN, NAV, or ATT. If the IRS is turned off, it must complete a full realignment cycle before the airplane can be moved.

If AC electrical power is subsequently removed from the airplane, the switched hot battery bus continues to supply electrical power to the IRS. The ON DC light illuminates, and the ground-call horn in the nose wheel well sounds to alert maintenance personnel that the IRS is on battery power.

When the IRS mode selector is turned OFF, the IRS remains powered for approximately 30 seconds. The ALIGN light illuminates until the system is completely shut down.

Inertial System Display Unit (ISDU)

The ISDU is located on the aft overhead panel and displays data according to the position of the display selector and system selector. The ISDU also contains a keyboard for entry of present position and heading.

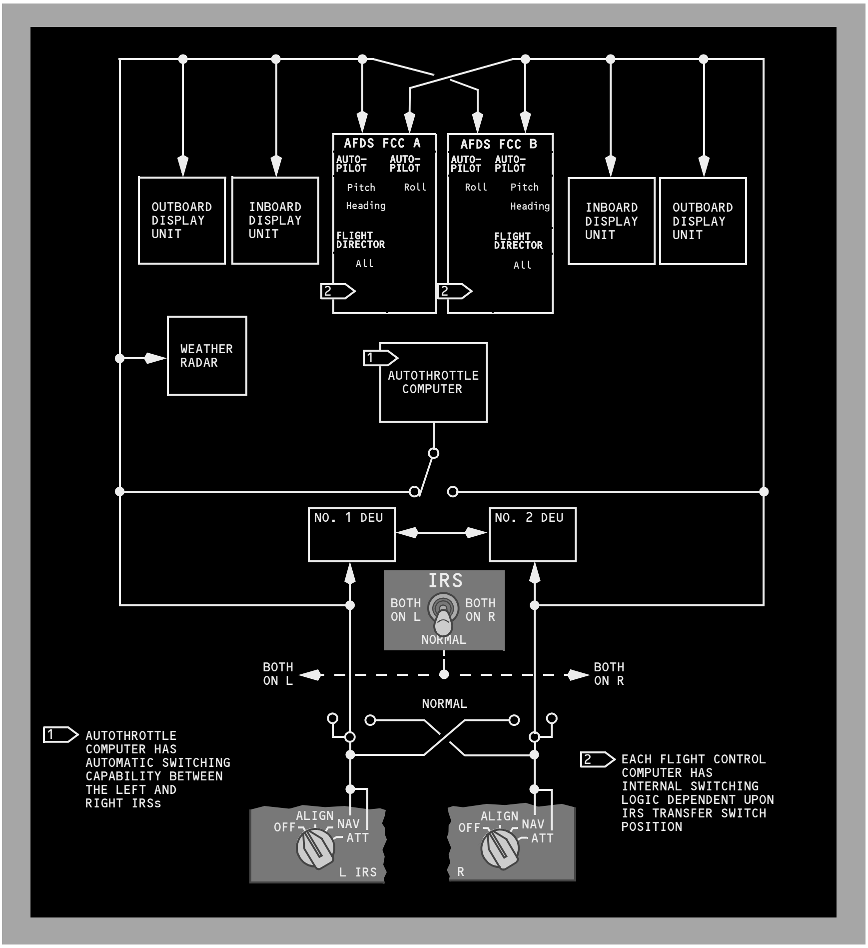
Mode Select Unit (MSU)

The MSU is located on the aft overhead panel and is used to select the operating mode for each IRS. Indicator lights on the MSU show status of each IRS.

IRS Transfer Switch

Should either IRS fail, the IRS transfer switch is used to switch all associated systems to the functioning IRU.

IRS Instrument Transfer Switch Schematic



Radio Navigation Systems
Automatic Direction Finding (ADF)

An automatic direction finding (ADF) system enables automatic determination of magnetic and relative bearings to selected facilities.

[Option – With 2 ADF receivers]
Two ADF receivers are installed. The ADF bearing signals are sent to the pointers on the DUs and the standby radio magnetic indicator. The audio is heard by using the ADF receiver control on the audio selector panel.

If heading or track information is lost or invalid, ADF bearing pointers on the DUs will be removed, and ADF bearing pointers on the standby radio magnetic indicator will not display correct magnetic bearing. Relative bearings indicated by pointers may be correct if the receiver is operating.

Distance Measuring Equipment (DME)

Two frequency scanning DME systems are installed.

The FMC autotunes DME receivers as necessary for position updating. During normal operations, two different DME signals or a signal from a collocated VOR/DME pair provide an accurate radio geographical position to the FMC. The identifiers of DMEs currently providing update data to the FMC are displayed on the NAV STATUS page 1/2. The radio position is displayed on the POS REF page 2/3. Specific DME station tuning for FMC position updating can be inhibited on the NAV OPTIONS page 2/2.

The flight crew must manually tune the DME on the VHF navigation control panel and the respective EFIS control panel VOR/ADF switch must be in the VOR position for DME to be displayed on the CDS. DME distance is also displayed on the CDS when the ILS receivers are tuned to a collocated DME and localizer facility.

Instrument Landing System (ILS)

Two ILS receivers are installed.

The ILS receivers are tuned manually on the VHF navigation control panel. The flight crew must manually tune the ILS for display on CDS. The ILS localizer and glideslope can also be displayed on the standby attitude indicator.

LOC updating of the FMC occurs only after the ILS is manually tuned. The tuned ILS frequency is displayed on the navigation display in the APP modes.

Navaid Identifier Decoding

[Option – PFD/ND]

The Morse code identifier of a tuned VOR, ILS, or ADF can be converted to alpha characters. The decoded identifier is then shown on the PFD and ND. The crew should monitor this identifier for correct navigation radio reception. The identifier name is not compared with the FMC database.

The Morse code identifier of a tuned VOR, ILS, GLS, or ADF can be converted to alpha characters. The decoded identifier is then shown on the PFD and ND. The crew should monitor this identifier for correct navigation radio reception. The identifier name is not compared with the FMC database.

Due to the large variation in ground station identifier quality, the decode feature may incorrectly convert the intended identifier name. Examples: the Hong Kong localizer “KL” may show as “KAI,” or the Boeing Field ILS may show as “QBFI” or “TTTT” instead of “IBFI.”

Pilots should verify the identity of the tuned navigation station from the audio Morse code when the tuned frequency remains shown or an incorrect identifier is shown.

Marker Beacon

[Option – EFIS/MAP]
Marker beacon indications for outer, middle, and inner marker are displayed on the upper outboard corner of the Captain’s and First Officer’s outboard display units.

[Option – PFD/ND]
Marker beacon indications for outer, middle and inner marker are displayed on the upper right hand corner of the attitude display located on the Captain’s and First Officer’s Primary Flight Display (PFD) units.

Very High Frequency Omni Range (VOR)

Two VOR receivers are installed.

The flight crew must manually tune the VOR on the navigation control panel for display on the DUs and the standby radio magnetic indicator. VOR–DME radio updating is available if the crew manually tunes a valid in–range VOR station.

[Option – EFIS/MAP]
Left and right VOR bearings are displayed on the DUs when a valid in–range VOR station is tuned, the respective EFIS control panel VOR/ADF switch is in the VOR position and the respective EFIS control panel POS switch is pushed. The DUs also show course deviation.

[Option – PFD/ND]
Left and right VOR bearings are displayed on the DUs when a valid in–range VOR station is tuned and the respective EFIS control panel VOR/ADF switch is in the VOR position. The DUs also show course deviation.

VHF NAV Transfer Switch

Should either VOR receiver fail, the VHF NAV transfer switch enables selection of the opposite VHF NAV receiver for display.

ATC Transponder

Two ATC transponders are installed and controlled by a single control panel. The ATC transponder system transmits a coded radio signal when interrogated by ATC ground radar. Altitude reporting capability is provided.

Transmissions are automatically enabled when the air/ground system indicates air mode.

TCAS is also controlled from the transponder panel. The TCAS system is described in Chapter 15.

Transponders may also transmit information, such as flight number, airspeed or groundspeed, magnetic heading, altitude, GPS position, etc., depending on the level of enhancement. At some airports, airport equipment monitors airplane position on the ground when the transponder is active (mode selector not in STANDBY or OFF). TCAS modes should not be used on the ground for ground tracking. If installed, the Automatic Dependent Surveillance-Broadcast (ADS-B) data is downlinked to ATC and may be used for airplane tracking. The left GPS provides data to Transponder 1 containing ADS-B position information and the right GPS provides ADS-B position data to Transponder 2.

Weather Radar

The weather radar system detects and locates various types of precipitation bearing clouds along the flight path of the airplane and gives the pilot a visual indication in color of the clouds' intensity. The radar antenna sweeps a forward arc of 180 degrees.

The radar indicates a cloud's rainfall intensity by displaying colors contrasted against a black background. Areas of heaviest rainfall appear in red, the next level of rainfall in amber, and the least rainfall in green.

In map mode, the radar displays surfaces in red, amber, and green (most reflective to least reflective).

These displays enable identification of coastlines, hilly or mountainous regions, cities, or large structures. Ground mapping mode can be useful in areas where ground–based navigation aids are limited.

The radar system performs only the functions of weather detection and ground mapping. It should not be used or relied upon for proximity warning or anticollision protection.

The turbulence mode displays normal precipitation and precipitation associated with turbulence. When the radar detects a horizontal flow of precipitation with velocities of 5 or more meters per second toward or away from the radar antenna, that target display becomes magenta. This magenta area is associated with heavy turbulence. The detection of turbulence is automatically limited to a 40 nautical mile range, regardless of the selected range.

[Option – Weather radar with IDNT]
The IDNT position activates the ground clutter reduction feature. Signals that are determined to have a high probability of originating from ground returns will be automatically removed from the display. Some portions of weather targets may be removed as well. The IDNT position is provided for analysis by the pilot and is not for continuous use.

[Option – With predictive windshear]
The weather radar also provides predictive windshear alerting below 1,200 feet RA. On the ground or in flight below 2,300 feet RA, radar antenna scan sweep is limited to 120 degrees with PWS enabled. Above 2,300 feet RA the radar sweep reverts to 180 degrees. (Refer to Chapter 15, Warnings.)

WXR-2100 Multiscan Radar

[Option – WXR-2100 Multiscan Radar]
A MultiScan weather radar emulates an ideal radar beam by taking information from different radar scans and merging the information into a total weather picture. Ground clutter suppression algorithms are then used to eliminate ground clutter. The result is the ability for flight crews to view all significant weather from 0 to 320 NM on a single display that is essentially clutter free. With the multiscan process two scans are taken, each optimized for a particular region in front of the aircraft. In general, the upper beam detects intermediate range weather while the lower beam detects short and long range weather by automatically adjusting the beams tilt and gain settings. The information is then stored in a temporary database. When the captain or first officer selects a range, the computer extracts the appropriate portions of the desired information, merges the data, then eliminates the ground clutter. The result is an optimized weather display for whichever range scale the flight crew selects. During automatic operation, multiscan uses variable gain that is based on atmospheric temperature profiles to compensate for variations in geographic location, time of day, and altitude in order to optimize weather returns in all phases of flight. Gain is thus adjusted to suit the environment in which the aircraft is flying and provide the optimum weather picture in the prevailing conditions.

The Multiscan Radar includes the following features:

Path Attenuation Compensation (PAC) Alert places an amber arc on the outer most range scale to warn the pilot if intervening rain fall has created an attenuated area. PAC Alert is operative whenever the radar is being operated in CAL gain and the aircraft is within 80 NM of a thunderstorm. PAC Alert is activated during automatic radar operation.

Oceanic Weather Reflectivity Compensation uses aircraft navigation inputs to identify oceanic regions and adjusts gain and tilt to account for the decreased reflectivity of oceanic thunderstorms. Thunderstorm thresholds are adjusted to more accurately represent the true thunderstorm threat to the aircraft.

OverFlight protection is designed to prevent thunderstorms that are in the aircraft flight path from falling below the radar beam and off the radar display during high altitude cruise. At extended ranges the upper MultiScan radar beam scans the wet, reflective portion of a thunderstorm in the same manner that conventional radar scans weather. As the aircraft approaches the storm and the cell begins to fall below the upper radar beam, MultiScan utilizes 6000 ft of bottom beam information to keep the reflective part of the storm in view. Within approximately 15 NM of the aircraft, MultiScan compares the stored digital image of the thunderstorm with the latest sweep information and shows whichever return is greater. If a cell that is a threat to the aircraft begins to fall below the radar beam, MultiScan shows the stored digital image of the storm to make sure that any threat thunderstorm remains on the display until it moves behind the aircraft. OverFlight protection is operational above 22000 ft MSL.

[Option - WXR V2.0]
Predictive OverFlight tracks cells below the aircraft and measures their growth rate and intensity when in AUTO and WX+T mode is selected. The system predicts turbulence above the cell and the increasing storm threat along the aircraft flight path. Predictive OverFlight is based on actual radar returns and the resultant analysis of cell growth, not on inference. Predictive OverFlight shows as a red enclosure filled with red dots. Predictive OverFlight functions in AUTO mode only with WX+T selected.

[Option - WXR V2.0]
Associated Threats are shown while the system is in AUTO and WX+T mode is selected. Associated threats show as red dots on the display and can be within the cell boundary or outside. They are determined by temperature as well as horizontal and vertical radar data. Two type of indications can be shown. The first is the electrified region found in precipitation around the freezing level. This indication shows when the freezing point is within 6000 feet of the aircraft. Associated hazards include icing and lightning. The second type of indication shows as red dots in a rectangle shape over the thunderstorm cell, and may extend beyond the cell in the downwind direction any time the wind is greater than 10 knots above 25000 feet. The anvil pattern above a storm cell is inferred from the detected cell intensity, and indicates a potential of icing, hail and/or lightning. This shows no matter which altitude the aircraft is at. The electrified region is active for aircraft temperatures warmer than negative
20 degrees C.

[Option - WXR V2.0]
Core Threat Adjustment provides a color and size adjustment to closer represent the actual threat. The core threat assessment uses horizontal and vertical growth rates and increases the color and size on the display if a return is below a certain decibel threshold. Core Threat Adjustment functions in AUTO mode only with WX+T selected.

[Option - WXR V2.0]
Two-Level Turbulence Detection provides two levels of turbulence detection when in AUTO and WX+T mode is selected. Severe turbulence is shown by solid magenta areas, while light and moderate turbulence (known as ride quality turbulence) is shown by magenta dots. Severe turbulence is indicated when the aircraft g-load is 0.3 g or greater, while ride quality turbulence is indicated when aircraft g-load is 0.2 g. When not in AUTO, the single level of turbulence (0.3g) is available. Two-Level Turbulence Detection functions in AUTO mode only with WX+T selected.

[Option - WXR V2.0]
Flight Path/Descent Assessment shows weather for the descent profile as soon as the aircraft starts a descent. All Multiscan Radar functions are available on the descent. The user does not need to switch to Manual mode to observe weather along the descent.

Windshear

On takeoff Warnings and Cautions are enabled from the beginning of the takeoff roll (0 knots) until the aircraft reaches 80 knots. From 80 knots until the aircraft passes 400 ft, only Warnings are enabled. From 400 ft through 1200 ft, Warnings and Cautions are enabled. All new alerts are disabled from the time the aircraft passes 100 knots until it reaches 50 ft.

On descent, below 2300 ft the weather scan switches from a 180 degree scan to a 120 degree scan, which indicates the windshear detection system is activated. The smaller scan sector allows faster updates and also allows weather and windshear events to be shown simultaneously during the entire windshear event. Windshear detection is always activated when the aircraft is below 2300 ft in the takeoff and landing environment even when the radar is turned off. Warnings and Cautions are enabled from the time the aircraft passes 1200 ft until 400 ft. From 400 ft until 50 ft, only Warnings are enabled. From 50 ft until touchdown (0 ft), all new alerts are disabled.

Windshear detection is activated during both manual and automatic radar operation.

If the radar is on in the MAP or TEST mode and the system detects a windshear event, the system display automatically changes to the WX+T mode to show the weather and windshear icons. The selected range does not change automatically.

A windshear WARNING is generated whenever a detected windshear event occurs within ± 0.25 NM of the longitudinal axis of the aircraft and within ± 30 degrees of the aircraft heading. When the aircraft is on the ground (takeoff roll), the windshear WARNING occurs for windshear events within 3 NM.

A windshear CAUTION is generated whenever a detected windshear event occurs outside the windshear warning region and within ± 30 degrees of the aircraft heading and less than 3 NM from the aircraft.

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Introduction

The flight management system (FMS) aids the flight crew in managing automatic navigation, in–flight performance optimization, fuel monitoring, and flight deck displays. Automatic flight functions manage the airplane lateral flight path (LNAV) and vertical flight path (VNAV). The displays include a map for airplane orientation and command markers (bugs) on the airspeed and N1 indicators to assist in flying efficient profiles.

The flight crew enters the desired route and flight data into the CDUs. The FMS then uses its navigation database, airplane position and supporting system data to calculate commands for manual or automatic flight path control.

The FMS can automatically tune the navigation radios and determine LNAV courses. The FMS navigation database provides the necessary data to fly routes, SIDs, STARs, holding patterns, and procedure turns. Lateral offsets from the programmed route can be calculated and commanded.

For vertical navigation, computations include items such as fuel burn data, optimum speeds, and recommended altitudes. Cruise altitudes and crossing altitude restrictions are used to compute VNAV commands. When operating in the Required Time of Arrival (RTA) mode, the computations include required speeds, takeoff times, and enroute progress information.

Flight Management Computer (FMC)

The basis of the flight management system is the flight management computer. Since the term FMC is universally understood, it is used here for standardization and simplification.

The FMC uses flight crew–entered flight plan information, airplane systems data, and data from the FMC navigation database to calculate airplane present position, and pitch, roll, and thrust commands required to fly an optimum flight profile. The FMC sends these commands to the autothrottle, autopilot, and flight director. Map and route information are sent to DUs. The EFIS control panels are used to select the desired information for the navigation displays. The mode control panel is used to select the autothrottle, autopilot, and flight director operating modes. Refer to the following chapters for operation of these other systems:

- Chapter 4, Automatic Flight
- Chapter 10, Flight Instruments, Displays.

The FMC and CDU are used for enroute and terminal area navigation, RNAV approaches and to supplement primary navigation means when conducting all types of instrument approaches.

[Option – Dual FMC]
The dual FMC installation is certified as a “sole source” navigation system. Airplanes equipped with two FMCs are certified to operate outside radio navaid coverage. The second FMC serves as a backup, providing complete navigational functions if the other FMC fails.

[Option – Dual FMC]
With a dual FMC installation, one FMC is always designated as primary. This is controlled by the position of the FMC Source Select switch. Refer to Chapter 11, FMC Source Select Switch.

[Option – Dual FMC]
The primary FMC:

- allocates navaid tuning and updating functions between FMCs
- insures synchronization between FMCs
- controls CDU displays
- provides input to the autopilot
- provides input to the autothrottle system
- processes ACARS (data link) messages.

[Option – Dual FMC]
Positioning the FMC Source Select Switch to BOTH ON L or BOTH ON R isolates FMC operation to use only the left or right FMC respectively. In the NORMAL position, the left FMC is primary by default. Although the aircrew can enter information into either CDU, the primary FMC is responsible for synchronizing this information with the secondary FMC and updating both CDU displays.

When external position updating is not available, the FMC uses the IRS position as reference. When the IRS is the only position reference, the FMC applies an automatic correction to the IRS position to determine the most probable FMC position. This correction factor is developed by the FMC’s monitoring IRS performance during periods of normal position updating to determine the typical IRS error value. It is important to note that, when external position updating is not available, navigation accuracy may be less than required. Flight crews should closely monitor FMC navigation, especially when approaching the destination. The accuracy of the FMC navigation should be determined during descent phase by using radio navaids and radar information if available.

Note: Inaccurate position updating may cause the airplane to deviate from the desired track.

Control Display Units (CDUs)

Two identical, independent CDUs provide the means for the flight crew to communicate with the FMC. The crew may enter data into the FMC using either CDU, although simultaneous entries should be avoided. The same FMC data and computations are available on both CDUs; however, each pilot has control over what is displayed on an individual CDU.

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Flight Management, Navigation — Chapter 11
Flight Management System Operation — Section 31

Introduction

When first powered, the FMS is in the preflight phase. As a phase is completed, the FMS automatically transitions to the next phase in this order:

- preflight
- takeoff
- climb
- cruise
- descent
- approach
- flight complete.

Preflight

During preflight, flight plan and load sheet information are entered into the CDU. The flight plan defines the route of flight from the origin to the destination and initializes LNAV. Flight plan and load sheet information provide performance information to initialize VNAV.

Required preflight information consists of:

- initial position
- route of flight
- performance data
- takeoff data.

Optional preflight data includes:

- navigation database
- SID
- STAR

[Option – FMC U11.0 and later]
- Route 2

- RTA data
- cruise wind
- reduced takeoff and climb thrust limits.

Each required or optional data item is entered on specific preflight pages.

Preflight begins with the IDENT page. If the IDENT page is not displayed, it can be selected from the IDENT prompt on the INIT/REF INDEX page. Visual prompts provide assistance in selecting the appropriate CDU pages. Preflight pages can be manually selected in any order.

After entering and checking the necessary data on each preflight page, the lower right line select key is pushed to select the next page. When ACTIVATE is selected on the RTE page, the execute light illuminates. The EXEC key is then pushed to complete the task of making the route active before continuing with the preflight.

If a standard instrument departure (SID) is to be entered into the route, the departure/arrival (DEP/ARR) page is selected. After selecting the desired SID, the resulting modification must be appropriately linked to the existing route and executed. This can be accomplished on the RTE or RTE LEGS page.

When all required preflight entries are complete, the preflight status prompts on the TAKEOFF REF page are no longer displayed.

Takeoff

The takeoff phase begins with selection of TO/GA and extends to the thrust reduction altitude where climb thrust is normally selected.

Climb

The climb phase begins at the thrust reduction altitude and extends to the top of climb (T/C) point. The T/C point is where the airplane reaches the cruise altitude entered on the PERF INIT page.

Cruise

The cruise phase begins at the T/C point and extends to the top of descent (T/D) point. Cruise can include step climbs and en route descents.

Descent

The descent phase begins at the T/D point or when either a level change or vertical speed descent is initiated. The descent phase extends to the beginning of the approach phase.

Approach

The approach phase begins two miles from the first waypoint of a published approach or approach transition selected from the ARRIVALS page.

Flight Complete

After landing, the flight complete phase clears the active flight plan and load data. Some preflight data fields initialize to default values in preparation for the next flight.

FMC and CDU Terminology

The following paragraphs describe FMC and CDU terminology.

Active – flight plan information currently being used to calculate LNAV or VNAV guidance commands.

Activate – designating an entered route as the active route for navigation. It is a two step process:

- push the ACTIVATE prompt
- push the execute (EXEC) key.

[Option – FMC U11.0 and later]
Activate – changing an inactive route to an active route for navigation is a two step process:

- push the ACTIVATE prompt
- push the execute (EXEC) key.

Altitude restriction – a crossing restriction at a waypoint.

Delete – remove FMC data and revert to default values, dash or box prompts, or a blank entry using the DELETE key.

Econ – a speed schedule calculated to minimize operating cost. The economy speed is based on the flight crew CDU–entered cost index. A low cost index reflects high fuel costs and results in a lower cruise speed.

Enter – placing an entry into the CDU scratchpad and then line selecting the information to the desired location. New characters can be typed, or existing data can be line selected into the scratchpad.

Erase – removing flight crew–entered information, which has resulted in a modification, by pushing the ERASE prompt.

Execute – making modified information part of the active flight plan by pushing the EXEC key.

Inactive – route, climb, cruise, or descent information not currently being used to calculate LNAV or VNAV commands.

Initialize – entering information required to make the system operational.

Message – information the FMC automatically writes in the scratchpad to inform the flight crew of a system condition.

Modify – active data that is changed but not yet executed. When a modification is made to the active route or performance mode, MOD is displayed in the page title, ERASE appears next to line select key 6 left, and the execute key illuminates.

Prompt – CDU displays that aid the flight crew in accomplishing a task. Prompts can be boxes, dashes, or a careted (< or >) line to remind the flight crew to enter or validate information.

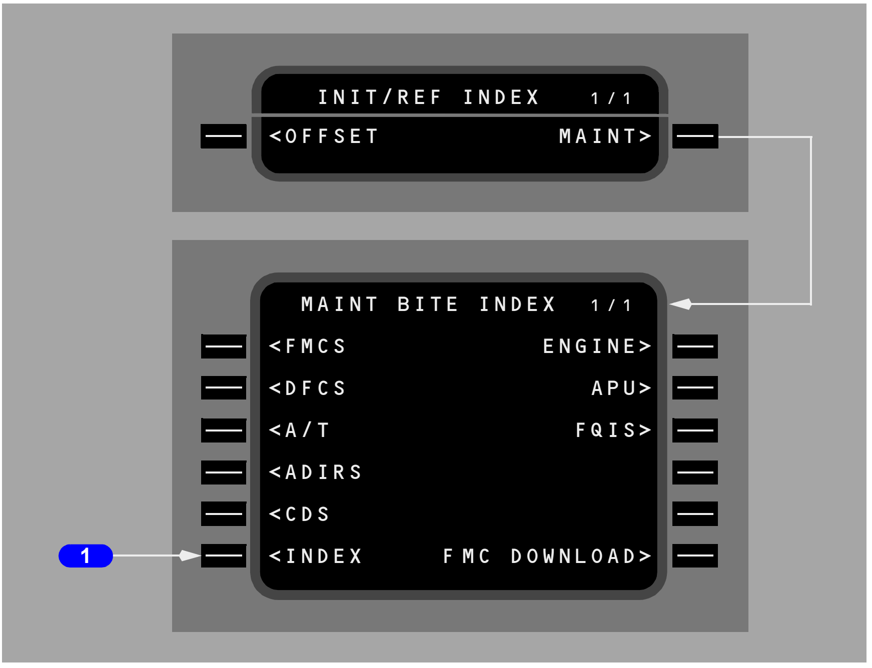
Select – pushing a key to obtain the desired information or action, or to copy selected data to the scratchpad.

Speed restriction – an airspeed limit associated with a specified altitude or waypoint.

Waypoint – a point on the route. It can be a fixed point such as a latitude and longitude, VOR or ADF station, airway intersection, or a non–fixed point such as a conditional waypoint. A conditional waypoint is not necessarily associated with a land reference; it reflects a time position, or altitude requirement. An example of a conditional waypoint is “when reaching 1000 feet.”

Maintenance Index Page

The MAINT BITE INDEX page is available only on the ground and provides access to data for use by maintenance personnel.



1 INDEX

Push – displays the INIT/REF INDEX page.

Navigation Position

[Option – With GPS]
The FMC determines present position from the IRS, GPS, and navigation radios. The FMC uses its calculated present position to generate lateral steering commands along the active leg to the active waypoint.

[Option – Dual FMC with GPS]
When the FMC Source Select Switch is positioned to NORMAL, the left FMC becomes primary, however, data from both FMCs is combined to determine a composite position and velocity for guidance and map displays.

FMC Position Update

[Option – With GPS]
On the ground, the FMC calculates present position based on GPS data. If GPS data is not available, the FMC calculates present position based on IRS data.

[Option – FMC U10.2 and later]
If GPS UPDATE is OFF, the FMC updates position to the takeoff runway threshold when a TO/GA switch is pushed. When making an intersection takeoff, the intersection data must be entered on the TAKEOFF REF page. If GPS UPDATE is ON with valid GPS reception, the TO/GA update is inhibited. GPS UPDATE is on the NAV OPTIONS page.

[Option – Runway position update via the CDU only]
On the ground prior to takeoff, FMC position update to the takeoff runway threshold position can be done on the TAKEOFF REF page.

[Option – With GPS]
In flight, the FMC position is continually updated from the GPS, navigation radios, and IRS. Updating priority is based on the availability of valid data from the supporting systems.

FMC position updates from navigation sensor positions are used in the following priority order:

- GPS
- two or more DME stations
- one VOR with a collocated DME
- one localizer and collocated DME
- one localizer.

The station identifiers and frequencies of the selected radio navigation aids are displayed on the NAV STATUS page 1/2.

FMC logic selects the GPS position as the primary update to the FMC position. If all GPS data becomes unavailable, the FMC reverts to radio or IRS updating.

The dual frequency–scanning DME radios are automatically tuned by the FMC. The stations to be tuned are selected based upon the best available signals (in terms of geometry and strength) for updating the FMC position, unless a specific station is required by the flight plan. Radio position is determined by the intersection of two DME arcs.

If the DME radios fail, or if suitable DME stations are not available, FMC navigation is based on IRS position information only. The two VHF Nav radios are used by the FMC for localizer updating during an ILS approach and by the crew for navigation monitoring.

Note: The FMC is designed to automatically reject unreliable navaid data during FMC position updating. However, in certain conditions, navaids which are in error may satisfy the reasonableness criteria and provide the FMC with an inaccurate radio position. One of the most vulnerable times is when a radio position update occurs just after takeoff. This is usually manifested in an abrupt heading correction after engaging LNAV. The position shift can be seen on the map which will shift the desired track and runway symbol to a position significantly different from that displayed during ground roll.

[Option – FMC U10.3 and later]
Note: If the flight crew observes either of these indications, the FMC should be carefully monitored.

When adequate radio updating is not available, navigation display map mode may display a shift error. This error results in the displayed position of the airplane, route, waypoints, and navigation aids shifted from their actual positions.

An across track, undetected map shift may result in the airplane flying a ground track that is offset from the desired track. An along track, undetected map shift may result in the flight crew initiating altitude changes earlier or later than desired. In either case, an undetected map shift may compromise terrain or traffic separation.

Map shift errors can be detected by comparing the position of the airplane on the navigation display map mode with data from the ILS, VOR, DME, and ADF systems.

Navigation Performance

The FMC uses data from the navigation systems to accurately calculate the position of the airplane. The current FMC position is shown on line 1 of the POS REF page 2/3.

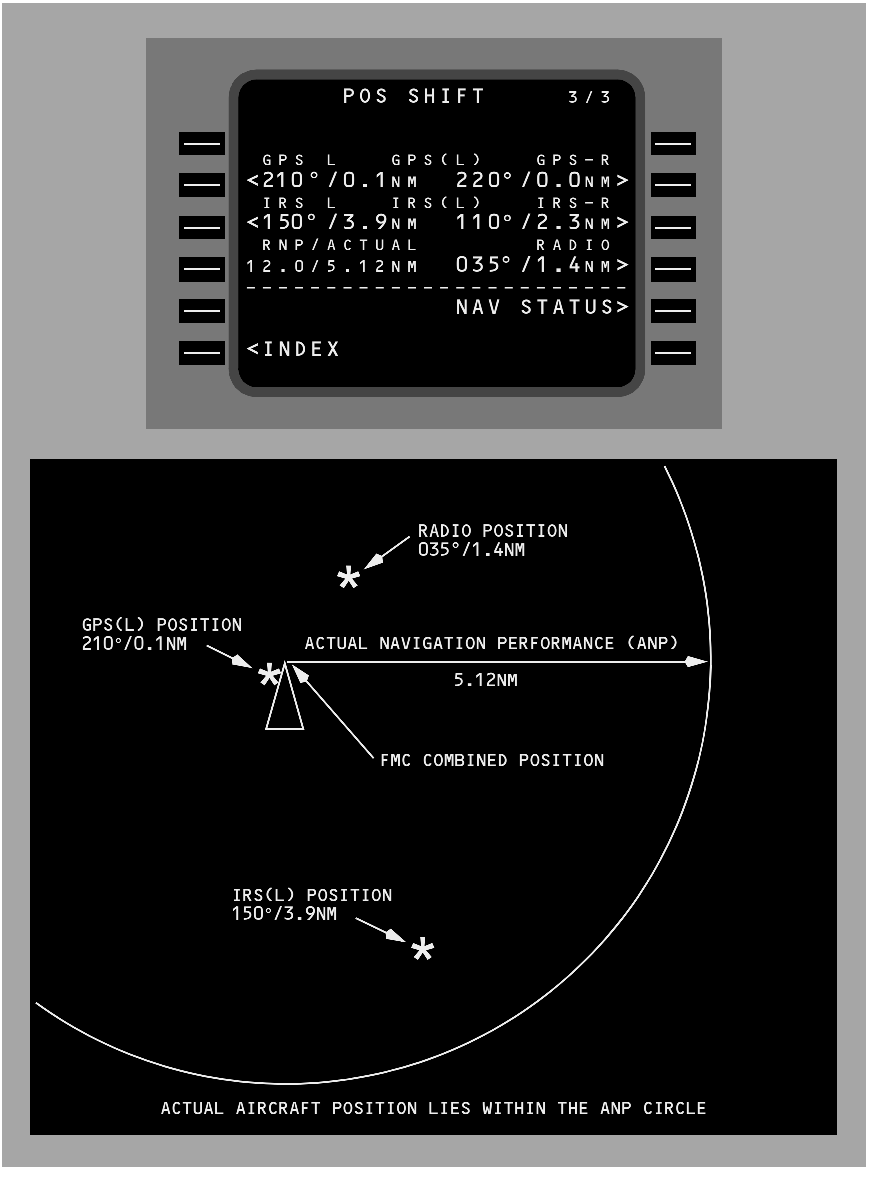
[Option – With GPS]
The FMC position is derived from a mathematical combination of the positions determined by the IRS, radio, and GPS systems. It represents the FMC's estimate of the actual position of the airplane. Its accuracy varies according to the accuracy of the other position determining systems.

[Option – FMC U10.4 and later]
Note: If the GPS position update is excessive, GPS updating is suspended until the GPS position can be determined to be reasonable.

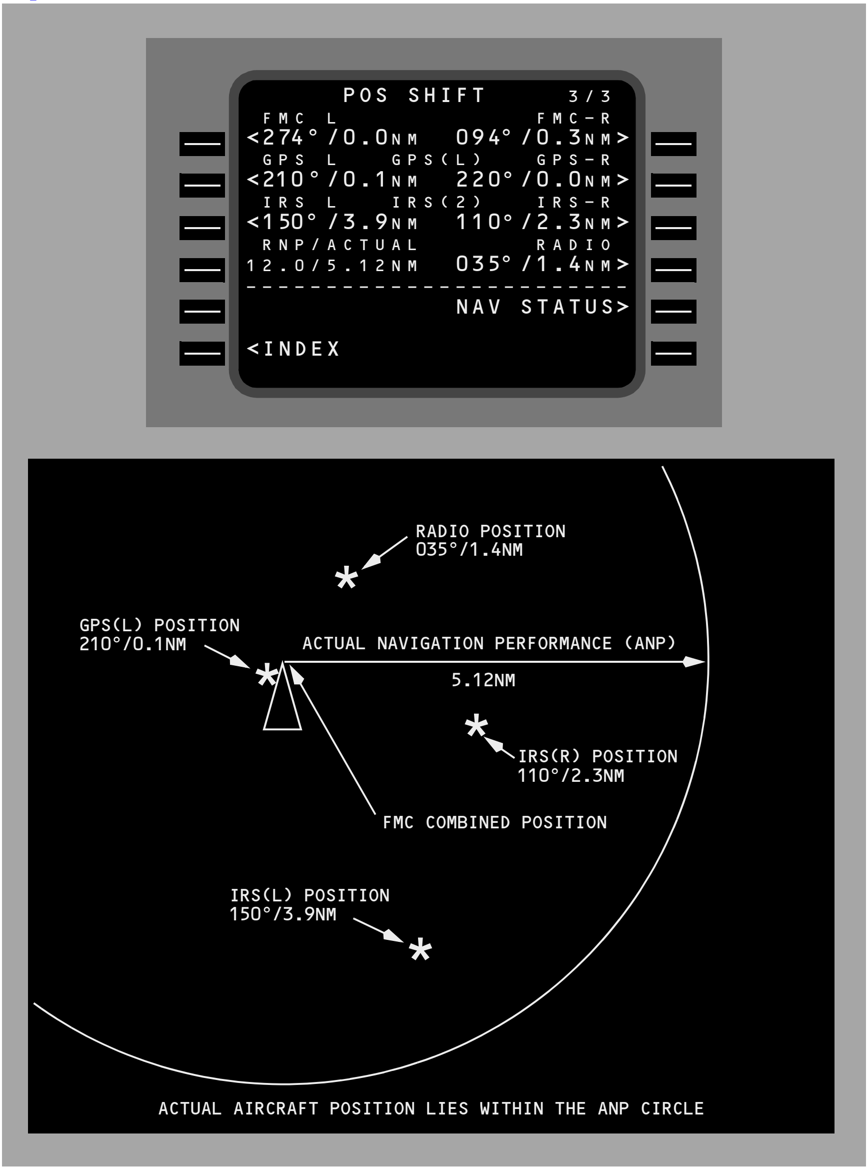
Actual Navigation Performance (ANP)

Actual navigation performance (ANP) is the FMC's estimate of the quality of its position determination. It is shown on POS SHIFT page 3/3 and on RTE LEGS pages. ANP represents the estimated maximum position error with 95% probability. That is, the FMC is 95% certain that the airplane's actual position lies within a circle with a radius of the ANP value around the FMC position. The lower the ANP value, the more confident the FMC is of its position estimate.

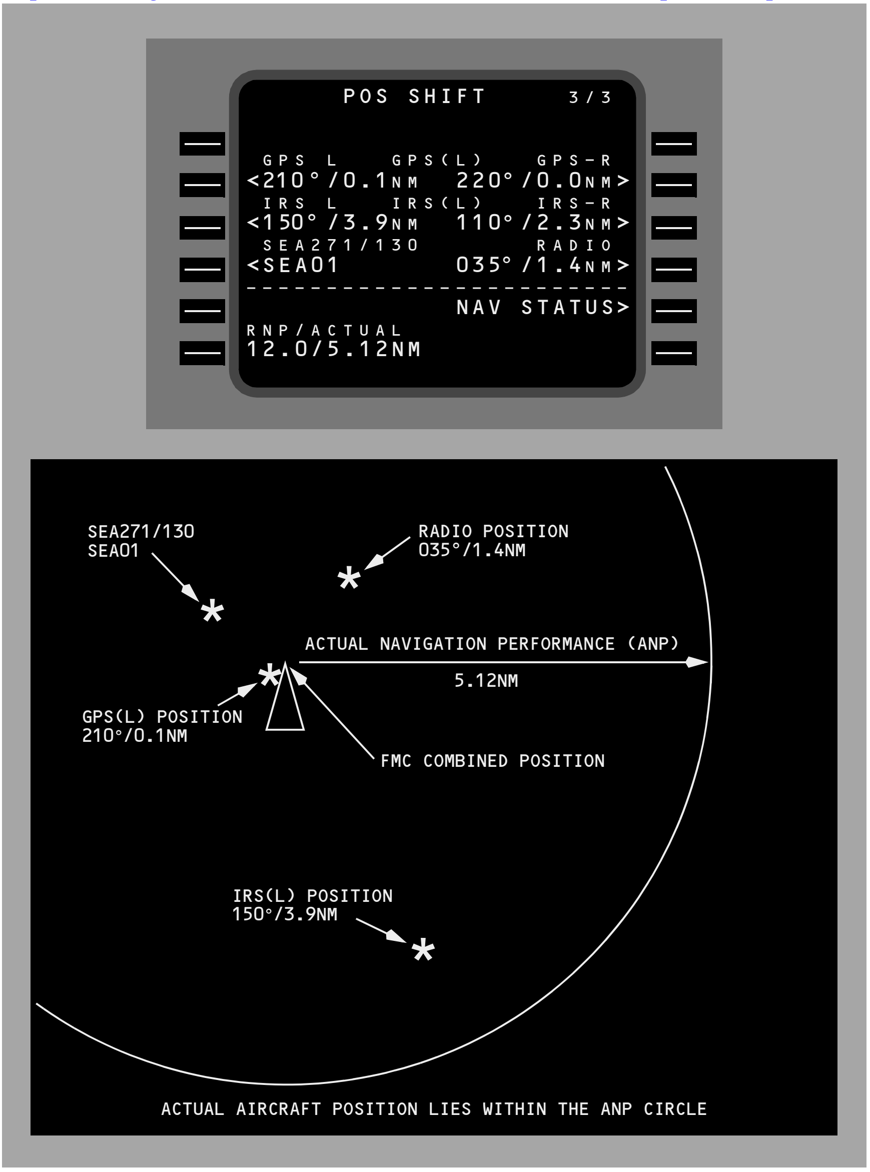
[Option – Single FMC with GPS]



[Option – Dual FMC with GPS]



[Option – Single FMC with GPS, U10.6 or later with manual position update]



Vertical Actual Navigation Performance (VANP)

[Option – FMC U10.5 and later with NPS enabled]
Vertical Actual Navigation Performance (VANP) is the FMC's estimate of the quality of its altitude determination. It is shown on RNP PROGRESS page 4/4. VANP represents the estimated maximum altitude error with 99.7% probability. That is, the FMC is 99.7% certain that the airplane's actual altitude lies within a vertical band equal to plus or minus the ANP value. The lower the VANP value, the more confident the FMC is of its altitude estimate.

Note: VANP is calculated from the baro-corrected altitude provided by the Air Data System. The pilot must set the baro setting reported by ATIS or provided in the approach clearance for the 99.7% confidence level to be valid.

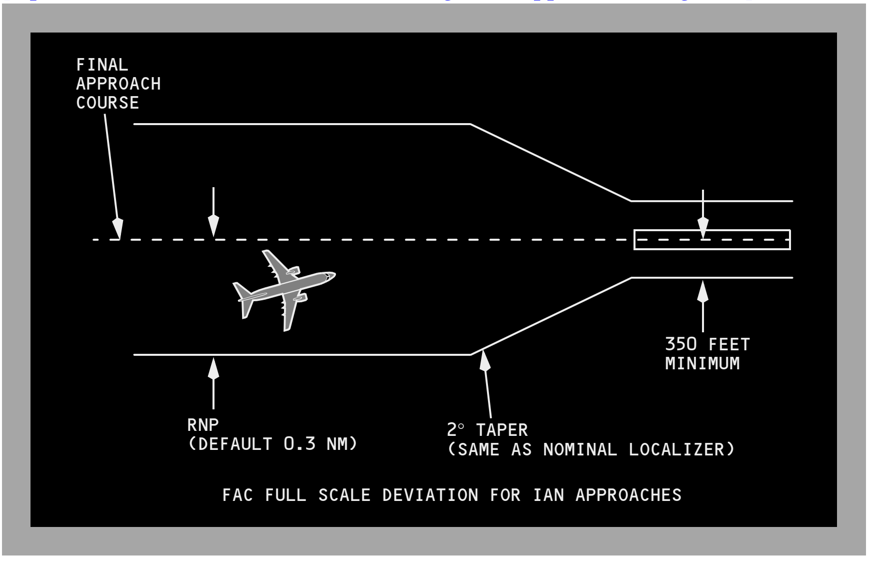
Required Navigation Performance (RNP)

Required Navigation Performance (RNP) is the navigation accuracy required for operation within a defined airspace. It is expressed in nautical miles. RNP values have been published for areas of operation around the world. Operations in these areas require on–board navigation systems to alert the flight crew if ANP exceeds RNP. The FMC supplies a default RNP value for en route, oceanic/remote, terminal, and approach phases of flight.

[Option – FMC U10.7 and later]
If ANP exceeds the displayed RNP value, the UNABLE REQD NAV PERF–RNP message will be displayed on the CDU scratchpad after the designated time to alert has elapsed. An additional amber UNABLE REQD NAV PERF–RNP will be displayed on the MAP. The amber FMC lights located on the forward instrument panel will also illuminate with the annunciation of this message. RNP is shown on the POS SHIFT, RNP PROGRESS 4/4 and the RTE LEGS pages.

[Option – FMC U14]
UNABLE REQD NAV PERF-RNP message will be displayed if there are differences between IRU-L and IRU-R inertial sensors (altitude or vertical speed) affecting vertical guidance control or vertical deviation cross track display while the VNAV phase is in DES and the aircraft is on an RNP-AR approach leg.

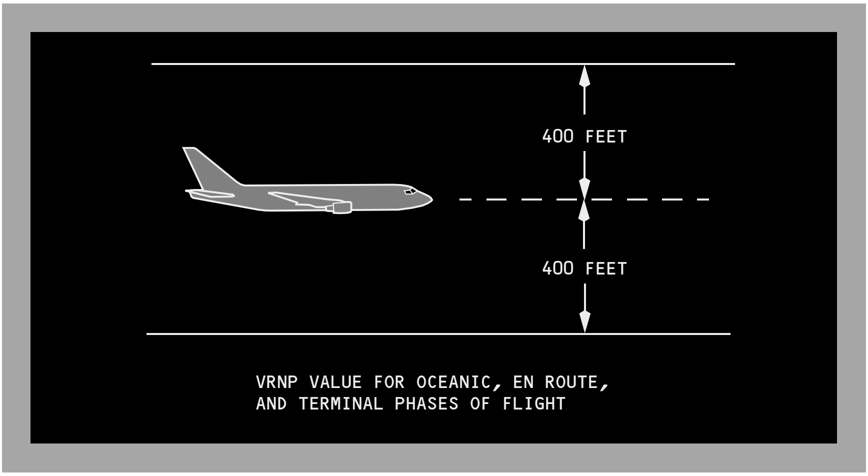
[Option – FMC U10.5 and later with Integrated Approach Navigation]

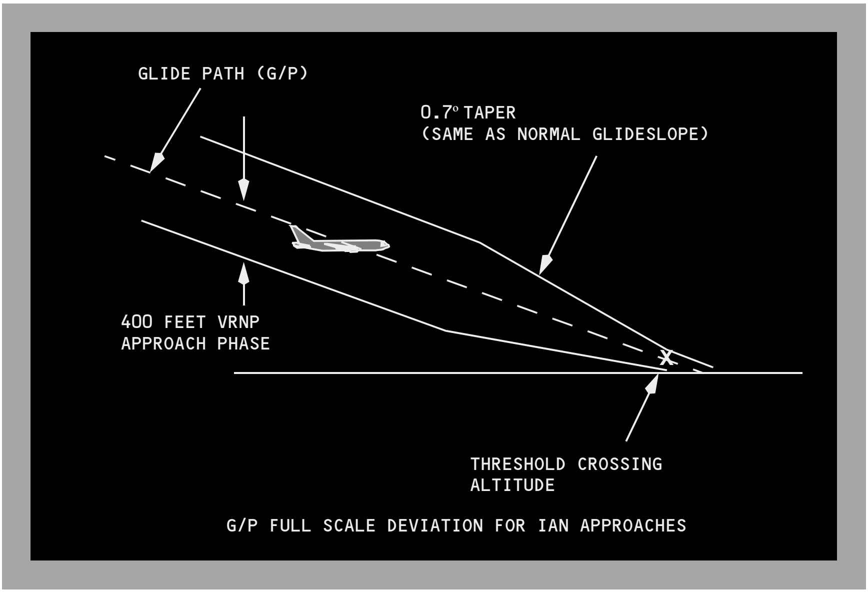


Vertical Required Navigation Performance (VRNP)

[Option – FMC U10.5 and later with NPS enabled]

The FMC uses 400 feet as a default Vertical Required Navigation Performance (VRNP) value for oceanic, en route, and terminal phases of flight.





When required, VRNP values may be manually entered or displayed on RNP PROGRESS page 4/4. The FMC will accept manual entry of a VRNP value greater than the default value, but the VERIFY VERT RNP VALUE advisory message will be displayed in the scratchpad. Manual entries are cleared at flight completion.

Lateral Navigation (LNAV)

LNAV provides steering commands to the next waypoint. If selected, LNAV engages when laterally within 3 nautical miles of the active route leg. If outside of 3 nautical miles of the active route leg, LNAV engages if on an intercept heading of 90 degrees or less and the intercept will occur before the active waypoint. FMC LNAV guidance normally provides great circle courses between waypoints. However, when an arrival or approach from the FMC database is entered into the active route, the FMC can supply commands to fly a constant heading, track, or follow an arc, as required by the procedure.

[Option – FMC U11.0 and later]
LNAV provides steering commands to the next waypoint. If selected, LNAV engages when laterally within 3 nautical miles of the active route leg. If outside of 3 nautical miles of the active route leg, LNAV engages if on an intercept heading of 90 degrees or less and the intercept will occur before the active waypoint. FMC LNAV guidance normally provides geodetic paths between waypoints. However, when an arrival or approach from the FMC database is entered into the active route, the FMC can supply commands to fly a constant heading, track, or follow an arc, as required by the procedure.

Waypoints

Waypoint (navigation fix) identifiers are displayed on the CDU and navigation display.

The CDU message NOT IN DATA BASE is displayed if a manually entered waypoint identifier is not stored in the database. The waypoint can still be entered as a latitude/longitude, place–bearing/distance or place–bearing/place–bearing waypoint.

FMC–generated waypoints contain a maximum of five characters assigned according to the following rules.

Navaid Waypoint Names

VHF – waypoints located at VHF navaids (VOR/DME/LOC) are identified by the official one, two, three or four character facility identifier. Examples:

- Los Angeles VORTAC – LAX
- Tyndall TACAN – PAM
- Riga, Latvia – RIX.

NDB – waypoints located at NDBs are identified by use of the station identifier. Example:

- Fort Nelson, CAN – YE.

Fix Waypoint Names

Fixes with one–word names – waypoints located at fixes with names containing five or fewer characters are identified by the name. Examples:

- DOT
- ACRA
- ALPHA.

Long Waypoint Names

Names with more than five characters are abbreviated using the following rules sequentially until five characters remain. Double letters are deleted. Examples:

- KIMMEL becomes KIMEL
- COTTON becomes COTON
- RABBITT becomes RABIT.

Keep the first letter, first vowel and last letter. Delete other vowels starting from right to left. Examples:

- ADOLPH becomes ADLPH
- BAILEY becomes BAILY
- BURWELL becomes BURWL.

Keep the last letter, then delete consonants from right to left. Examples:

- ANDREWS becomes ANDRS
- BRIDGEPORT becomes BRIDT
- HORSBA becomes HORSA.

Fixes with multiword names use the first letter of the first word and abbreviate the last word, using the above rules sequentially until a total of five characters remain. Examples:

- CLEAR LAKE becomes CLAKE
- ROUGH ROAD becomes RROAD.

Unnamed Point Waypoint Names

Unnamed turn points, intersections and DME fixes – if an unnamed turn point, intersection or fix is collocated with a named waypoint or navaid on a different route structure (such as low altitude routes or an approach), the name or identifier of the collocated waypoint is used. Example:

- Unnamed turn point on J2 between the Lake Charles (LCH) and New Orleans (MSY) VORTACs is coincidental with the Lafayette (LFT) low altitude VORTAC. LFT is used as the identifier for the turn point.

Identifier codes for unnamed turn points not coincidental with named waypoints are constructed from the identifier of a navaid serving the point and the distance from the navaid to the point. If the distance is 99 nautical miles or less, the navaid identifier is placed first, followed by the distance. If the distance is 100 nautical miles or more, the last two digits are used and placed ahead of the navaid identifier. Examples (NAVAID – DISTANCE – IDENT):

- INW – 18 – INW18
- CSN – 106 – 06CSN
- TCS – 89 – TCS89.

Unnamed flight information region (FIR), upper flight information region (UIR), and controlled airspace reporting points – waypoints located at unnamed FIR, UIR, and controlled airspace reporting points are identified by the three–letter airspace type identification followed by a two–digit sequence number.

Unnamed oceanic control area reporting points – positions in the northern hemisphere use the letters N and E, while positions in the southern hemisphere use the letters S and W. Latitude always precedes longitude. For longitude, only the last two digits of the three digit value are used.

Placement of the designator in the five character set indicates whether the first longitude digit is 0 or 1. The letter is the last character if the longitude is less than 100° and is the third character if the longitude is 100° or greater.

N is used for north latitude, west longitude. E is used for north latitude, east longitude. S is used for south latitude, east longitude. W is used for south latitude, west longitude. Examples:

- N50° W040° becomes 5040N
- N75° W170° becomes 75N70
- N50° E020° becomes 5020E
- N06° E110° becomes 06E10
- S52° W075° becomes 5275W
- S07° W120° becomes 07W20
- S50° E020° becomes 5020S
- S06° E110° becomes 06S10.

Procedure Arc Fix Waypoint Names

Unnamed terminal area fixes along a DME arc procedure – unnamed fixes along a DME arc procedure are identified with the first character D. Characters 2 through 4 indicate the radial on which the fix lies. The last character indicates the arc radius. The radius is expressed by a letter of the alphabet where A = 1 mile, B = 2 miles, C = 3 miles, and so forth. Examples:

- EPH252°/24 = D252X
- EPH145°/24 = D145X
- GEG006°/20 = D006T.

An unnamed waypoint along a DME arc with a radius greater than 26 miles is identified as an unnamed turn point that is not coincidental with a named waypoint. Examples:

- CPR338°/29 = CPR29
- GEG079°/30 = GEG30.

When there are multiple unnamed waypoints along a DME arc with a radius greater than 26 miles, the station identifier is reduced to two characters, followed by the radius, and then a sequence character. Examples:

- CPR134°/29 = CP29A
- CPR190° /29 = CP29B
- CPR201°/29 = CP29C.

Procedure Fix Waypoint Names

Marker beacons – a marker beacon is identified by the marker type identifier followed by the runway number. Examples:

- Outer Marker 13R = OM13R
- Middle Marker 21 = MM21.

Runway–related fixes – waypoints located at unnamed runway–related fixes are identified by adding a two–letter prefix to the runway number. The following list is used to determine the appropriate prefix:

- RX – runway extension fix
- FA – VFR final approach fix
- CF – final approach course fix
- FF – final approach fix
- IF – initial approach fix
- OM – outer marker
- MM – middle marker
- IM – inner marker
- BM – back course marker
- MD – minimum descent altitude
- A – (+ an alpha) step down fix
- RW – runway threshold
- MA – missed approach point other than RW
- TD – touchdown point inboard of RW.

Examples: OM25L, MM09, IM23, RW04, RW18L.

For airports with more than one approach to the same runway, the two letter prefix may change to allow different identifiers for the same waypoint. The first letter identifies the type of fix and the second letter identifies the type approach as follows:

- C( ) – final approach course fix
- F( ) – final approach fix
- P( ) – missed approach point
- I( ) – initial approach fix
- D( ) – minimum descent altitude
- T( ) – touch down point
- R( ) – runway centerline intercept.
- ( )I – ILS
- ( )L – localizer only( )B –backcourse ILS
- ( )D – VOR/DME
- ( )V – VOR only
- ( )S – VOR with DME points
- ( )N – NDB
- ( )Q – NDB with DME points
- ( )M – MLS
- ( )T – Tacan
- ( )R – RNAV.

Examples: CI32R, PV15, FN24L.

Unnamed turn points – unnamed turn points that are part of a procedure are identified as a latitude and longitude waypoint. These include waypoints (except conditional waypoints) defined by flying a course or track from a waypoint (except conditional waypoints) to a radial or DME distance. These waypoints are automatically entered in a route by selection of a procedure using these waypoints, from the departures or arrivals page.

Airport reference points – airport reference points are identified by the ICAO identifier.

Duplicate Waypoint Names

Duplicate identifiers – should application of these rules result in more than one waypoint having the same identifier, then a CDU page change occurs when an attempt is made to enter the duplicated identifier.

[Option – FMC U10.6 and later]
The page title is SELECT DESIRED XXX, where XXX is the three letter identifier of the waypoint in question.

The page lists the latitude and longitude of waypoints with the same identifier and the type of facility or waypoint. Selecting the latitude/longitude of the desired waypoint enters the correct waypoint on the original page. See chapter 11, section 42, “Select Desired Waypoint Page” for additional information.

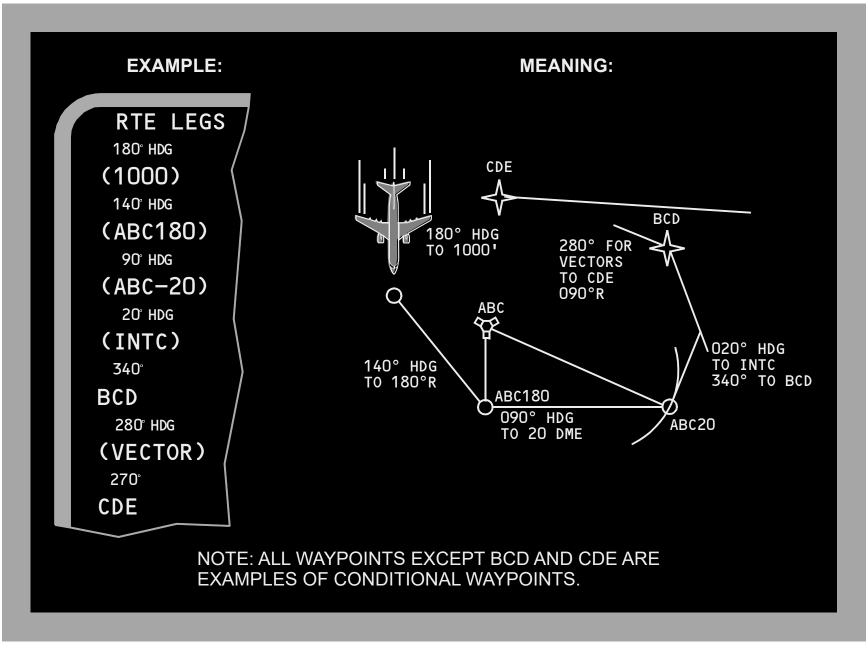
When a waypoint identifier is listed in the route more than once, certain route modifications (such as DIRECT TO or HOLD) use the first occurrence of the waypoint even if the second occurrence is selected. If a new waypoint entry is attempted that has the same identifier as a waypoint already in the route, the select desired waypoint page will not be displayed and the first waypoint will be used. To use the second occurrence waypoint, the first occurrence waypoint must be deleted from the route.

Conditional Waypoint Names

Conditional waypoints are automatically entered into a route as a result of selecting a procedure on a DEPARTURES or ARRIVALS page. Normally, conditional waypoints cannot be manually entered on a route or legs page. These waypoints are events when a condition occurs and are not at a geographically–fixed position. The types of conditions are:

- passing through an altitude
- flying a heading to a radial or DME distance
- intercepting a course
- heading vector to a course or fix.

Altitude and course intercept conditional waypoints are displayed on the CDU inside (parentheses) marks. The following diagram depicts conditional waypoints.



Note: When (VECTOR) is the active leg and LNAV is not engaged, the FMC automatically sequence to the next waypoint when within 3 nm of the next leg. If (VECTOR) is the active waypoint and LNAV is engaged, the FMC does not automatically sequence to the next waypoint. The next waypoint becomes active only upon EXECution of the procedures for Proceeding Direct To a Waypoint or Intercepting a Leg to a Waypoint.

Manually Entered Latitude/ Longitude Waypoint Names

Pilot defined waypoints entered as a latitude and longitude are displayed in a five–character format. The first three characters are WPT followed by a two digit sequence number. Latitude and longitude waypoints are entered with no space or slash between the latitude and longitude entries. Leading zeroes must be entered. All digits and decimal points (to 1/10 minute) must be entered unless the latitude or longitude are full degrees. Examples:

- N47° W008° is entered as N47W008 and displayed as WPT01
- N47° 15.4’ W008° 3.4’ is entered as N4715.4W00803.4 and displayed as WPT02.

Manually Entered Place–Bearing/Distance or Place–Bearing/Place–Bearing Waypoint Names

Waypoints entered as a place–bearing/distance or place–bearing/place–bearing are identified by the first three characters of the entry followed by a two–digit sequence number. Examples:

- SEA330/10 becomes SEA01
- SEA330/OLM020 becomes SEA02.

Manually Entered Along–Track Waypoint Names

Along–track waypoints are a special case of place–bearing/distance waypoints applied to the current route. When a waypoint is desired on the route where none exists, the along–track waypoint feature creates the desired waypoint without creating a route discontinuity.

Along–track waypoints are entered using the waypoint name (the place), followed by a slash and minus sign, for points before the waypoint, or no sign for points after the waypoint, followed by the mileage offset for the newly defined waypoint. The route course takes the place of the bearing which is not entered. The created waypoint is then inserted over the original waypoint. The distance offset must be less than the distance between the originating waypoint and next (positive value) or preceding (negative value) waypoint. Latitude and longitude waypoints cannot be used to create along–track waypoints. Examples:

- VAMPS/25 is 25 miles after VAMPS on the present route, and is displayed as VAM01
- ELN/–30 is 30 miles before ELN on the present route, and is displayed as ELN01.

Greater Than 99 Numbered Waypoints

[Option – FMC U10.6 and later]
When the quantity of numbered waypoints exceeds 99 the identifier will use the first two characters of the entry followed by the smallest three-digit sequence number beginning with 100. Examples:

- SEA104/74 becomes SE100
- SEA104/OLM064 becomes SE101.

Navigation Displays

The route is displayed on the navigation display in the map, map center, and plan modes. The display color and format represent the following status:

- an inactive route is displayed as a cyan dashed line
- an activated but not yet executed route is displayed as a cyan dashed line
- the active route is displayed in magenta
- modifications to an active route are displayed as dashed white lines
- modified waypoints are displayed in white
- executed route offsets are displayed as a dot and dash magenta line.

Vertical Navigation (VNAV)

VNAV provides vertical profile guidance through the climb, cruise, and descent phases of flight.

Speed/Altitude Restrictions

VNAV controls the path and speed to comply with waypoint crossing restrictions. Waypoint crossing restrictions are entered on the LEGS page waypoint line by pushing the applicable key on the right side of the CDU. Barometric altitude restrictions must be below the cruise altitude to be valid. Values entered as part of a procedure and manually entered restrictions are shown in large font. FMC predicted values do not act as restrictions, and are shown in small font.

[Option – With color]
A waypoint restriction is magenta when it is active. The restriction does not have to be in line 1 to be active.

[Option – With color]
Modified waypoint restrictions are shaded white until they are executed.

[Option – U10.7 and later]
All speed restrictions are considered by the FMC as “at” restrictions, unless modified by the pilot.

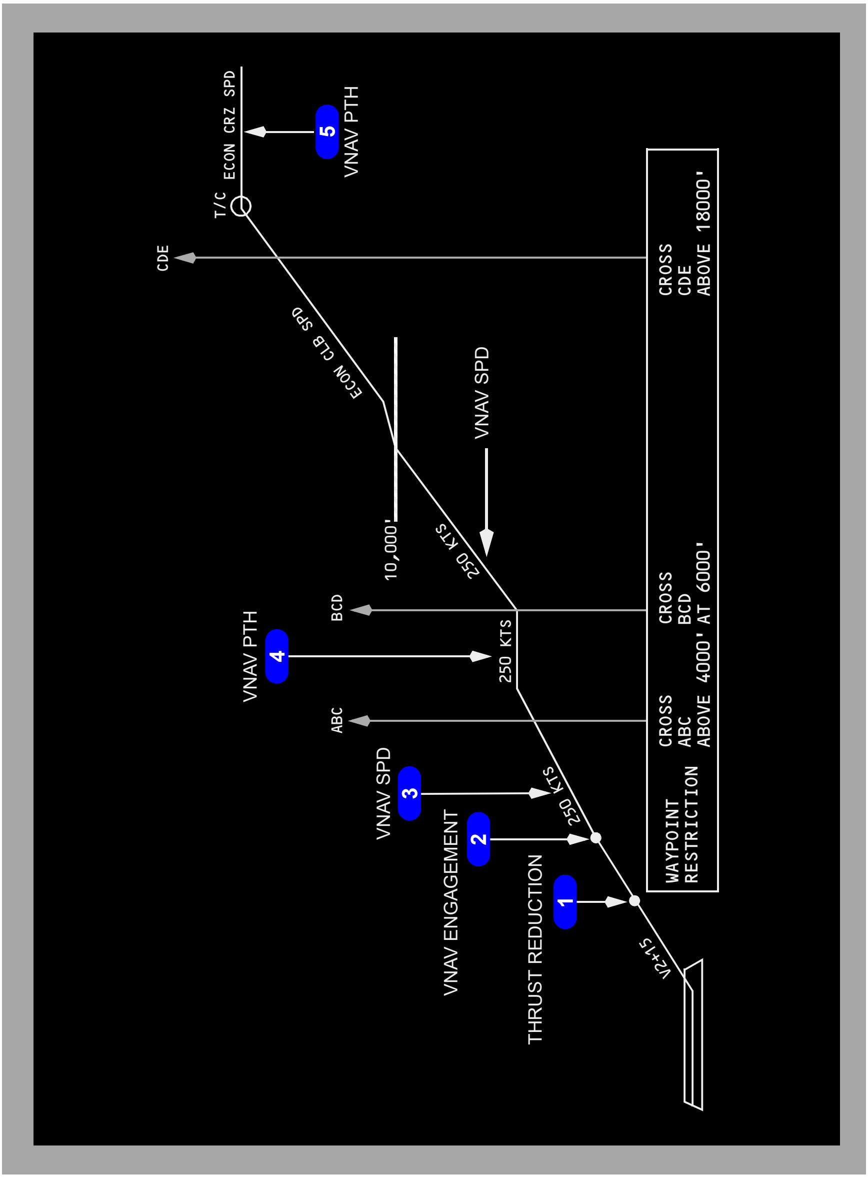
[Option – U10.7 and later]
When modified by the pilot:

- “At or above” airspeed restrictions are entered with a suffix letter A (example: 250A/).
- “At or below” airspeed restrictions are entered with a suffix letter B (example: 200B/).
- Mandatory airspeed restrictions are entered without any suffix letter (example: 220/).

At or above altitude restrictions are entered with a suffix letter A (example: 220A). At or below altitude restrictions are entered with a suffix letter B (example: 240B). Mandatory altitude restrictions are entered without any suffix letter (example: 270).

Altitude restrictions that are between two altitudes are displayed with the lower altitude limit first, then the upper altitude limit (example: 14000 FL240).

Takeoff and Climb



1 Thrust Reduction

Climb thrust is selected by pushing the N1 switch.

[Option – With automatic thrust reduction after takeoff]
Climb thrust is selected by pushing the N1 switch or automatically upon reaching the thrust reduction altitude.

[Option – With quiet climb]
When cutback mode is selected ON, the FMC calculates and commands a thrust cutback at the required cutback altitude. A new N1 is calculated during climb and normal climb thrust is restored at the RESTORE altitude.

2 VNAV Engagement

VNAV commands an airspeed increase to the planned climb speed profile, limited by configuration.

3 VNAV Climb

The VNAV climb profile uses VNAV SPD at the default climb speed or pilot selected climb speed to remain within all airspeed and altitude restrictions that are part of the SID entered into the active route. Autothrottle uses selected climb thrust limit.

Note: Selection of ENG OUT on the CLB page provides the crew with advisory engine out performance information.

If the climb speed profile cannot achieve an altitude restriction, the UNABLE NEXT ALTITUDE scratchpad message is shown.

4 Climb Restrictions

VNAV enters the VNAV PTH mode to remain within departure or waypoint restrictions. Speed maintained during this time can be:

- procedure based speed restriction
- waypoint speed restriction
- default VNAV climb speed
- manually entered climb speed.

5 Top Of Climb (T/C)

The point where the climb phase meets the cruise altitude is called the top of climb. Approaching this point, the FMC changes from the climb phase to the cruise phase. The T/C is shown any time the FMC calculates a change from a climb phase to a cruise phase, such as a step climb.

The T/C point is shown on the map as a green open circle with the label T/C.

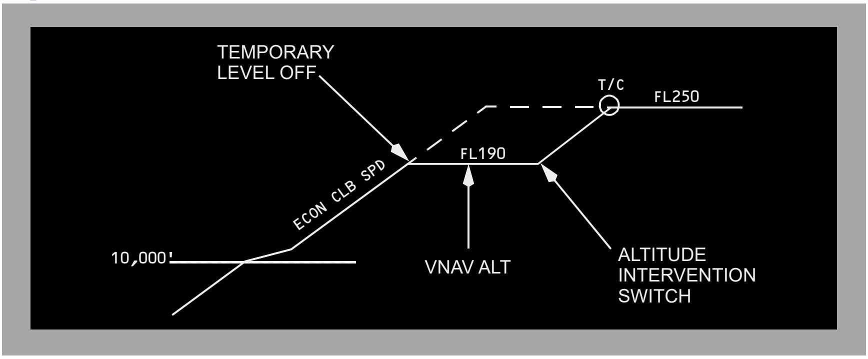
MCP Altitude Intervention

[Option]

[Option – With VNAV ALT]
The altitude intervention switch may be used to resume climb after a temporary level off.

[Option – FMC U11.0 and later]
The Altitude Intervention function will only apply to the active flight plan.

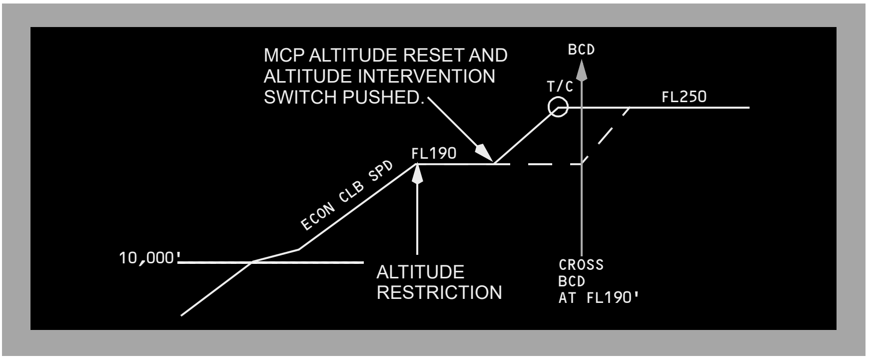
[Option – With VNAV ALT]



[Option – With VNAV ALT]
Whenever the airplane levels off at an MCP altitude that is not in the FMC, VNAV ALT engages. In the illustration above, FMC cruise altitude is FL250 and the clearance altitude, FL190, is set in the MCP. Pitch maintains altitude and thrust maintains FMC target speed. In the illustration above, the speed after the temporary level off would be ECON CLB SPEED.

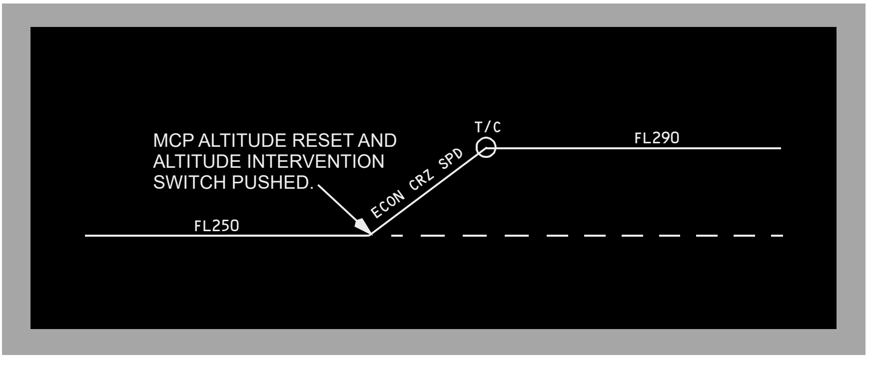
[Option – With VNAV ALT]
To resume the climb, put the clearance altitude into the MCP altitude window and push the altitude intervention switch. VNAV SPD engages. Pitch maintains FMC speed and thrust increases to the climb limit. In the example, the airplane climbs to FMC CRZ ALT and then levels off in cruise.

The altitude intervention switch may be used during climb or descent to delete altitude restrictions between the current altitude and the MCP altitude. When level at a restriction altitude, and cleared to a higher altitude prior to crossing the restriction waypoint, reset the MCP altitude to the new clearance altitude and push the altitude intervention switch.



In the illustration above, the current altitude restriction is deleted and the airplane continues VNAV climb to the cruise altitude. T/C moves to match the new climb profile.

The altitude intervention switch may be used to increase cruise altitude. When level at a cruise altitude, and then cleared to a higher cruise altitude, reset the MCP altitude to the new cruise altitude and push the altitude intervention switch.



In the illustration above, the cruise altitude is increased and the airplane enters a VNAV cruise climb at the economy cruise speed.

Altitude intervention cannot be used to decrease cruise altitude. Setting a lower altitude then pushing the altitude intervention switch causes the FMC to enter an early descent in the selected descent mode.

[Option – FMC U11.0 and later]
The Altitude Intervention function will only apply to the active flight plan. Altitude intervention software enables a climb or descent to a new cruise altitude to be initiated from the Mode Control Panel.

[Option – FMC U11.0 and later]
The altitude intervention option allows the crew to initiate a cruise descent using the altitude intervention feature on the Mode Control Panel when the airplane is not in close proximity to the top of descent. A distance of 50 NM will be used as a determinant for this operation. If the airplane is greater than 50 NM from T/D, the pilot may dial the MCP altitude down and press the ALT INTV button on the MCP. FMC response is similar to use of altitude intervention for a cruise climb initiation. FMC ALT is set to the new cruise altitude and cruise descent is initiated using existing guidance techniques for cruise descent. A CRZ DES can be initiated using altitude intervention when greater than 50 NM from top of descent provided that the MCP ALT is not set below a descent altitude constraint. For this condition of more than 50 nm to T/D, and the MCP altitude dialed below a descent constraint, the result of pressing the ALT INTV button will be to transition from CRZ to EARLY DES and to honor the constraint. Subsequent presses of the ALT INTV button may be used to delete the constraint.

Cruise

At cruise altitude, the FMC sets cruise speed at the default or pilot entered speed until reaching the top–of–descent (T/D) point. Alternate cruise speed options are:

- long range (LRC)
- flight crew entered speed.

Cruise thrust is set as required to maintain level flight at the target speed, with the autothrottle engaged. The FMC uses maximum range cruise speed if cost index is set to zero.

Fuel and ETA predictions are based on a constant altitude cruise unless a step climb altitude is entered.

Step Climb

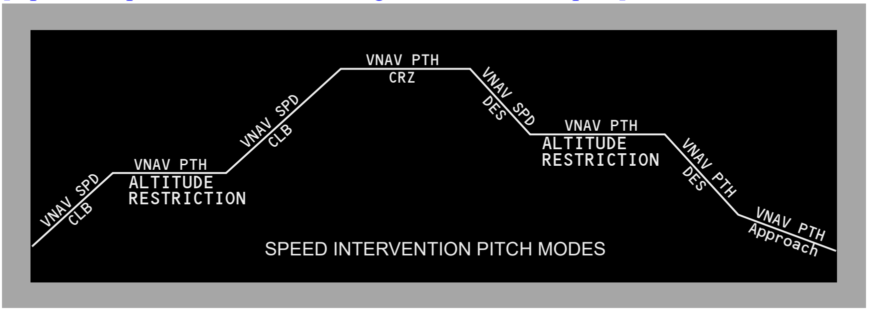
If a step climb altitude is entered in the CRZ page STEP altitude, the FMC calculates the point where the step climb should begin.

The distance and ETA to the next step point are shown on the CRZ and PROGRESS pages. The next step point is shown on the map as a green open circle with the label S/C.

MCP Speed Intervention

[Option – Speed intervention]

[Option – Speed intervention with geometric descent path]



The above illustration shows VNAV mode for each phase of flight during speed intervention.

With VNAV engaged, pushing the speed intervention switch enables speed intervention. Speed intervention allows the flight crew to change airplane speed with the IAS/MACH selector.

[Option - U13 and below]
In a path descent using speed intervention, VNAV PTH changes to VNAV SPD when the active descent segment is an idle or non-idle thrust segment. In VNAV PTH, thrust controls speed; in VNAV SPD, pitch controls speed.

[Option - U14 and above]
In a path descent using speed intervention, but not in a late descent, VNAV remains in VNAV PTH when the active descent segment is an idle thrust segment VNAV pitch control mode will remain (VNAV PTH) and VNAV will request autothrottle speed (FMC SPD).

If speed intervention is initiated during a late path descent, the FMC will transition to VNAV SPD guidance until the VNAV path is intercepted. The FMC will then tranistion to VNAV PTH guidance upon capturing the VNAV descent path.

Note: Aircraft equipped with geometric descent path will transition to VNAV PTH after the first altitude restriction.

FMCS speed targets constrain the aircraft within its operating limits except when in the speed intervention mode. These operating limits include stall protection, maximum operating speed, flap placards, thrust limits, and maneuver margins.

When a navigation data base vertical angle leg is flown (GP x.xx on RTE LEGS page), VNAV switches to VNAV PTH if not already in VNAV PTH.

In approach phase during speed intervention, the pitch mode remains in VNAV PTH after speed intervention is exited. The FMC will remain in the current vertical mode regardless of IAS MACH selector changes.

[Option – FMC U10.4 and later]
When speed intervention is exited the descent mode will switch back to path mode.

Descent

VNAV can perform a descent in either of two modes – path descent or speed descent. During a path descent, the FMC uses idle thrust and pitch control to maintain a vertical path, similar to a glideslope in three dimensions. During a speed descent, the FMC uses idle thrust and pitch control to maintain a target descent speed, similar to a level change descent.

[Option – With common VNAV]
VNAV performs descents using pitch control to maintain a vertical path. Thrust is used to control speed, similar to a glideslope in three dimensions.

Top Of Descent (T/D)

The point where the cruise phase changes to the descent phase is the top of descent. The T/D point is shown on the map as a green open circle with the label T/D. T/D is calculated from an end of descent (E/D) point.

Intermediate T/D points show on the map as green open circles with the label T/D–XXXXX (altitude). Intermediate T/D points exist when path segments between altitude restricted waypoints produce a level path segment. The intermediate T/D point shows where the descent will resume.

[Option – FMC U11.0 and later]
When an exit from a holding pattern is requested by the pilot through CDU action:

- a turn path to the inbound leg will be generated immediately if the airplane is on the outbound leg or in the fix end turn when the T/D does not occur in the hold pattern.
- the entire hold pattern will be flown when the T/D does occur in the hold pattern.

End of Descent (E/D)

The FMC calculates a descent path based on airspeed restrictions, altitude restrictions and the end of descent (E/D) point. The E/D point is shown on the map as a green open circle with the label E/D. The E/D is the last of the following which is not preceded by a lateral discontinuity:

- the runway threshold for approaches with a runway waypoint on the RTE LEGS page, or

[Option – FMC U11.0 and later]
- the runway threshold for approaches with a runway waypoint on the active RTE LEGS page, or
- the missed approach point for approaches not showing a runway waypoint on the RTE LEGS page, or

[Option – FMC U11.0 and later]
- the missed approach point for approaches not showing a runway waypoint on the active RTE LEGS page, or

[Option – FMC U10.6 or later]
- the last descent waypoint, or
- the lowest “at” altitude restriction if no arrival procedure is entered.

Entering an instrument arrival procedure provides an E/D point.

If there is no E/D point, FMC predictions assume a computed profile to 1000 feet above the destination field elevation, at a position which will vary according to selection of arrival procedures. The FMC will provide a slowdown profile for approach. VNAV path descent is not available if there is no E/D point.

VNAV Descent and Approach Path

The descent path starts at the calculated top of descent (T/D) point and includes waypoint altitude restrictions. The path is based on:

- idle thrust
- speedbrakes retracted
- descent wind speed decreasing with decreasing altitude
- applicable target speed.

[Option – With geometric descent path]
After the first “at” or “at or below” restriction, the path angle is constant between waypoints.

[Option – FMC U10.2 and later]
Note: When passing top of descent and using high target speeds (within approximately 6 knots of Vmo/Mmo), VNAV may revert to LVL CHG to prevent overspeed. Reduce airspeed to the VNAV target descent speed prior to reengaging VNAV.

[Option – With common VNAV]

Note: When passing top of descent and using high target speeds (within approximately 6 knots of Vmo/Mmo), VNAV may revert to VNAV SPD to prevent overspeed.

Normally, the target speed is economy speed above the airspeed restriction altitude and 240 knots below that altitude, until deceleration for approach. VNAV will not permit descent below the airspeed restriction altitude until the airspeed is at or below the restricted value plus ten knots. The start and end of the airport speed restriction deceleration segment is shown on the map as a green open circles with no labels.

The descent path assumes deceleration to reach the final approach fix (FAF), or the glideslope intercept point at VREF 40+20 knots.

Target speeds are changed by entries on the DESCENT page. Entries made on the LEGS page are “at or below” and may limit the target speed. Wind and thrust assumptions are changed on the DES FORECASTS page.

Deceleration points show on the map as green open circles with the label DECEL. Deceleration points show prior to:

- airspeed constrained waypoints
- holding patterns
- approach flap extension.

If more than one deceleration segment exists in the flight plan, only the next deceleration point shows. Deceleration points can also show prior to cruise holding patterns or other speed reductions.

[Option – With VNAV ALT]

During descent, VNAV ALT engages if the airplane levels at an MCP altitude not in the FMC.

VNAV Path Descent

An E/D point must be defined in order to accomplish a path descent. It may be defined manually or by the selection of an arrival procedure.

[Option – FMC U10.5A and earlier]

The FMC defaults to the path descent mode for planning purposes. If the necessary information for a path descent is not available by the time the airplane reaches the T/D point, the FMC will revert to the speed descent mode.

The path descent normally begins automatically at the calculated T/D point, provided the MCP altitude is reset for the descent. If descent is not initiated by the T/D, a path descent may not be achievable. At the T/D, the FMC commands idle thrust and pitch to follow the descent path.

The descent complies with waypoint altitude restrictions by following the calculated vertical path.

Note: A path descent uses the target speed for planning purposes only. There is no attempt to maintain the target speed during the idle portion of the descent.

[Option – FMC U12.0 and later]
Note: When in path descent, if actual airplane speed is less than the descent target speed by a customized threshold amount loaded in the Loadable Defaults Database, the FMC will transition to FMC SPD as the thrust mode. The valid range for the threshold is 5 to 15 knots. The A/T mode returns to the retard/arm mode when the airplane speed is then equal to the target speed.

Note: When descending in VNAV PTH, the FCC will disengage VNAV and switch to LVL CHG if actual speed becomes equal to or slightly less than the minimum speed, denoted by the underspeed limiting symbol in the MCP IAS/Mach window. This can also happen in turbulence or gusty conditions when the minimum speed may momentarily increase due to G loading. See section 4.20, Minimum Speed Reversion.

The FMC uses a special program called "Energy Compensation" at certain times during an ACT PATH DES. This program goes into effect when the MCP has been temporarily set to an altitude above the planned descent path. The airspeed cursor will slowly move toward a slower airspeed while the "TARGET" speed on the FMC remains constant. The airspeed reduction improves the capability of recapturing the planned descent path. When the airplane is cleared to resume the descent, the airspeed will slowly build up to the FMC target speed as the airplane recaptures the planned descent path.

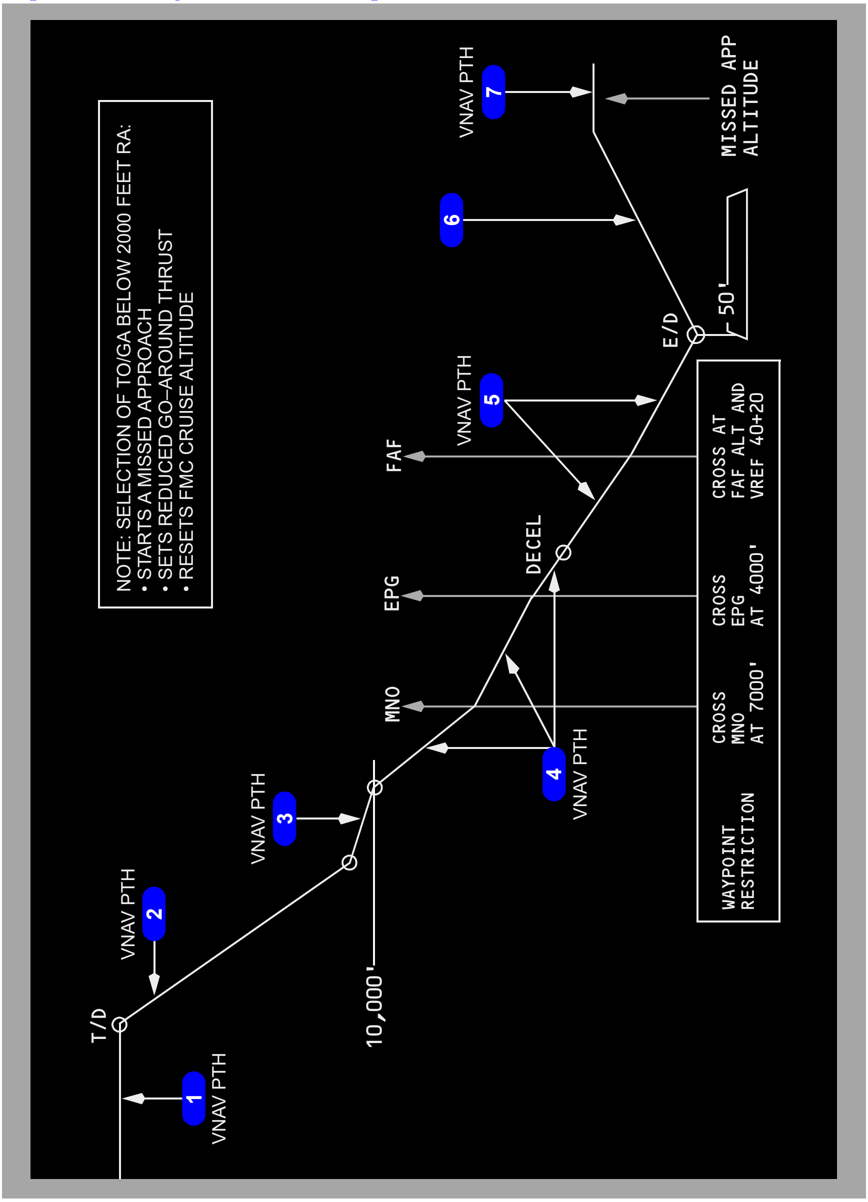
The CDU message DRAG REQUIRED is displayed if an unexpected tailwind results in a significant increase in airspeed to maintain path. VNAV disengages if a limit speed will be exceeded.

The CDU message DRAG REQUIRED is displayed if an unexpected tailwind results in a significant increase in airspeed to maintain path. VNAV reverts to VNAV SPD if a limit speed will be exceeded, with COMMON VNAV and U10.6 or later.

[Option – FMC U10.4 and later]
A path descent must be initiated while within the allowable cross–track error for LNAV, however LNAV may be disengaged during descent while remaining in the path mode. VNAV will remain in path regardless of cross–track.

VNAV Cruise and Path Descent Profile (Instrument Approach using VNAV)

[Option – With geometric descent path]



1 Cruise

Before the top of descent, FMC is in cruise mode and uses VNAV PTH and ECON cruise speed.

2 Descent

After top of descent, FMC is in descent mode and VNAV changes to economy descent speed and descends in VNAV PTH.

3 Speed Restriction Deceleration

Before the speed restriction altitude, VNAV decelerates to commanded speed using VNAV PTH.

When at restricted speed, VNAV commands decreased pitch and descends in VNAV PTH.

4 Altitude Restrictions

[Option – With geometric descent path]
The VNAV path conforms to altitude restrictions at MNO, EPG, and the FAF. The thrust mode changes to FMC SPD as required to maintain the target speed.

5 Approach

VNAV descends and starts approach in VNAV PTH at the commanded speed.

6 Missed Approach

When TO/GA is pushed during approach, or when crossing the missed approach point, VNAV disengages.

When selected during missed approach, VNAV engages in VNAV SPD.

7 Missed Approach Level Off

At missed approach altitude VNAV changes to VNAV PTH.

VNAV Speed Descent

A speed descent may be selected manually by selecting the SPEED prompt on the PATH DES page. With no E/D specified, the speed descent is the only descent mode available.

The speed descent maintains the target speed. Normally, the target speed is economy above the airspeed restriction altitude and 240 knots below that altitude, until deceleration is necessary for the approach. VNAV will not permit descent below the altitude restriction until the airspeed is at or below the restricted value.

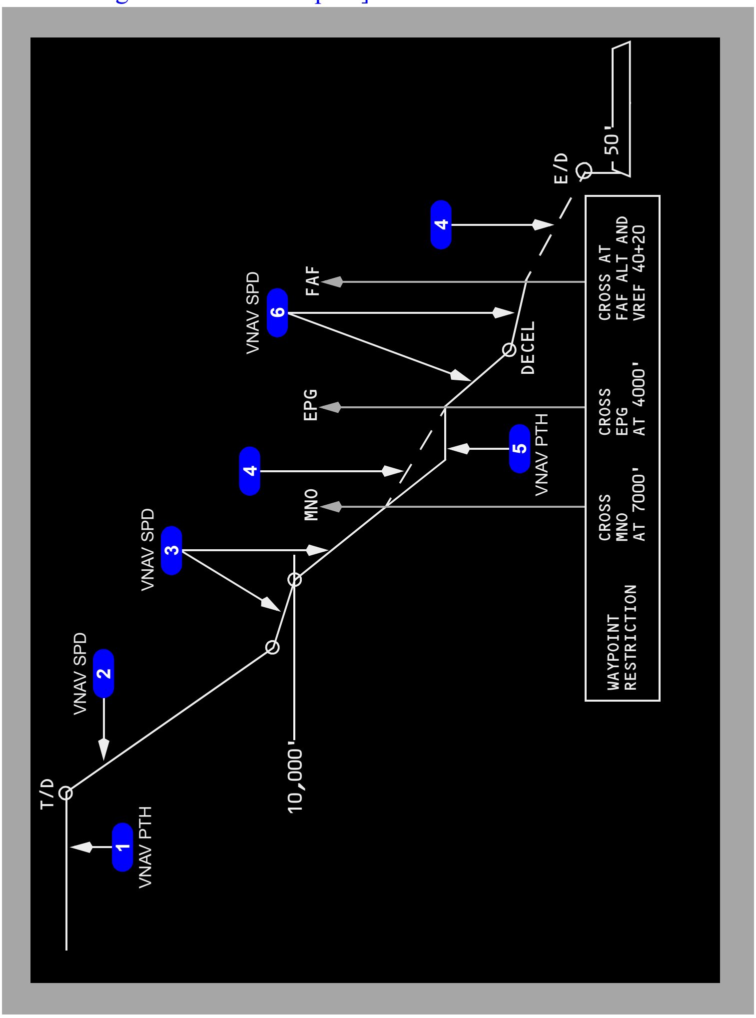
The speed descent normally begins automatically at the calculated T/D, provided the MCP altitude is reset for the descent. At the T/D, the FMC commands pitch to maintain target descent speed. LNAV does not have to be engaged in order to fly a VNAV speed descent.

The descent attempts to comply with waypoint altitude restrictions, and will not violate these restrictions. The VNAV speed descent will not, however, guarantee the airplane reaches an altitude restriction at the required point.

A speed descent cannot automatically revert to a path descent, except during STAR, approach transition, or approach leg with a vertical angle. However, if all required parameters for a path descent are available, a path descent may be manually selected at any time by selecting the PATH prompt on the speed descent page.

VNAV Cruise and Speed Descent Profile (Instrument Approach using VNAV)

[Option – With geometric descent path]



1 Cruise

Before the top of descent, FMC is in cruise mode and uses VNAV PTH and ECON cruise speed.

2 Descent

After top of descent, FMC is in descent mode and VNAV changes to economy descent speed and descends in VNAV SPD.

3 Speed Restriction Deceleration

Before the speed restriction altitude, VNAV decelerates to commanded speed using VNAV SPD.

When at restricted speed, VNAV commands decreased pitch and descends in VNAV SPD.

4 VNAV Path

During a speed descent, VNAV may not maintain the FMC computed VNAV path. However, if E/D shows, a VNAV path is available.

5 Altitude Restrictions

VNAV conforms to altitude restrictions at MNO and EPG. After MNO VNAV continues an idle thrust descent using VNAV SPD.

Upon reaching the next altitude restriction, VNAV commands level flight using VNAV PTH. The thrust mode changes to FMC SPD.

6 Descent and Approach

After EPG, VNAV continues the idle thrust descent using VNAV SPD.

Prior to the approach, VNAV decelerates to approach speed. The FMC prompts manual flap extension.

Vertical Angle

A vertical angle can be assigned to a waypoint from the navigation database. This vertical angle defines a VNAV path between the waypoint and the waypoint preceding it. This feature can be available in approaches, approach transitions, and STARs. For example, the vertical angle for the glideslope of an ILS approach would typically be 3 degrees. This angle is displayed on the ACT RTE LEGS page above the speed/altitude line for the associated waypoint. Vertical angles may be expected in any approach ending at RWXXX or MAXXX. The E/D will be RWXXX or MAXXX, and the E/D altitude will be either threshold crossing height (TCH – typically 50 feet above the touchdown zone elevation) or the altitude specified at MAXXX.

If a path (VNAV PTH) descent is active when a vertical angle leg becomes active, the path mode will remain active, but VNAV will follow the vertical angle rather than the idle thrust descent path.

If the vertical angle leg becomes active during a speed (VNAV SPD) descent, the VNAV mode will change to VNAV PTH automatically, and there will be no SPEED prompt on the descent page.

Early Descent

[Option - Without Common VNAV and FMC U11.0 or later]
If a path descent is planned, VNAV commands a 1000 fpm descent until the idle descent path is intercepted. If a speed descent is planned, VNAV commands an idle thrust descent.

[Option - With Common VNAV and FMC U10.8A or earlier]
A descent in VNAV started before the top of descent point is an early descent. VNAV commands a 1000 fpm descent until the idle descent path is intercepted.

[Option - With Common VNAV and FMC U11.0 or later]
VNAV commands a 1000 fpm descent until the idle descent path is intercepted.

[Option - With Common VNAV]
When in VNAV ACT DES, the FMC is considered to be in early descent when the airplane is below the computed descent path. VNAV commands a 1000 fpm descent until the idle descent path is intercepted or an FMC target altitude is complied with for any AT, or At-or-Above altitude constraints that exists in the flight plan, whichever occurs first i.e. idle descent path intercept or FMC target altitude compliance.

[Option - Without Common VNAV]
When in VNAV ACT DES, the FMC is considered to be in early descent when the airplane is below the computed descent path. VNAV commands a 1000 fpm descent until the idle descent path is intercepted or an FMC target altitude is complied with for any AT, or At-or-Above altitude constraints that exists in the flight plan, whichever occurs first i.e. idle descent path intercept or FMC target altitude compliance. If a speed descent is planned, VNAV commands an idle thrust descent.

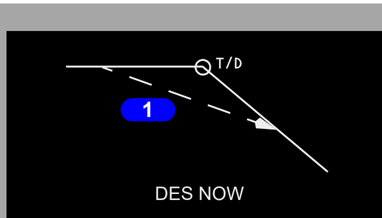
To start an early descent, use DES NOW prompt on the DES page.

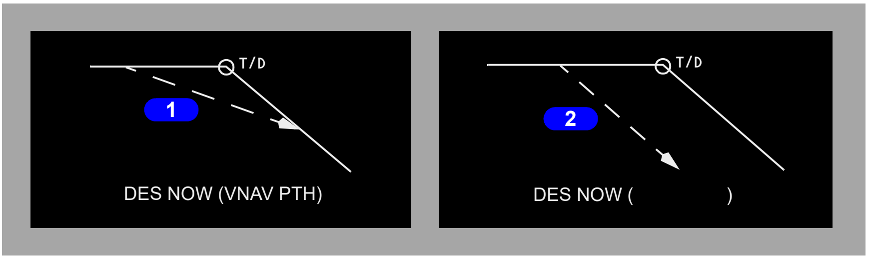
[Option – With speed and altitude intervention and FMC U10.8A or earlier]
An early descent can also be started by pushing the altitude intervention switch.

[Option – With speed and altitude intervention and FMC U11.0 and later]

A CRZ DES occurs upon lowering the MCP ALT to a lower altitude while at or above any descent constraint altitude and pressing ALT INTV. The airplane must be further than 50 nm from the Top of Descent (T/D) at the current cruise altitude. If within 50 nm of the top of descent, the Early Descent mode will be invoked. In the previous Operational Flight Programs (OFPs), this action resulted in always going into the Early Descent mode of operation regardless of distance from the top of descent.

- A cruise descent can be started by using the altitude intervention feature on the MCP when the airplane is not within a distance of 50 NM to the T/D, or by entering a new cruise altitude on the FMC CRZ page after setting the new level-off altitude in the MCP.
- Altitude Intervention may be used to initiate Early Descent when the airplane is 50 nm or less to T/D.
- If Altitude Intervention is used to initiate descent when 50 NM or less to T/D and the MCP ALT below current altitude, or descent is initiated via DES NOW prompt on the DES page, Early Descent vertical speed commands of -1000 fpm are generated by the FMC for autopilot V/S tracking until path intercept, or next constraint altitude if altitude is reached when VNAV is engaged, or MCP ALT level off occurs.
- If Altitude Intervention is used to initiate descent when more than 50 NM to T/D with VNAV engaged and the MCP ALT below current altitude but at or above any descent constraint altitude, the result will be cruise altitude reset to the MCP ALT and Cruise Descent vertical speed commands of -1000 fpm to the new cruise altitude.
- If Altitude Intervention is used to initiate descent when more than 50 NM to T/D with VNAV engaged and the MCP ALT below current altitude and below a descent constraint altitude, the result will be Early Descent vertical speed commands of -1000 fpm until path intercept or MCP ALT level off occurs.





1 DES NOW

VNAV starts an early descent at 1000 fpm and captures the idle descent path. VNAV uses FMC SPD for the autothrottle mode and VNAV PTH for the pitch mode.

1 DES NOW (VNAV PTH)

With a VNAV path descent planned, VNAV starts an early descent at 1000 fpm and captures the idle descent path. VNAV uses FMC SPD for the autothrottle mode and VNAV PTH for the pitch mode.

2 DES NOW (VNAV SPD)

With a VNAV speed descent planned, VNAV starts an idle thrust early descent. VNAV does not attempt to capture the VNAV descent path. VNAV uses VNAV SPD for the pitch mode and the autothrottle commands IDLE, followed by ARM.

Approach

The FMC transitions to "on approach" when the airplane is within:

- 2 NM of the first approach waypoint (including approach transitions such as arcs and procedure turns), or
- 2000 feet of airport elevation, whichever occurs first.

When the FMC is "on approach", the following features are available:

- UNABLE RNP alerting levels are higher
- when preparing for a missed approach and the MCP altitude is set at least 300 feet above the current airplane altitude, VNAV remains in VNAV PATH
- if the airplane is more than 200 feet below the vertical path, VNAV commands zero vertical speed until intercepting the path.

Note: Display of a specified path angle is not limited to approaches. A path angle may be defined for a leg in a STAR and displays on the RTE LEGS page for the procedure.

The FMC transitions out of “on approach” under the following conditions:

- selecting TO/GA
- the airplane lands
- the waypoint cycles to the first waypoint of the missed approach
- executing a direct-to waypoint in the missed approach.

The following situations are generally encountered during approach operations, but are not determined by “on approach” logic:

- If speed intervention is engaged:
  - during a path descent with flaps up on an idle or non-idle leg, VNAV switches to VNAV SPD
  - with flaps down, VNAV remains in VNAV PTH
  - when a point to point (geometric path) leg is active, VNAV remains in VNAV PTH
  - while a vertical angle leg (GP x.xx on RTE LEGS page) is active, VNAV remains in VNAV PTH
- if a vertical angle leg (GP x.xx on RTE LEGS page) becomes active, VNAV switches to VNAV PTH without pilot action
- if on a vertical angle leg, and cross track exceeds two times the RNP value, while LNAV is not engaged, VNAV will disengage.

VNAV will remain engaged at all flap settings, allowing approaches to be flown using the vertical angle guidance. Speed for final approach can be set on the APPROACH REF page.

If an ILS approach is flown in VNAV using vertical angle guidance, VNAV will disconnect when passing the GS–XXX point if G/S is armed, but it can be reengaged. If the GS–XXX point is deleted, VNAV will remain engaged throughout the approach.

For an approach without a runway waypoint on the RTE LEGS page, the VNAV path is calculated to the MDA or a calculated altitude at the missed approach point. The calculated altitude may be below the MDA to ensure a flight path angle and normal threshold crossing height.

Note: It is the flight crew’s responsibility not to descend below the MDA until adequate visual contact is achieved.

Integrated Approach Navigation (IAN)

[Option – FMC U10.5 and later with integrated approach navigation]

Integrated Approach Navigation (IAN) provides the capability to fly most FMC instrument approaches utilizing a procedure similar to that for ILS approaches. No special aircrew action is required other than to line select an IAN compatible approach into the FMC flight plan.

During an IAN approach, the FMC provides:

- glide path (G/P) deviations from the defined VNAV vertical path to the missed approach waypoint
- glide path (G/P) is constructed on an angle that passes through the altitude constraint at the missed approach waypoint, and is the steeper of either the published angle, or the angle that clears the altitude constraint at the waypoint prior to the missed approach waypoint
- final approach course (FAC) deviations from the defined LNAV lateral path to the missed approach waypoint
- final approach course (FAC) only provides guidance to the runway if the missed approach waypoint is located at the runway approach end
- a source for the deviation scales
- distance to the missed approach waypoint.

The FMC also adds the following capabilities:

- IAN operations without valid PERF Data (i.e. during a performance down-mode).
- display of vertical angle with or without PERF Data on both active and inactive routes.

IAN can be used when the pilot defines a visual flight rule (VFR) approach by entering a flight path angle (FPA) on the Arrival (ARR) page when a runway is selected.

Adds functionality for IAN support for Pilot-Defined Final Approach by:

- allowing IAN to be used when the pilot defines a VFR approach by selecting a RWY #### and FPA on the Airport ARRIVALS page.
- correctly depicting the crew entered angle on the VSD.
- showing the angle above the respective leg on the ACT RTE X LEGS page.
- not changing the current operation of the FPA field. FPA field depicts a runway with a pilot-entered FPA the same as a runway with a vertical angle per the NDB.

Additionally, normal flight director steering bars are displayed that reflect G/P and FAC guidance.

IAN provides both lateral and vertical deviation for the following approaches:

- NDB
- NDB/DME
- RNV (RNAV)
- VOR
- VOR/DME
- GPS

IAN provides vertical deviations for the following approaches:

- BCS (BAC)
- ILS (G/S OFF)
- LOC

IAN approaches may be flown with or without the autopilot. At or above minimums, the pilot flying is expected to disengage the autopilot and manually complete the flare and touchdown. Both visual and aural alerts are provided if the autopilot remains engaged below 100 feet RA with either FAC or G/P engaged. “AUTOPILOT, AUTOPILOT” is annunciated over the flight deck speaker and an amber AUTOPILOT flashes over the attitude display.

RNP is used to scale the displayed FAC deviations.

Both RNP and VRNP are used to scale the displayed FAC and G/P deviations.

If the UNABLE REQD NAV PERF - RNP message is displayed on the MAP, IAN FAC and/or G/P deviation point will be sent invalid.

Lateral RNP may be revised from the RNP PROGRESS, RTE LEGS and POS SHIFT pages.

VRNP values may be revised on RNP PROGRESS page 4/4. The FMC will accept manual entry of a VRNP value greater than the default value, but the scratchpad message VERIFY VERT RNP VALUE will be displayed.

Manual entries are cleared at flight completion.

For additional IAN information, see chapters 4, 10, 15, and Normal Procedures in Volume 1.

Go-Around

Below 2000 feet radio altitude, the FMC transitions to go-around logic from approach logic when any of the following events occur:

- pushing either TO/GA switch while in a descent
- executing a direct-to waypoint in the missed approach (other than the missed approach point)
- automatically while in a descent and the last waypoint of the approach cycles to the first waypoint of the missed approach.
- the airplane climbs at a vertical speed greater than 600 fpm and the flaps are retracted from a landing setting toward a flap setting of 15 or 1

Once the FMC go-around logic is established:

- the FMC transitions from active descent to active climb
- the thrust limit changes to go-around thrust

- all descent altitude constraints below the current airplane altitude are deleted and replaced with predicted altitudes
- the original destination airport (airport from which the go-around was just initiated) becomes the new origin airport allowing SID selection if a diversion to another airport is required.

Note: LNAV may be engaged when the airplane climbs above 400 feet radio altitude.

If the go-around was initiated by pushing a TO/GA switch or selection of go-around thrust, the CRZ ALT will change to the highest of:

- the highest constraint in the missed approach
- 1500 feet above airport elevation
- the MCP altitude.

Note: If the MCP altitude is the lowest of the three, the autopilot, if engaged, will level off at the MCP altitude.

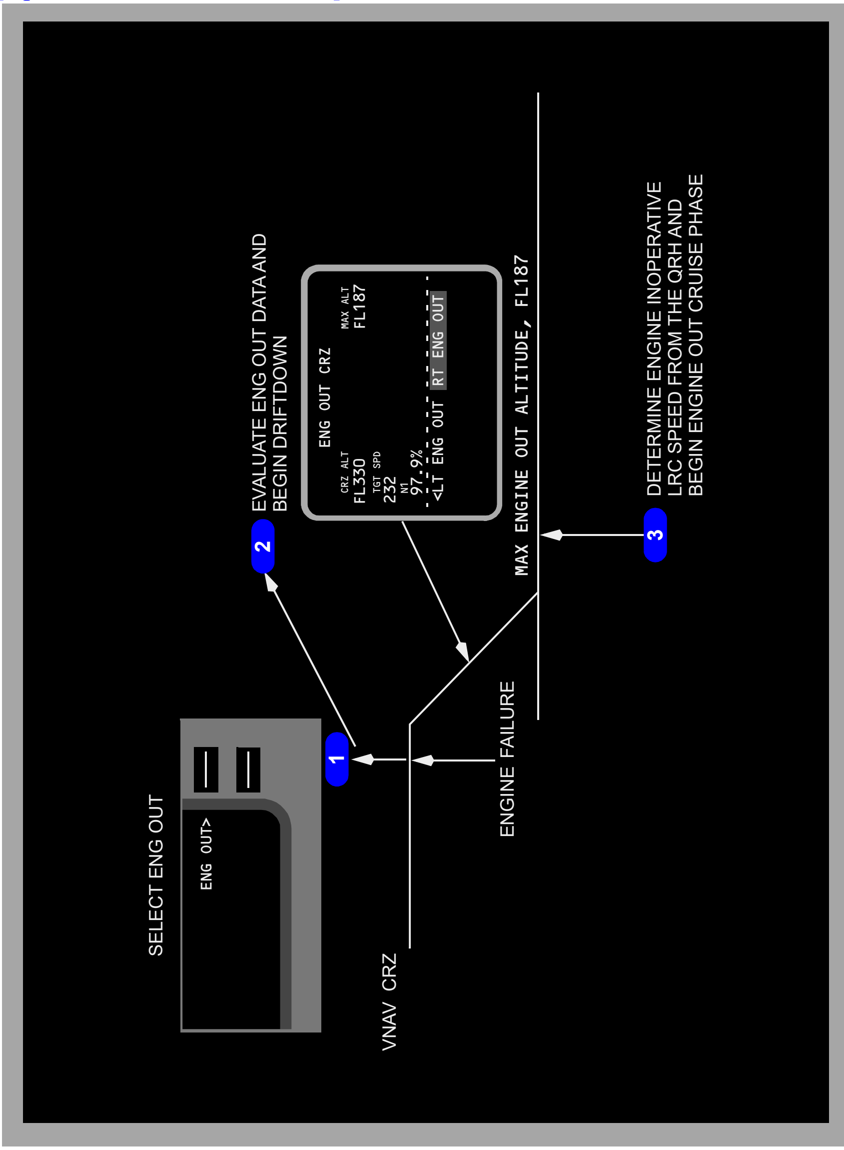
If the go-around was initiated by direct-to or waypoint sequencing, the CRZ ALT will change to the highest of:

- the highest constraint in the missed approach
- 1500 feet above airport elevation.

Refer to section NP21.xx, Go-Around Procedure and section 4.20, Go-Around for additional information.

VNAV Cruise (Engine Out Above Eng Out Max Alt)

[Option – FMC U10.3 and later]



1 Engine Out Modification

Select the ENG OUT prompt on the CRZ page. The ENG OUT page displays the appropriate engine out driftdown performance data to enable the airplane to descend to the engine out maximum altitude. Refer to FMC Cruise, section 11.42 for a complete description of the ENG OUT CRZ page.

2 Drift Down Execution

After selecting the left or right ENG OUT mode, perform the driftdown as follows:

- disengage A/T
- set maximum continuous thrust on operating engine (N1 line)

[Option – FMC U10.3 and later]
- set MCP speed to ENG OUT SPD
- set MCP altitude to MAX ALT or lower altitude as required
- select LVL CHG.

The airplane then descends at CON thrust and the driftdown airspeed to the MAX ALT. As the driftdown proceeds and airplane gross weight decreases, the maximum altitude may increase.

Note: The engine out cruise page provides advisory performance data for operating with one engine.

3 Engine Out Cruise

Engine out cruise operates like normal cruise with engine out cruise speeds. If range is a factor, determine Engine Inoperative LRC speed from the QRH. Thrust limit remains in CON.

Required Time of Arrival (RTA)

VNAV controls cruise speed to achieve a flight crew specified arrival time at a specified waypoint. After the appropriate waypoint and RTA are input to the FMC, the FMC will compute a recommended takeoff time, speeds required to comply with the RTA, and progress information for the flight. If the RTA is not achievable, the RTA UNACHIEVABLE scratchpad message is displayed.

Data Entry Rules

Altitude Entry

Altitudes can be entered into the FMC as three digit (xxx), four digit (xxxx), five digit (xxxxx), or flight level (FLxxx) numbers. The FMC automatically displays altitude or flight level entries in the proper form based on the transition altitude. Some data lines further restrict the valid entry forms.

Three digit entries represent altitude or flight levels in increments of 100 feet. Leading zeros are required.

Examples of three digit (xxx, FLxxx) entries with transition altitude = 10,000 feet:

- 800 feet is entered as 008 or FL008 and displayed as 800
- 1,500 feet is entered as 015 or FL015 and displayed as 1500
- 11,500 feet is entered as 115 or FL115 and displayed as FL115
- 25,000 feet is entered as 250 or FL250 and displayed as FL250.

Four digit entries represent feet, rounded to the nearest ten feet. Leading zeros are required. This form is used when the altitude does not exceed 9,994 feet.

Examples of four digit (xxxx) entries with transition altitude = 18,000 feet:

- 50 feet is entered as 0050 and displayed as 50
- 835 feet is entered as 0835 and displayed as 840
- 1,500 feet is entered as 1500 and displayed as 1500
- 8,500 feet is entered as 8500 and displayed as 8500
- 9,994 feet is entered as 9994 and displayed as 9990.

Five digit entries represent feet, rounded to the nearest ten feet. This form is used when the altitude exceeds 9,994 feet.

Examples of five (xxxxx) digit entries with transition altitude = 4,000 feet:

- 50 feet is entered as 00050 and displayed as 50
- 835 feet is entered as 00835 and displayed as 840
- 1,500 feet is entered as 01500 and displayed as 1500
- 8,500 feet is entered as 08500 and displayed as FL085
- 9,995 feet is entered as 09995 and displayed as FL100
- 11,500 feet is entered as 11500 and displayed as FL115
- 25,000 feet is entered as 25000 and displayed as FL250.

Negative altitude entries are allowed to –1000 feet.

Airspeed Entry

Airspeeds can be entered into the FMC as calibrated airspeed or Mach number. Calibrated airspeeds are entered as three digits (xxx) in knots. Mach numbers are entered as one, two, or three digits following a decimal point.

Data Pairs

Many CDU pages display data in pairs separated by a slash "/." Examples of these pairs include wind direction/speed and waypoint airspeed/altitude restrictions. When entering both values in a pair, the slash is inserted between the values. When it is possible to enter only one value of the pair, the slash may not be required. When entering only the outboard value of a pair, the trailing or leading slash may be entered, but is not required before transferring to the data line. When entering the inboard value of a pair, the trailing or leading slash must be entered before transferring to the data line. Omission of the required slash normally results in an INVALID ENTRY message.

Bearing Entry

Entry of a bearing value requires three digits. For example, key 090, not 90. A bearing entry of 360 is displayed as 000.

Plus/Minus Signs

When entering temperature or an along–track displacement distance, positive values are assumed by the FMC and + signs are not required. For negative values, key in the – sign.

FMC Databases

The FMC contains two databases:

- performance database
- navigation database.

The performance database eliminates the need for the flight crew to refer to a performance manual during flight, and provides the FMC with the information required to calculate pitch and thrust commands. All information normally required can be displayed on the CDU. The database includes:

- airplane drag and engine characteristics
- maximum and optimum altitudes
- maximum and minimum speeds.

Maintenance personnel can refine the database by entering correction factors for drag and fuel flow.

The navigation database includes most information normally determined by referring to navigation charts. This information can be displayed on the CDU or navigation display. The database contains:

- the location of VHF navigation aids
- waypoints
- airports
- runways
- other airline selected information, such as SIDs, STARs, approaches, and company routes.

If the permanent database does not contain all of the required flight plan data, additional airports, navaids, and waypoints can be defined by the crew and stored in either a supplemental or a temporary navigation database. Use of these additional databases provides world–wide navigational capability, with the crew manually entering desired data into the FMC via various CDU pages. Information in the supplemental navigation database is stored indefinitely, requiring specific crew action for erasure; the temporary navigation database is automatically erased at flight completion.

The supplemental and temporary databases share storage capacity for forty navaids and six airports, the entries being stored in either database on a first come, first served basis. For the waypoint category, exclusive storage is reserved in the temporary database for twenty entries (including those created on the RTE or RTE LEGS pages). An additional twenty waypoints (up to a maximum of forty) can be stored in either the temporary or supplemental database on a first come, first served basis.

When any storage capacity is full, entries which are no longer required should be deleted by the crew to make space for additional new entries. Created waypoints cannot be stored in the database runway category.

The FMC contains two sets of navigation data, each valid for 28 days. Each set corresponds to the normal navigation chart revision cycle. The FMC uses the active set for navigation calculations. The contents of the navigation database are periodically updated and are transferred to the FMC before the expiration date of the current data.

Thrust Management

The autothrottle operates in response to flight crew mode control panel inputs or to automatic FMC commands. Reference thrust can be selected on the N1 LIMIT page. Automatic FMC autothrottle commands are made while VNAV is engaged. The autothrottle system:

- uses reference thrust limits calculated by the FMC
- commands the thrust levers
- commands thrust equalization through the electronic engine controls.

Thrust limits are expressed as N1 limits. Thrust equalization references N1.

The FMC calculates a reference thrust for the following modes:

- takeoff
- derated takeoff
- assumed temperature takeoff
- climb
- reduced climb
- cruise
- continuous
- go–around.

[Option – With takeoff bump thrust]
The FMC calculates a reference thrust for the following modes:

- takeoff
- derated takeoff
- assumed temperature takeoff
- takeoff bump
- climb
- reduced climb
- cruise
- continuous
- go–around.

[Option –With takeoff bump thrust and quiet climb]
The FMC calculates a reference thrust for the following modes:

- takeoff
- derated takeoff
- assumed temperature takeoff
- takeoff bump
- climb
- reduced climb
- cruise
- continuous
- go–around
- noise abatement (cutback).

The thrust reference mode automatically transitions for the respective phase of flight. These modes can be selected on the N1 LIMIT page. The selected thrust reference mode is displayed on the thrust mode display.

[Option – FMC U10.1 and later, with automatic thrust reduction after takeoff]
The flight crew can specify the thrust reduction height where the transition from takeoff to climb thrust takes place by making an entry on TAKEOFF REF page 2. Allowable entries are 800 feet to 9,999 feet.

[Option – FMC U10.3 and later]
The default value is determined by the airline and is stored in the model/engine database.

[Option – With quiet climb]
With cutback mode selected ON, the flight crew can specify the thrust reduction and restore altitudes on TAKEOFF REF page 2. The FMC calculates and commands a cutback thrust rating based on data provided through the model/engine database. In addition the FMC uses the reduction altitude to calculate the required cutback altitude. A new N1 is calculated during climb and normal climb thrust is restored at the RESTORE altitude.

Reduced Thrust Takeoff

Reduced thrust takeoffs lower EGT and extend engine life. They are used whenever performance limits and noise abatement procedures permit.

Takeoff Derate

[Option – FMC U10.1 and later]
Fixed derates can be selected on the N1 LIMIT page. Performance data for these derates is provided in the Airplane Flight Manual (AFM).

With derated takeoff selected, the thrust setting parameter is considered a limitation for takeoff; therefore, thrust levers should not be advanced further except in an emergency. A further thrust increase following an engine failure could result in a loss of directional control while on the ground. Use the takeoff speeds supplied by the FMC or specified in Chapter PI, Performance-Inflight, for the selected derate condition.

Derated takeoff rating can be further reduced by assumed temperature.

[Option – With FMC computed QRH takeoff speeds]
Use the takeoff speeds provided by the FMC or specified in Chapter PI, Performance–Inflight, for the selected derate or variable takeoff rating condition.

Use the takeoff speeds specified in Chapter PI, Performance–Inflight, for the selected derate or variable takeoff rating condition.

Assumed Temperature Thrust Reduction Takeoff

[Option – FMC U10.1 and later]
A takeoff thrust less than the full rated thrust may be achieved by using an assumed temperature that is higher than the actual temperature. The desired thrust level is obtained through entry of a SEL TEMP value on the N1 LIMIT page or TAKEOFF REF page 2. Use approved sources for selecting the assumed temperature.

The maximum thrust reduction authorized is 25 percent below any certified rating. Do not use assumed temperature reduced thrust if conditions exist that affect braking, such as slush, snow, or ice on the runway, or if potential windshear conditions exist.

If the assumed temperature method is applied to a fixed derate, application of additional power should not exceed the fixed derate N1 limit as loss of directional control could occur while on the ground.

When the assumed temperature method is used with full rate, the reduced thrust setting is not considered a limitation. If conditions are encountered where additional thrust is desired, the crew can manually apply full thrust.

Takeoff Bump Thrust

[Option]
Takeoff bump thrust may be used to meet extra thrust requirements for takeoff at certain airports. Takeoff bump thrust provides thrust above normal maximum takeoff thrust. The takeoff thrust bump setting may be selected on the N1 LIMIT page. Takeoff thrust bump is only available for takeoff, and cannot be applied to go around, max continuous, or climb thrust ratings. If takeoff thrust bump is selected, assumed temperature reduced thrust is not available.

Derated Thrust Climb

Two fixed climb thrust derates can be selected on the N1 LIMIT page. CLB–1 provides a climb limit reduced by 3% N1 (approximately 10% thrust). CLB–2 provides a climb limit reduced by 6% N1 (approximately 20% thrust). The reduced climb setting gradually increases to full rated climb thrust by 15,000 feet. In cruise, the thrust reference automatically changes to CRZ. The reference can be manually selected on the N1 LIMIT page.

Use of an assumed temperature reduced thrust takeoff or takeoff derate affects the FMCs climb derate computation. If a reduced thrust takeoff has been specified on the TAKEOFF REF page, the FMC will re-compute CLB-1 and CLB-2 values as required to avoid a climb N1 value greater than the reduced thrust takeoff N1 value.

Use of derated climb thrust reduces engine maintenance costs, but increases total trip fuel.

Fuel Monitoring

The FMC receives fuel data from the fuel quantity indicating system. Fuel quantity values show on the PERF INIT page and on PROGRESS page 1/3.

The scratchpad message VERIFY GW AND FUEL shows if total fuel quantity data is invalid. The PERF INIT page FUEL line changes to dashes. The FMC uses the last valid fuel quantity for performance predictions and VNAV operation. The flight crew should manually enter estimated fuel weight. Periodic fuel weight update is required for the remainder of the flight to keep gross weight current. The FMC does not update the manual fuel weight entry. The scratchpad message VERIFY GW AND FUEL shows again each 30 minutes if subsequent entries are not performed. The scratchpad message does not show during descent with Vref selected.

The scratchpad message CHECK FMC FUEL QUANTITY shows if the FMC has detected an unexpected drop in fuel quantity.

The FMC continually estimates the amount of fuel that will remain when the destination airport is reached if the active route is flown. The CDU message USING RSV FUEL is displayed if the estimate is less than the fuel reserve value entered on the PERF INIT page. The CDU message INSUFFICIENT FUEL is displayed if predicted fuel at destination will be 2000 lb. (900 kg) or less.

Loss of FMC Electrical Power

The FMC requires continuous electrical power to operate. When the electrical power is interrupted for less than ten seconds:

- LNAV and VNAV disengage
- all entered data is retained by the FMC
- the FMC resumes normal operation when power is restored.

If power is lost for ten seconds or more on the ground, all preflight procedures and entries must be done again when power is restored.

If power is lost for more than ten seconds in flight:

- LNAV and VNAV disengage
- all entered data is retained by the FMC, and when power is restored the RTE LEGS page is displayed with the scratchpad message SELECT ACTIVE WPT/LEG.

Before LNAV can engage, the FMC must be instructed how to return to the route. Select the desired active waypoint and proceed direct or intercept a course to the waypoint.

FMC Failure

[Option – Dual FMC]

Single FMC Failure

The FMC/CDU is designed to automatically preserve the most capable modes of navigation and guidance that can be maintained with the equipment and navigation aids available. If an error or system failure results in reduced capability, then the FMC may generate a crew message for display in the CDU scratchpad. If other system inputs to the FMC should fail, affected CDU displays are blanked to prevent the display of misleading or erroneous data. For example, loss of the total fuel input causes some performance related data to be blank. The messages and FMC internal responses provide an orderly transition from full FMC guided flight to less automated capability.

If the right FMC fails, the FMC alert light and the FMC message light will illuminate. The message SINGLE FMC OPERATION will be displayed in both scratchpads. VTK will display on the right navigation display. LNAV and VNAV will disengage if autopilot B is in use (can be reengaged if autopilot A is selected). After 25 to 30 seconds, the right navigation display will display failure information. The right navigation display may be restored by placing the FMC source select switch to BOTH ON L.

[Option – MCDU]
If the left FMC fails, the FMC alert light will illuminate. The MENU page will appear on both CDUs. VTK will appear on the left navigation display. LNAV and VNAV will disengage, but can be reengaged if autopilot B is in use or is selected. After 25 to 30 seconds, the left navigation display will display failure information. To restore full operation, the FMC source select switch must be moved to BOTH ON R.

[Option – FMC U10.2 and later]
Note: During an FMC software restart, the navigation display map track may rapidly slew to 0 degrees then to the correct value.

Dual FMC Failure

[Option – MCDU]
If both FMCs fail, the FMC alert light will illuminate. The MENU page will appear on both CDUs. VTK will appear on both navigation displays. LNAV and VNAV will disengage. After 25 to 30 seconds, both navigation displays will display failure information.

FMC Failure

[Option – Single FMC]

[Option – CDU]
If the FMC fails, the FMC alert light will illuminate. The FMC/CDU FAIL light will appear on both CDUs, and both CDUs will display failure modes. VTK will appear on both navigation displays. LNAV and VNAV will disengage. After 25 to 30 seconds, both navigation displays will display failure information.

[Option – MCDU]
If the FMC fails, the FMC alert light will illuminate. The MENU page will appear on both CDUs. VTK will appear on both navigation displays. LNAV and VNAV will disengage. After 25 to 30 seconds, both navigation displays will display failure information.

[Option – FMC U10.2 and later]
Note: During an FMC software restart, the navigation display map track may rapidly slew to 0 degrees then to the correct value.

Software Exception Handling Logic

[Option – FMC U10.8 and later]
Note: A Software Exception is the disruption in the normal flow execution of the software code; i.e. an attempt to solve an unsolvable map calculation.

Prior to U10.8, the FMC would shut down after three consecutive software resets within 60 seconds. U10.8 and on, is revised such that FMC resets are managed more effectively. The software exceptions handling logic has been revised to prevent a complete FMC restart in the event of most software exceptions. If performance data is entered, an exception in most processing will result in a downgrade of FMC operation, not a complete loss of function.

In the downgrade mode:

- LNAV and Map are retained
- FMC Predictions are halted
- VNAV is disconnected

If the software exception occurs in processing of the active flight plan, an alerting level message, VNAV INVALID - PERF, will be displayed for the pilot indicating re-entry of Cost Index is required in order to restart the internal software predictions process, which is required before reengagement of VNAV. Predictions can be restarted allowing VNAV to be reengaged after entry and EXEC of Cost Index on the PERF INIT page.

When a software reset occurs in the MOD PLAN and not the ACT PLAN, the FMC will delete the MOD PLAN. An advisory message, INVALD MOD PLAN, will be displayed for the pilot indicating that this has occurred. LNAV and VNAV will remain engaged for this case.

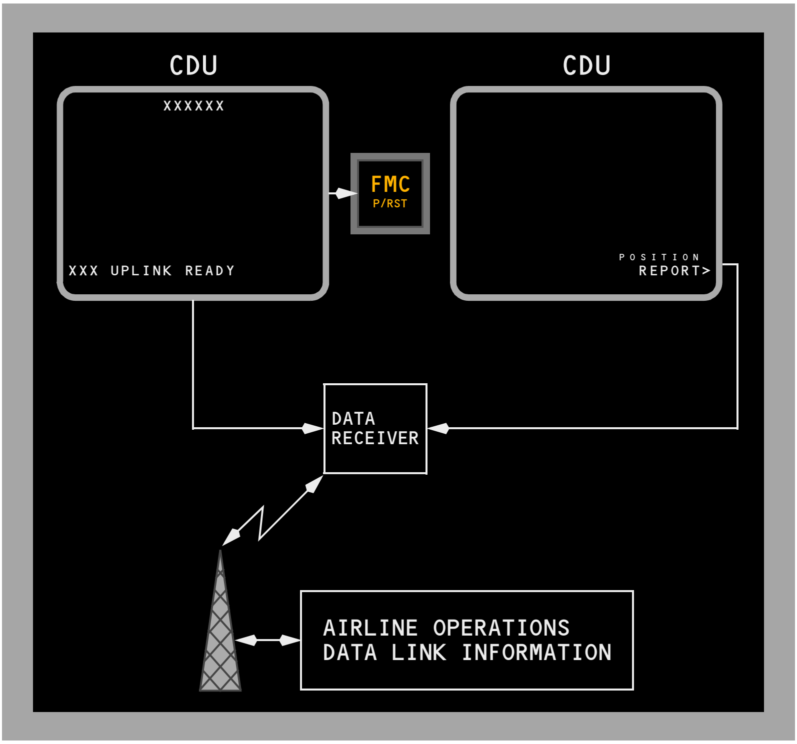
When a software reset occurs in an INACTIVE PLAN, the FMC will delete the INACTIVE PLAN (no change from current operation). An advisory message, INVALD INACTIVE PLAN, will be displayed for the pilot indicating that this has occurred.

This improvement will not prevent all restarts; it does not cover those that may leave the FMC’s memory in an inconsistent state.

[Option]

Company Data Link

The airplane communications system enables two–way data link communications between the FMC and airline operations. A downlink occurs when data is transferred from the FMC and transmitted through the airplane communications system to a receiver on the ground. Data may be downlinked from the FMC either manually or automatically. An uplink is the opposite of a downlink; data is transmitted from a ground station for input to the FMC. Data may be uplinked at the discretion of the airline operations dispatcher or in response to a downlink request.



Data Link

Downlinks are data link messages transmitted to a ground station. Requests for data and reports of FMC information are two types of downlinks. Requests are made manually by the flight crew. Reports can be made manually or may occur automatically.

Uplinks are messages transmitted to the airplane. Most uplinks require manual selections by the flight crew. Some uplinks are input automatically.

Manual Downlinks

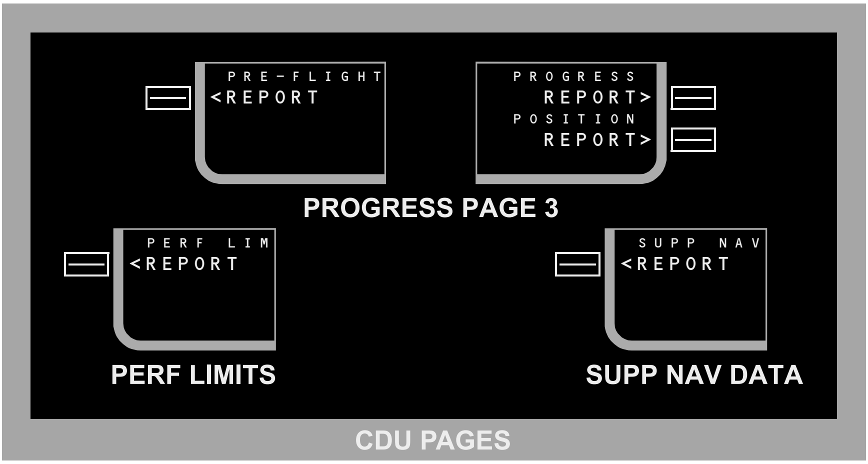
Select a REQUEST prompt to start the downlink request for data. REQUEST prompts are on PERF INIT, PERF LIMITS, TAKEOFF REF, PROGRESS, DES FORECASTS, RTE, ALTERNATE DEST, RTE DATA, and SUPP NAV DATA pages. Downlink reports of the active route may be accomplished by selection of the REPORT prompt on the PERF LIMITS or PROGRESS page and a position report may be downlinked by selection of the REPORT prompt on the PROGRESS page. The contents of the supplemental navigation database can be downlinked by selection of the REPORT prompt on the SUPP NAV DATA page.

When the communications function is unable to process FMC downlinks, the words FAIL, VOICE, NO COMM, or FULL are displayed on the CDU pages in place of the REQUEST and REPORT prompts and the header line displays the word DATALINK. The status messages are:

- FAIL – the ACARS management unit is inoperative
- VOICE – radio is operating in the VOICE mode
- NO COMM – radio is operational but not available
- FULL – all available downlink space is full.

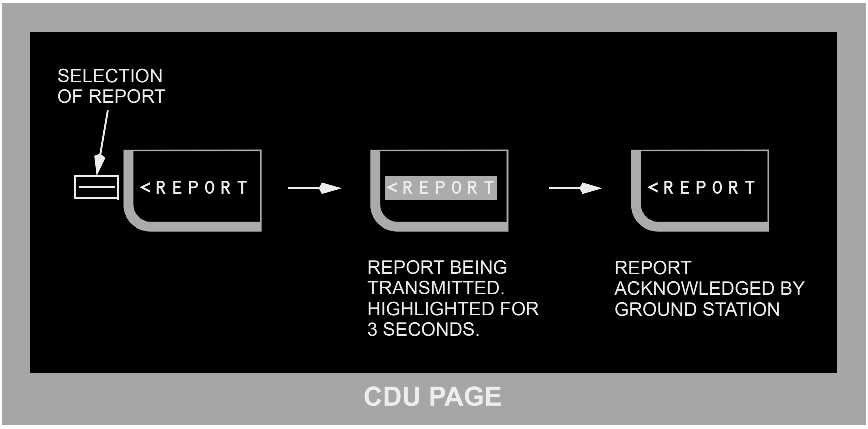
Reports

A REPORT prompt on each page downlinks a unique report applicable to that page. The pages below contain report prompts.



Report Status

Below is a typical sequence of status in response to sending a report.



Automatic Downlinks

The FMC can be configured by the airline to automatically transmit downlinks of FMC data at predetermined points during the flight or in response to specific information requests from the airline dispatcher. The FMC response in these cases is completely automatic and no crew action is necessary.

Uplinks

Uplinked data may be loaded automatically or may require flight crew action. Three uplinks automatically load data into the FMC when the REQUEST prompt is selected and do not require execution.

Uplinked data that waits in system memory for flight crew action are considered to be pending. A pending uplink is included or discarded when the flight crew selects the applicable prompt. Flight crew response to an uplink depends on the type of uplink. Flight crew action is made with ACCEPT/REJECT or LOAD prompts, FMC modification ERASE prompt or EXEC key, or when the page with the uplink is selected.

Data can be uplinked from the airline dispatcher directly to the FMC. The uplinks are annunciated to the crew by the FMC alert lights. The uplink is identified by a CDU scratchpad message.

PERF INIT uplinks are available only on the ground and after an origin airport has been entered on the RTE page.

RTE DATA cruise winds are available when not in descent and a cruise altitude and a flight plan route exist.

DES FORECASTS winds are available if a cruise altitude exists.

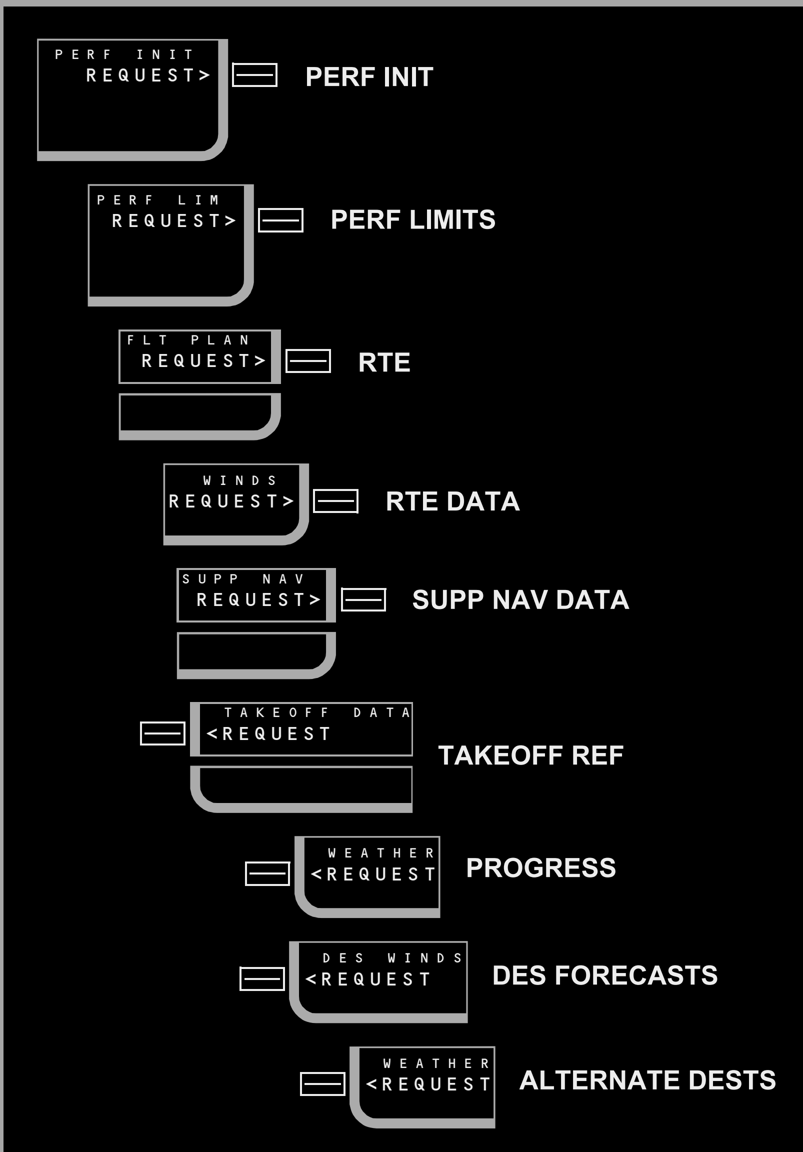
Long Delete Function

[Option – MCDU]
During uplink, CDU keys are ignored until data is loaded into the FMC. The uplink may be suspended by pressing and holding down the DEL key for at least one second. For all uplinks, except SUPP NAV DATA uplinks, the loaded data is then removed from the flight plan and placed back into the ready to be loaded state. Uplinks that do not generate a modified plan are reloaded when there has been no CDU pushbutton activity for 30 seconds. Uplinks that do generate a modified plan can be reloaded using the LOAD prompt on the appropriate page.

When the long delete is used during a SUPP NAV DATA uplink, the uplink is suspended, but the data loaded up to that point remains in the database. After 30 seconds of keyboard inactivity, the remaining data is loaded.

Requests

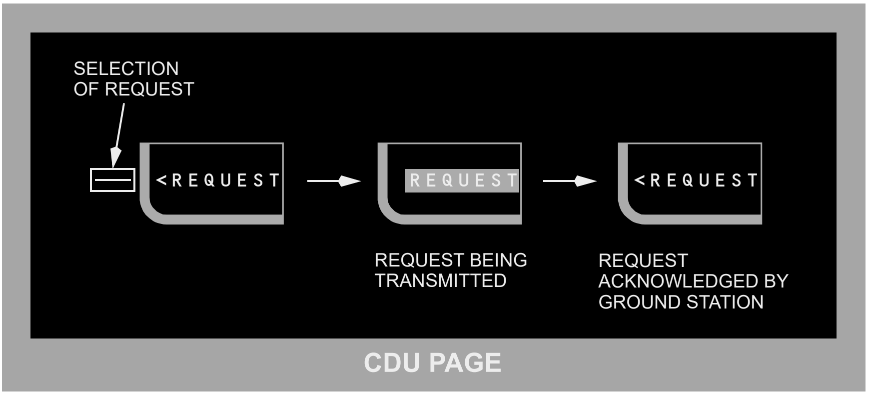
A REQUEST prompt on each page downlinks a unique request applicable to that page. The pages below contain request prompts.



CDU PAGES

Request Status

Below is a typical sequence of status in response to sending a request.



FMC Data Link Uplinks (Accept/Reject)

ACCEPT and REJECT are shown on the TAKEOFF REF 1/2 page following receipt of uplink data.

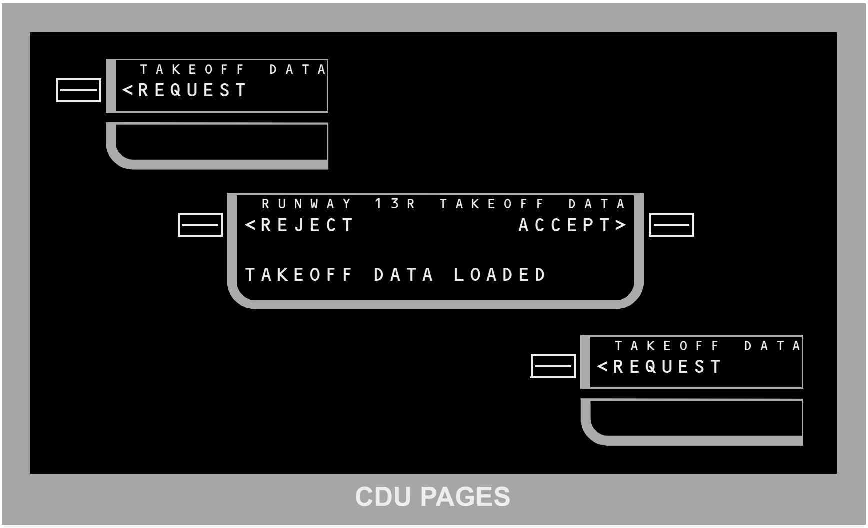
Uplink data for the current runway is shown initially in small font for preview.

Selecting ACCEPT:

- displays uplinked data in large font
- replaces previous data with uplinked data
- returns page display to normal (pre–uplink) format
- clears scratchpad message
- transmits a downlink accept message (if enabled) to acknowledge acceptance.

Selecting REJECT:

- replaces uplinked data with previous data
- returns page display to normal (pre–uplink) format
- clears scratchpad message
- transmits a downlink reject message (if enabled) to inform of rejection.



FMC Data Link Uplinks (Load/Activate/Exec)

LOAD is shown on the RTE page after receipt of uplink data. After the uplinked data is loaded, the ACTIVATE prompt is shown. After selecting ACTIVATE, the EXEC light illuminates.

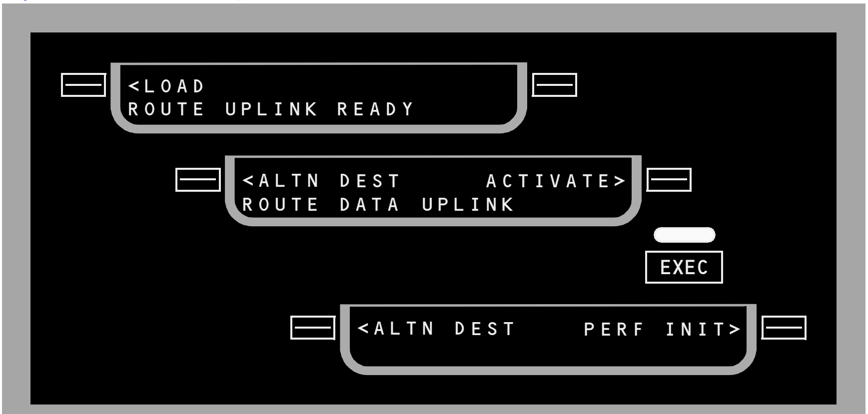
Selecting LOAD:

- loads uplinked data into FMC for viewing
- updates scratchpad message
- transmits a downlink accept message (if enabled) to acknowledge acceptance.

Selecting ACTIVATE and EXEC:

- puts uplinked data in active flight plan
- returns page display to normal (pre–uplink) format
- clears scratchpad message
- transmits a downlink accept message (if enabled) to acknowledge acceptance.

[Option – Liquid crystal display CDU or Liquid crystal display MCDU or Liquid crystal FANS MCDU]



CDU PAGES

FMC Data Link Uplinks (Load/Exec–Erase)

LOAD shows on the PERF INIT, PERF LIMITS, RTE DATA, and DES FORECASTS pages after receipt of uplink data.

After the uplinked data is loaded, the EXEC light illuminates and the ERASE prompt is displayed.

Selecting LOAD:

- loads uplinked data into FMC for viewing
- updates scratchpad message
- uplinked data modifies previous data
- ERASE prompt displays
- EXEC light illuminates.

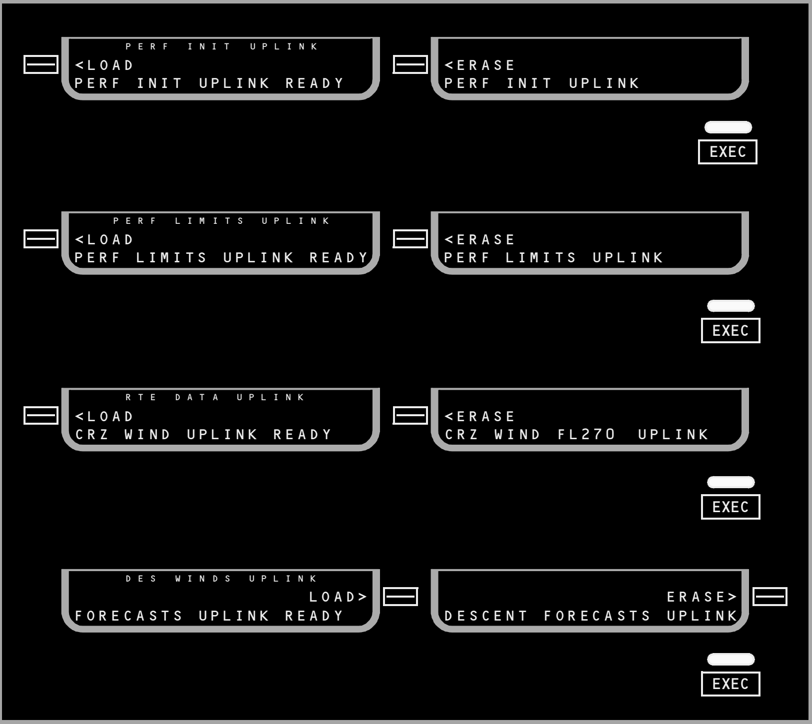
Pushing the EXEC key:

- incorporates modified data into active flight plan
- clears scratchpad message
- returns page display to normal (pre–uplink) format
- transmits a downlink accept message (if enabled) to acknowledge acceptance.

Selecting ERASE:

- removes modified data
- clears scratchpad message
- returns page display to normal (pre–uplink) format.
- transmits a downlink reject message (if enabled) to inform of rejection.

[Option – Liquid crystal display CDU or Liquid crystal display MCDU or Liquid crystal FANS MCDU]



CDU PAGES

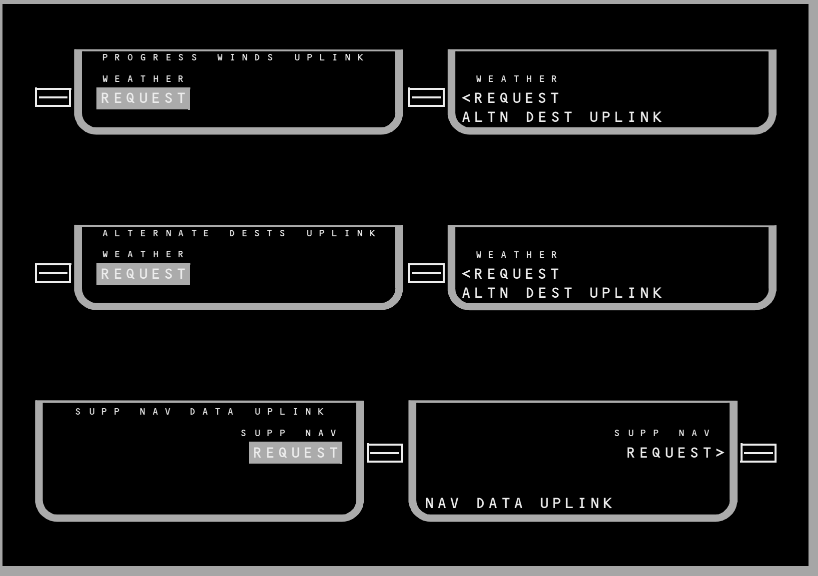
FMC Data Link Uplinks (Request)

Selecting the REQUEST prompt is the only action required to uplink data on the PROGRESS, ALTERNATE DEST, and SUPP NAV DATA pages.

After the uplinked data is loaded, an uplink message appears in the scratchpad.

Selecting REQUEST:

- loads uplinked data into FMC
- displays scratchpad message when uplink complete
- uplinked data modifies previous data.



CDU PAGES

FMC Data Link Uplinks (Automatic)

Data can be automatically uplinked.

The scratchpad message XXXXX UPLINK READY is displayed and the FMC alert light illuminates.

CDU PAGES

Data Link Management

The flight crew should monitor system status of FMC data link by observing status displays on CDU pages.

CDU Data Link Status Displays

Data link operation is verified when the correct line title is above the related prompt. In the example below, the line title TAKEOFF DATA is above the REQUEST prompt on the TAKEOFF REF page.

CDU PAGES

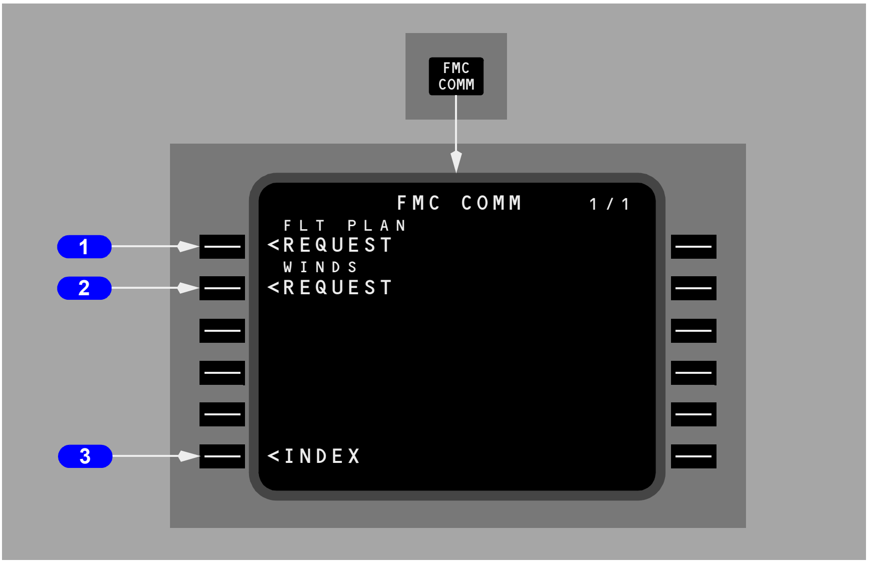
When the data link system is not operating, CDU page prompts change to FAIL, VOICE, NO COMM or FULL and the headings change to DATALINK. A typical example is shown below.

CDU PAGES

FMC Communications Page

[Option – FANS MCDU with company data link]

FMC communication page provides ability to initiate AOC datalink downlink requests. The actual prompts available and types of information requests generated is customer definable. The page examples below are representative only.



1 Flight Plan Request (FLT PLAN)

Push – transmits a data link request for a flight plan uplink.

2 Winds Request (WINDS)

Push – transmits a data link request for a winds uplink.

3 INDEX

Push – displays the INIT/REF INDEX page.

[Option – FMC U10.5 or later with FANS MCDU and ATS Data Link]

Air Traffic Control Data Link

[Option - U12 and below]
For airplanes with the Air Traffic Control (ATC) data link function installed, these functions are accomplished on the CDU. They include Air Traffic Services (ATS) Facilities Notification, Automatic Dependent Surveillance (ADS), and ATC Data Link

[Option - U13 and above with FANS2 option enabled]
For airplanes with the Air Traffic Control (ATC) data link function installed, these functions are accomplished on the CDU. They include Air Traffic Services (ATS) Facilities Notification, Automatic Dependent Surveillance (ADS), Aeronautical Telecommunication Network (ATN) and ATC Data Link.

The ATC LOGON/STATUS page provides the capability to initiate an Air Traffic Services Facilities Notification (AFN), downlink to a specified ATS facility and to display the ADS, ATC DL, and data link status.

The ATC UPLINK pages display messages uplinked by an ATS facility and provide the capability to respond to uplinked messages and to load clearances which contain loadable data.

The ATC REQUEST pages provide capability to create downlink requests for vertical and speed clearances, lateral offsets, and route changes.

The FMC formats reports in response to requests from an ATS facility for reports and confirmation. These reports are accessible via the ATC REPORT page and display for review or modification on the VERIFY REPORT pages.

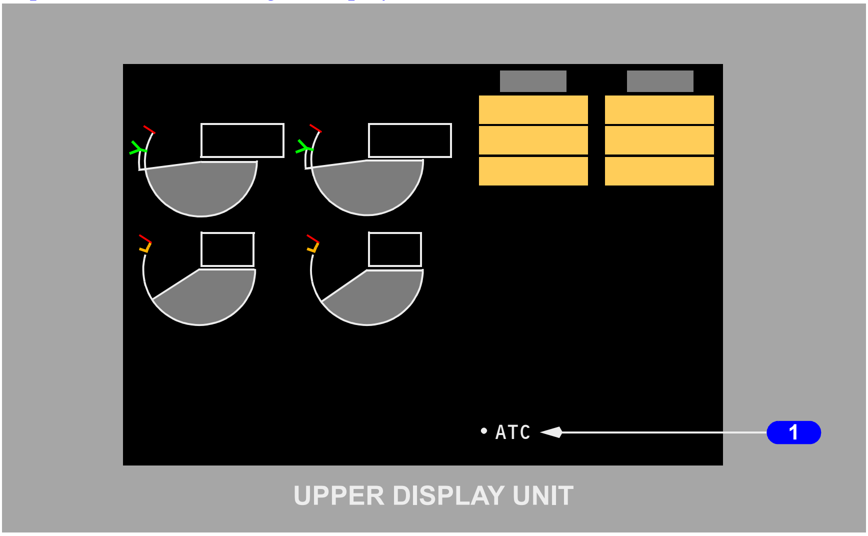
The ATC LOG page provides a list of all uplinks and downlinks stored in the ATC Log and provides access to the XXXXZ ATC UPLINK, XXXXZ ATC REQUEST, XXXXZ ATC REPORT, and XXXXZ EMERGENCY pages corresponding to each logged uplink or downlink.

To accomplish Automatic Dependent Surveillance, the FMC can simultaneously receive requests from five ATC centers and one airline center. Airline ADS addresses are stored in the airline policy file. The ADS functions include periodic, event, and on–demand reporting. The type and content of a report is initiated by uplink request. These functions are automatic. The flight crew can disable this function on the ATC LOGON/STATUS page.

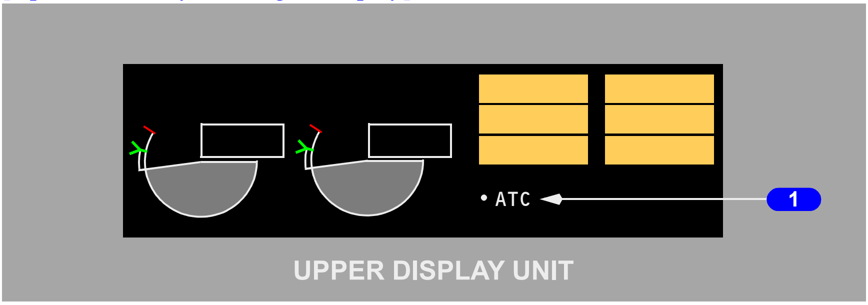
ATC Uplink Message

[Option – Side by side or over/under engine display and BP 04]
An uplinked ATC message will be accompanied by a white •ATC message on the primary engine display and a Hi/Lo chime over the flight deck loudspeaker. ATC MESSAGE will also be displayed in the CDU scratch pad.

[Option – Over/under engine display]



[Option – Side by side engine display]



1 •ATC Uplink Message (white)

Indicates receipt of an uplinked ATC message. Hi/Lo chime is sounded and ATC MESSAGE is displayed on the CDU scratch pad.

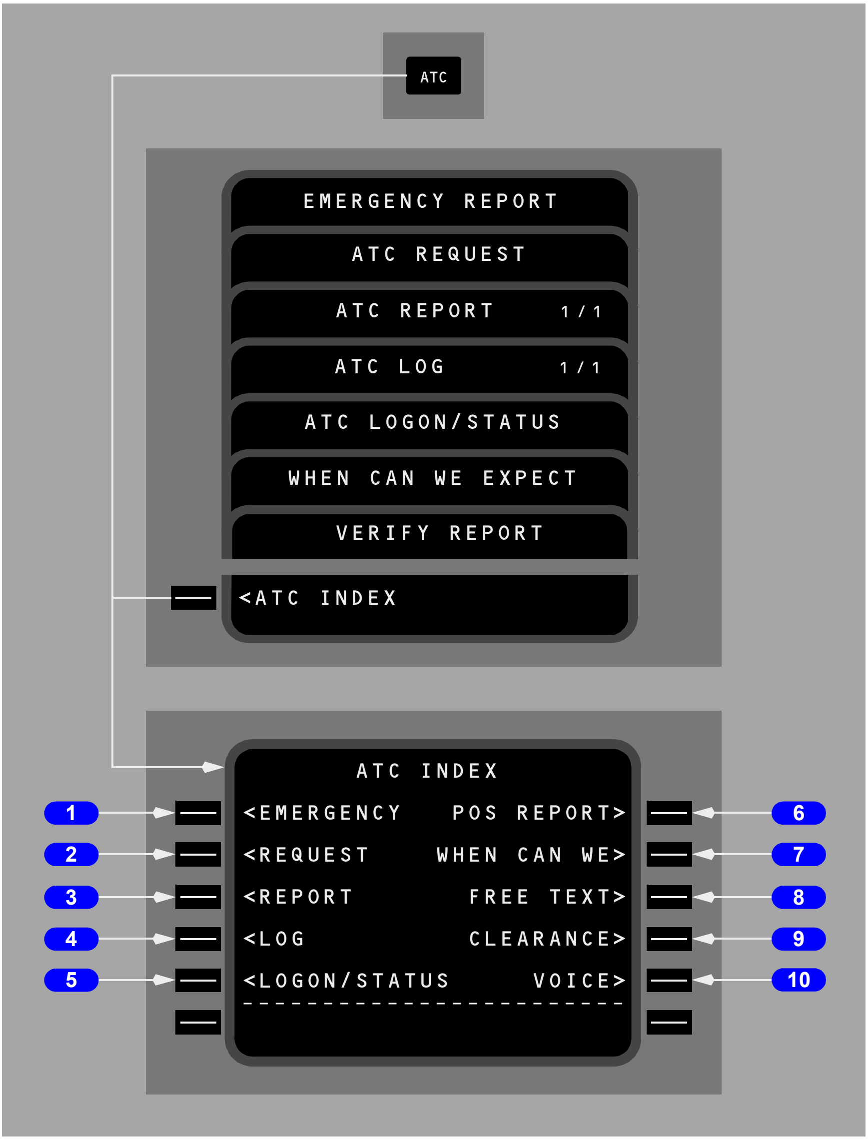
The •ATC message will continue to be displayed as long as any pending ATC uplink messages remain in the queue.

ATC Index Page

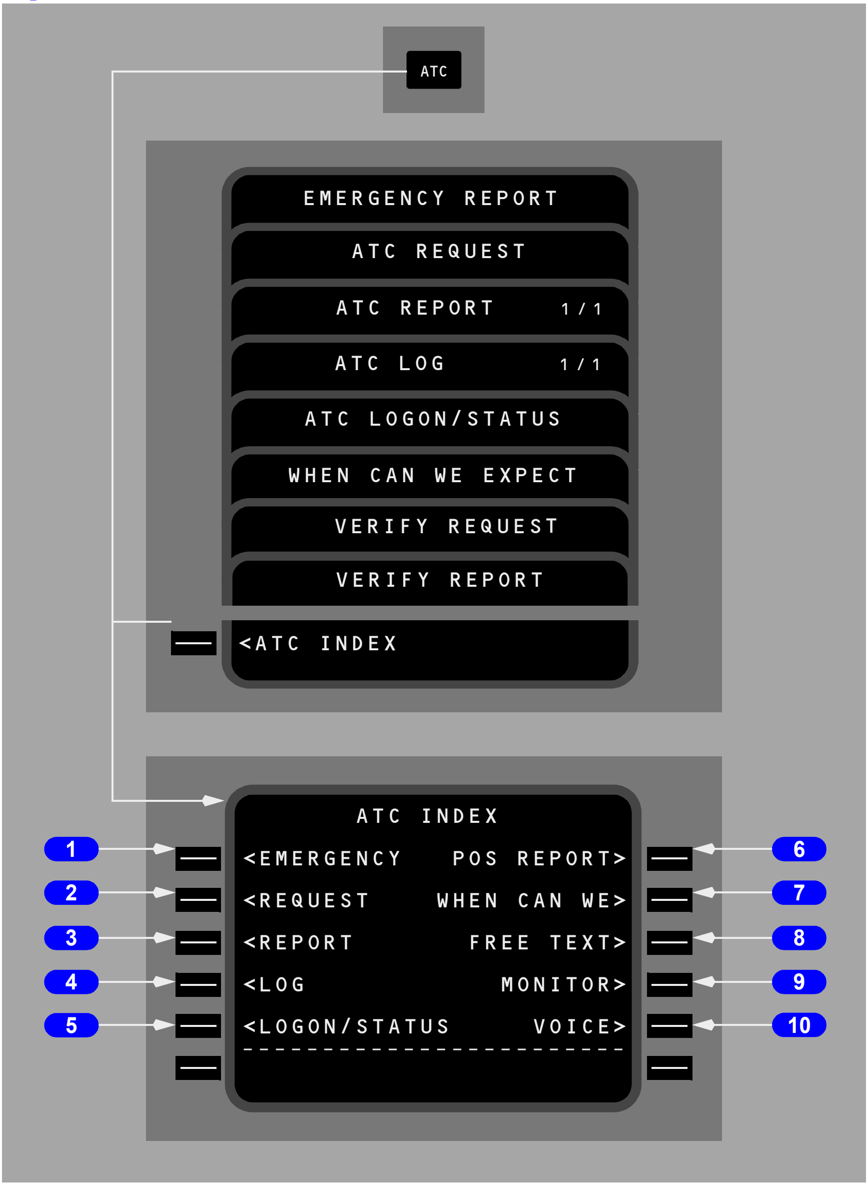
The ATC INDEX CDU page provides access to pages used for ATC data link functions.

[Option - U14 and above with FANS2 option enabled]

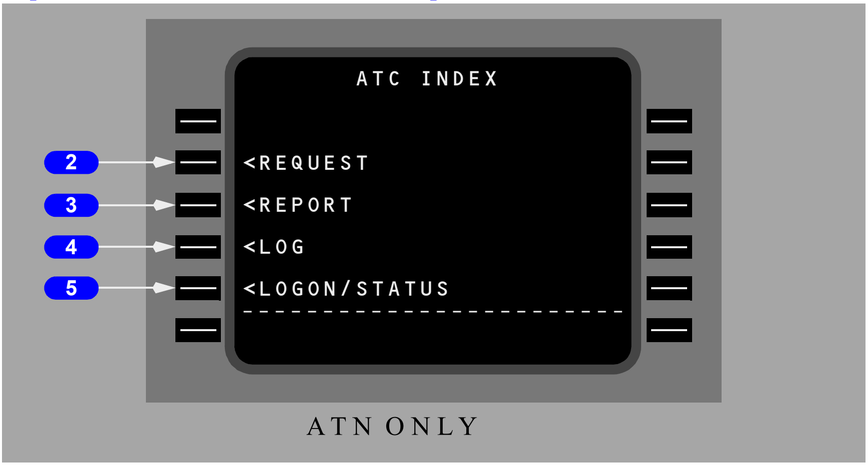
Note: For those FANS pages that do not exist in the ATN environment, upon inter-center transfer from a FANS Center to an ATN Center these pages revert to the ATC INDEX page.


ATC
EMERGENCY REPORT
ATC REQUEST
ATC REPORT 1/1
ATC LOG 1/1
ATC LOGON/STATUS
WHEN CAN WE EXPECT
VERIFY REPORT
<ATC INDEX
ATC INDEX
<EMERGENCY POS REPORT>
<REQUEST WHEN CAN WE>
<REPORT FREE TEXT>
<LOG CLEARANCE>
<LOGON/STATUS VOICE>
1
2
3
4
5
6
7
8
9
10

[Option - U14 and above]



[Option - U13 and above with FANS2 option enabled]



1 EMERGENCY

Push – displays EMERGENCY REPORT page.

2 REQUEST

Push – displays ATC REQUEST page.

3 REPORT

Push – displays ATC REPORT page.

4 LOG

Push – displays ATC LOG page.

5 LOGON/STATUS

Push – displays ATC LOGON/STATUS page.

6 Position Report (POS REPORT)

Push – displays POS REPORT page.

7 WHEN CAN WE

Push – displays WHEN CAN WE EXPECT page.

8 FREE TEXT

Push – displays VERIFY REPORT page for free text messages.

9 CLEARANCE

Push – displays VERIFY REQUEST pages for clearance request.

[Option - U14 and above and above with FANS2 option enabled]

9 MONITOR

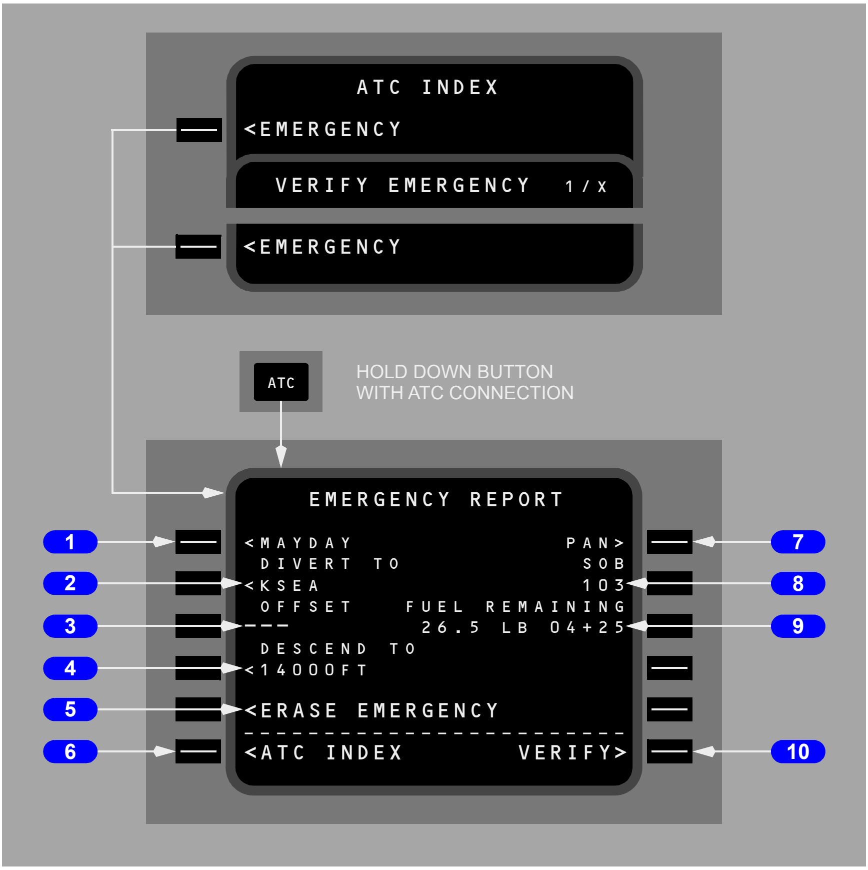
Push – displays page for all CONDITIONAL CLEARANCE uplinks that are being monitored by the system.

10 VOICE

Push – displays VERIFY REQUEST page for voice contact request.

Emergency Report Page

The EMERGENCY REPORT pages provide the capability to create downlink messages to alert an ATS facility to an aircraft emergency and to the lateral and vertical maneuvers the flight crew intend to execute.



1 MAYDAY

Push –

- displays VERIFY EMERGENCY page
- displays MAYDAY MAYDAY MAYDAY message
- when current altitude more than 150 feet above altitude in 4L, displays DESCENDING TO altitude on VERIFY EMERGENCY page.

2 DIVERT TO

Displays active destination airport.

Valid entries are: waypoint, navaid, airport, latitude–longitude, or place bearing/distance.

Entered position may be deleted.

Push –

- message includes remainder of route if active destination airport or enroute waypoint displayed
- message includes direct to routing if neither active destination airport or enroute waypoint are displayed.

3 OFFSET

Valid entry is LXX, RXX or XX (XX is any number from 1 to 99 nm.). For either side, L or R is not entered.

Message includes entered offset.

Entered offset may be deleted.

4 DESCEND TO

Displays MCP altitude.

Valid entry is XXX or FLXXX (flight level), XXXXX (feet), or XXXXXm (meters).

Entered altitude may be deleted.

Push – message indicates crew intention to descend to displayed altitude.

5 ERASE EMERGENCY, CANCEL EMERGENCY

Initial display is blank.

Entry or selection of data on any line displays ERASE EMERGENCY.

Displays CANCEL EMERGENCY after EMERGENCY REPORT sent.

ERASE EMERGENCY –

Push – erases all emergency data.

CANCEL EMERGENCY –

Push – selects CANCEL EMERGENCY message.

6 ATC INDEX

Push – displays ATC INDEX page.

7 PAN

Push –

- displays VERIFY EMERGENCY page
- displays PAN PAN PAN message.

8 Souls On Board (SOB)

Valid entry is number of persons on airplane.

Message includes SOB.

Entered SOB may be deleted.

9 FUEL REMAINING

Initial display is blank.

Displays FMC computed fuel remaining in quantity and time when a SOB number is entered.

Valid entry is HH+MM (hours and minutes).

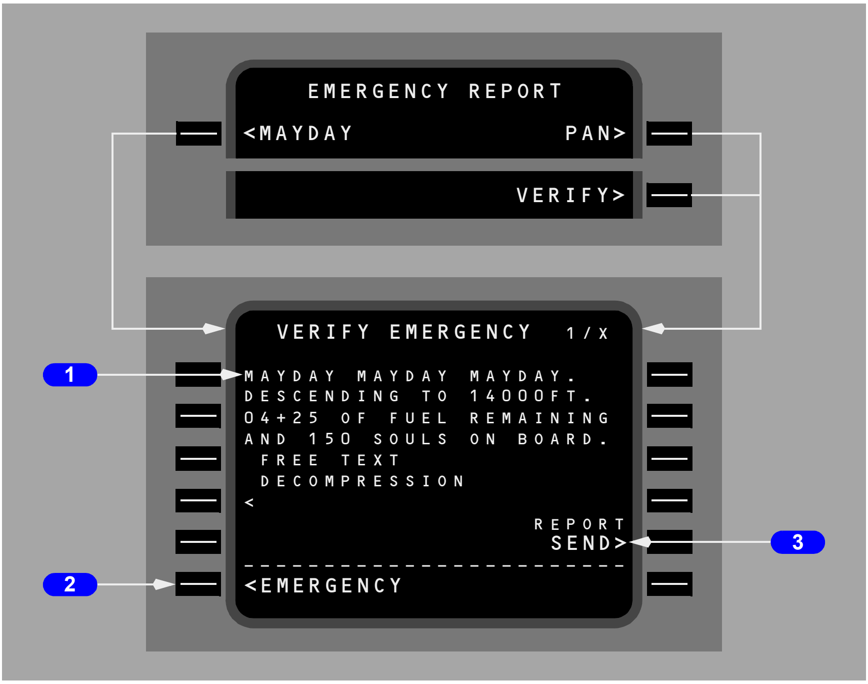
Only fuel remaining in hours and minutes is downlinked.

10 VERIFY

Push – displays VERIFY EMERGENCY page.

Verify Emergency Page 1/X

The VERIFY EMERGENCY page displays the EMERGENCY REPORT for review before it is sent. The page allows entering a free text message.



1 Lines 1 – 5

Page 1/X line 1 displays MAYDAY MAYDAY MAYDAY message or PAN PAN PAN message as selected on EMERGENCY REPORT page.

Pages 1/X to X/X display data from the EMERGENCY REPORT page and provide at least one line for free text entry.

2 EMERGENCY

Push – displays EMERGENCY REPORT page.

3 REPORT SEND

If the emergency message spans multiple pages, the REPORT SEND prompt will only appear on the last VERIFY EMERGENCY page.

Push –

- creates emergency report message containing information on VERIFY EMERGENCY page
- when MAYDAY selected, transmits POSITION REPORT and activates ADS in emergency mode.
- creates log entry of transmitted message.

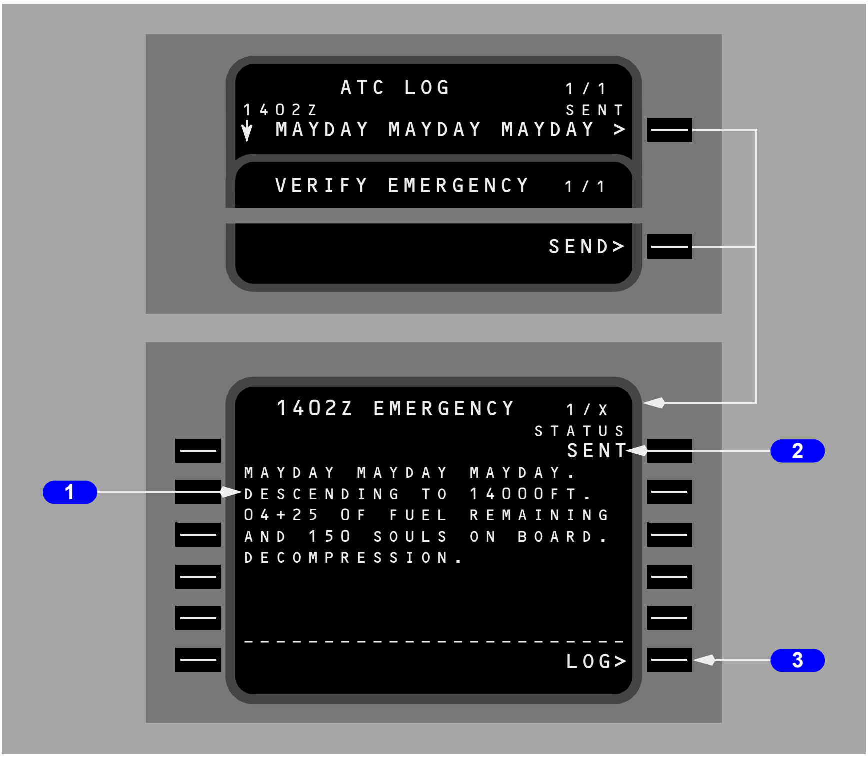
When CANCEL EMERGENCY displayed in 5L on EMERGENCY REPORT page:

Push –

- sends CANCEL EMERGENCY message
- deactivates ADS emergency mode
- creates ATC LOG entry of transmitted message
- displays SENDING
- displays XXXXZ ATC REQUEST page upon network acknowledgement
- displays NO ATC COMM when data link READY and no ATC connection
- displays NO COMM for no available communications media.

XXXXZ Emergency Page X/X

XXXXZ EMERGENCY page displays the transmitted report. XXXXZ is the time the report was transmitted.



1 Lines 1 – 5

Pages 1/X to X/X display message transmitted to ATC at time of page title. Line 1 is blank on page 1/X.

2 STATUS SENT

Displays emergency report status from ATC LOG page.

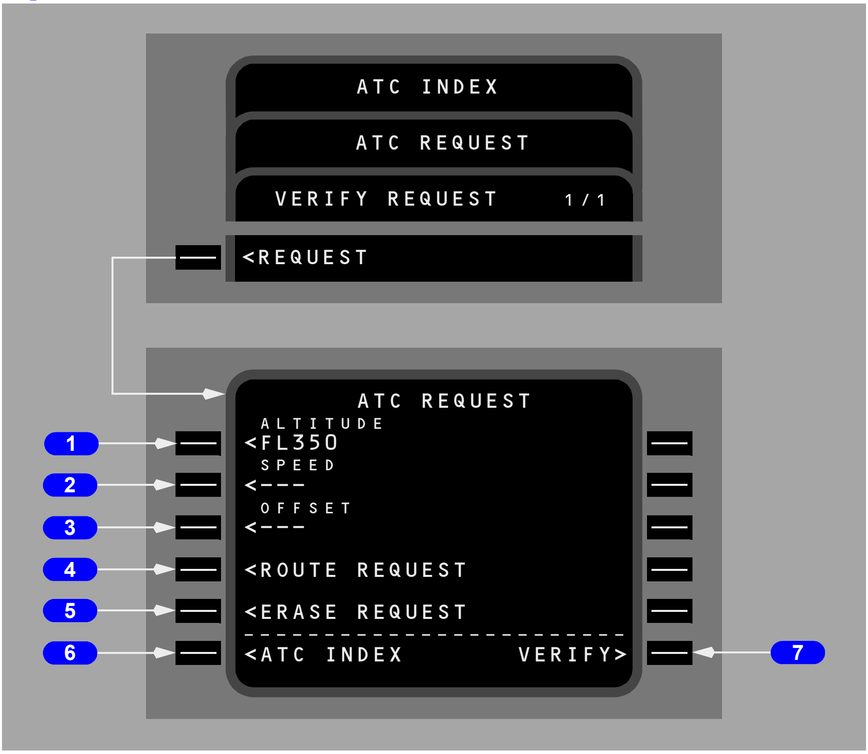
3 LOG

Push – Displays the ATC LOG page.

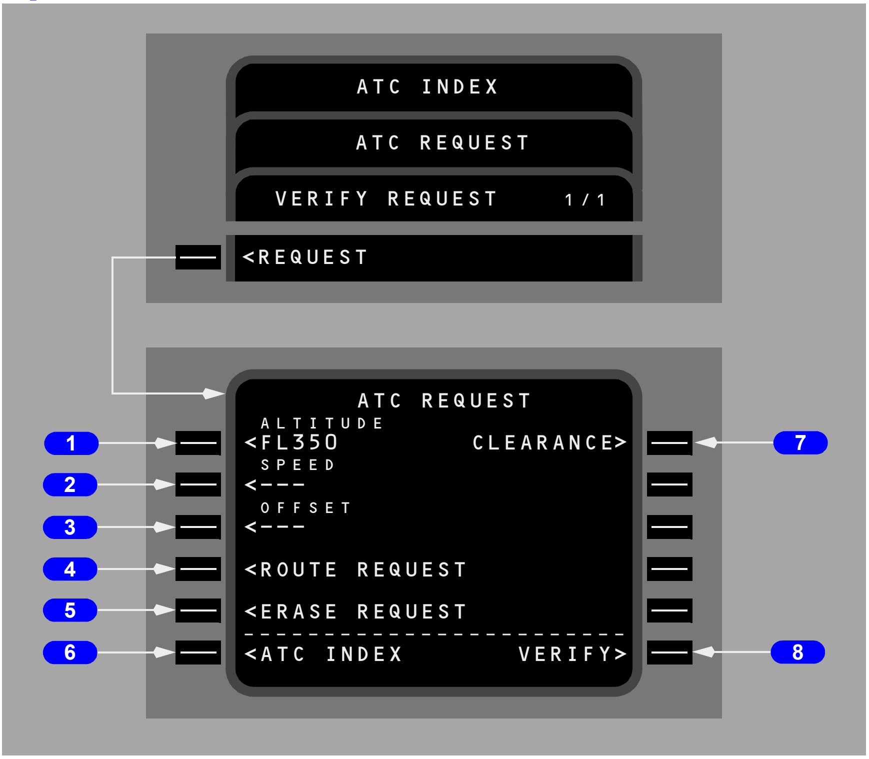
ATC Request Page

The ATC REQUEST page allows entry of altitude, speed, and offset direction and distance requests.

[Option - U13 and below]



[Option - U14 and above]



[Option - U14 and above with FANS2 option enabled]

1 ALTITUDE

Initially displays dashes.

Valid entries are XXX or FLXXX (flight level), XXXXX (feet), XXXXXM (meters), XXXXX/XXXXX or FLXXX/FLXXX (block altitude).

Block altitude in meters is not permitted.

Entry may be deleted.

Push –

- with altitude/flight level entered, displays ATC ALT REQUEST page with altitude/flight level on altitude line
- with dashes displayed, displays ATC ALT REQUEST page with dashes on altitude line.

2 SPEED

Initially displays dashes.

Valid entry is IAS or Mach.

Entry may be deleted.

Push –

- with speed/Mach entered, displays ATC SPEED REQUEST page with speed/Mach on speed line
- with dashes displayed, displays ATC SPEED REQUEST page with dashes on speed line.

3 OFFSET

Initially displays dashes.

Valid entry is LXX, RXX or XX (XX is any number from 1 to 99 nm.). For either side, L or R is not entered.

Entry may be deleted.

Push –

- with offset entered, displays ATC OFFSET REQUEST page with offset on offset line
- with dashes displayed, displays ATC OFFSET REQUEST page with dashes on offset line.

4 ROUTE REQUEST

Push – displays ATC ROUTE REQUEST page.

5 **ERASE REQUEST**

Push – erases all entered or selected data on any of the four ATC REQUEST pages.

6 **ATC INDEX**

Push – displays ATC INDEX page.

[Option - U13 or below]

7 **VERIFY**

Push – displays VERIFY REQUEST page.

[Option - U14 and above]

7 **CLEARANCE**

Push – results in the display of the VERIFY REQUEST page 1/X for the CLEARANCE request.

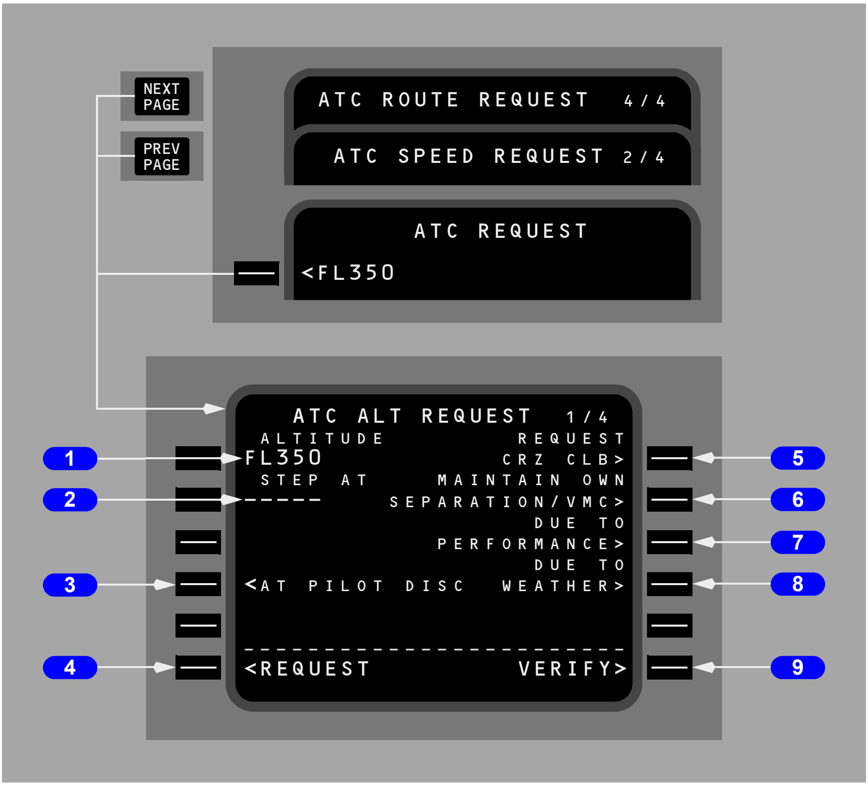
[Option - U14 and above or FANS2 option enabled]

8 **VERIFY**

Push – displays VERIFY REQUEST page.

ATC Altitude Request Page 1/4

The ATC ALT REQUEST page 1/4 allows downlink requests for altitude changes.



[Option - U14 and above with FANS2 option enabled]

ATN ONLY

1 ALTITUDE

Initially displays dashes or altitude entered on ATC REQUEST page.

Valid entries are XXX or FLXXX (flight level), XXXXX (feet), XXXXXM (meters), XXXXX/XXXXX or FLXXX/FLXXX (block altitude).

Block altitude in meters is not permitted.

Entry selects a message requesting a level altitude, climb, or descent based on current altitude.

Altitude may be deleted.

2 STEP AT

Initially displays dashes.

Valid entries are: fix name, navaid, airport, latitude–longitude, place bearing/distance, or time.

Entry of a position or time with an altitude request selects a message requesting a step up or down at a specified time based on current altitude.

Entry may be deleted.

3 AT PILOT Discretion (AT PILOT DISC)

Push – displays AT PILOT DISCRETION in large font and selects as message element.

Selection may be deleted.

4 REQUEST

Push – displays ATC REQUEST page.

5 Request Cruise Climb (REQUEST CRZ CLB)

Push – displays CRZ CLB in large font and selects message requesting cruise climb to entered altitude.

Selection may be deleted.

6 MAINTAIN OWN SEPARATION/VMC

Push – displays SEPARATION/VMC in large font and selects MAINTAIN OWN SEPARATION AND VMC message element.

Selection may be deleted.

7 DUE TO PERFORMANCE

Push – displays PERFORMANCE in large font and selects DUE TO PERFORMANCE message element.

Selection may be deleted.

8 DUE TO WEATHER

Push – displays WEATHER in large font and selects DUE TO WEATHER message element.

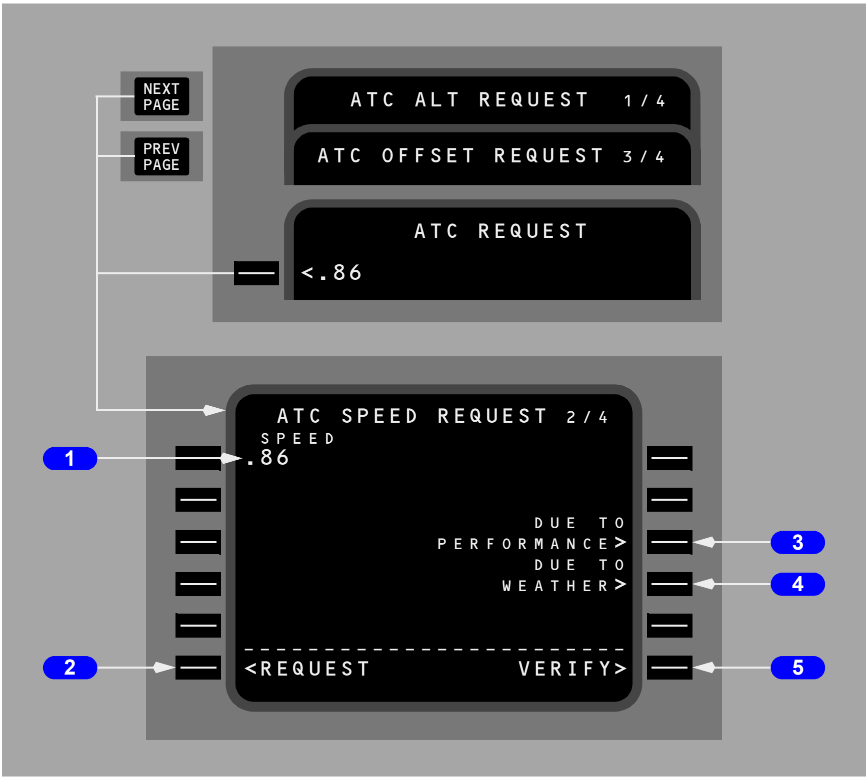
Selection may be deleted.

9 VERIFY

Push – displays VERIFY REQUEST page.

ATC Speed Request Page 2/4

The ATC SPEED REQUEST page 2/4 allows downlink requests for speed changes.



1 SPEED

Initially displays dashes or speed/Mach entered on ATC REQUEST page.

Valid entry is IAS or Mach.

Entry selects a message requesting the speed or Mach.

Entry may be deleted.

2 REQUEST

Push – displays ATC REQUEST page.

3 DUE TO PERFORMANCE

Push – displays PERFORMANCE in large font and selects DUE TO PERFORMANCE message element.

Selection may be deleted.

4 **DUE TO WEATHER**

Push – displays WEATHER in large font and selects DUE TO WEATHER message element.

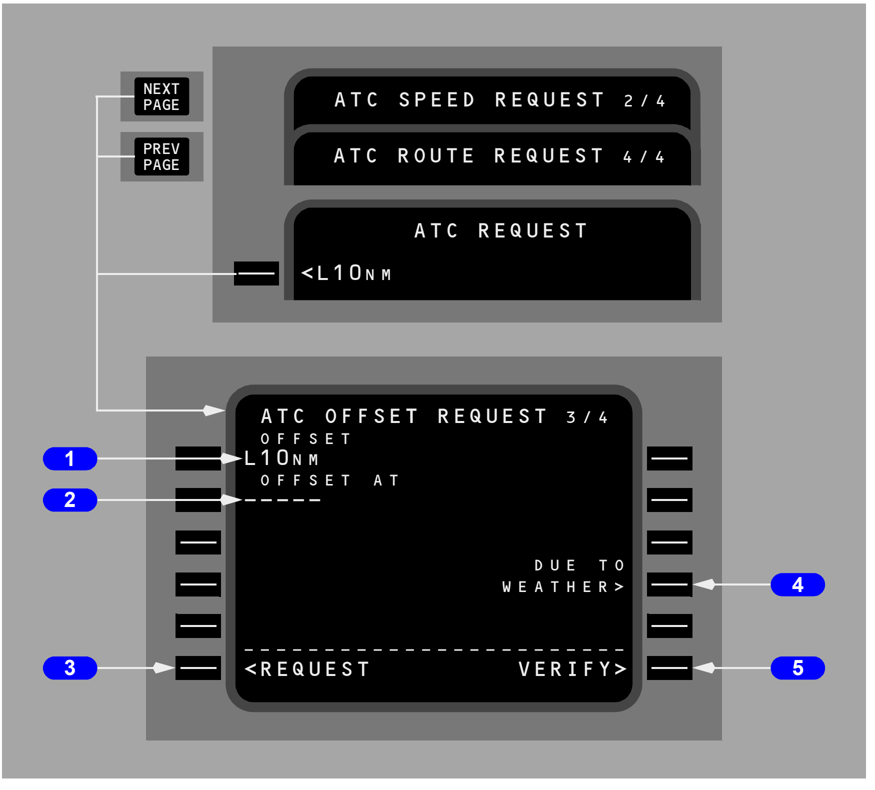
Selection may be deleted.

5 **VERIFY**

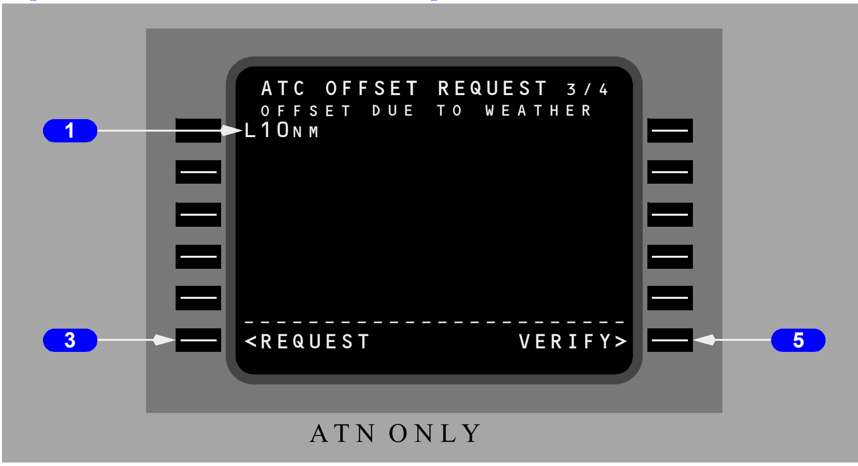
Push – displays VERIFY REQUEST page.

ATC Offset Request Page 3/4

The ATC OFFSET REQUEST page 3/4 allows downlink requests for later offsets.



[Option - U14 and above with FANS2 option enabled]



1 **OFFSET**

Initially displays dashes or offset requested on ATC REQUEST page.

Valid entry is LXX, RXX or XX (XX is any number from 1 to 99 nm.). For either side, L or R is not entered.

Entry selects a message requesting an offset from the active route.

Entry may be deleted.

2 **OFFSET AT**

Entry of a position or time with an offset request selects a message requesting an offset at the specified position or time.

Valid entries are: fix name, navaid, airport, latitude–longitude, place bearing/distance, or time.

Entry may be deleted.

3 **REQUEST**

Push – displays ATC REQUEST page.

4 **DUE TO WEATHER**

Push – displays WEATHER in large font and selects REQUEST WEATHER DEVIATION UP TO entered offset direction and distance.

Selection may be deleted.

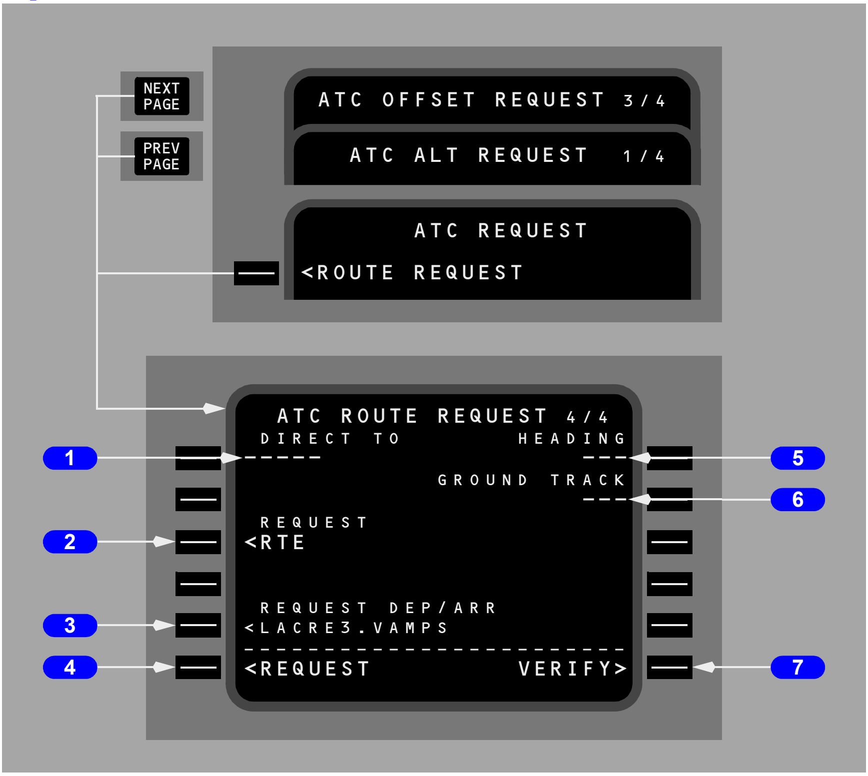
5 VERIFY

Push – displays VERIFY REQUEST page.

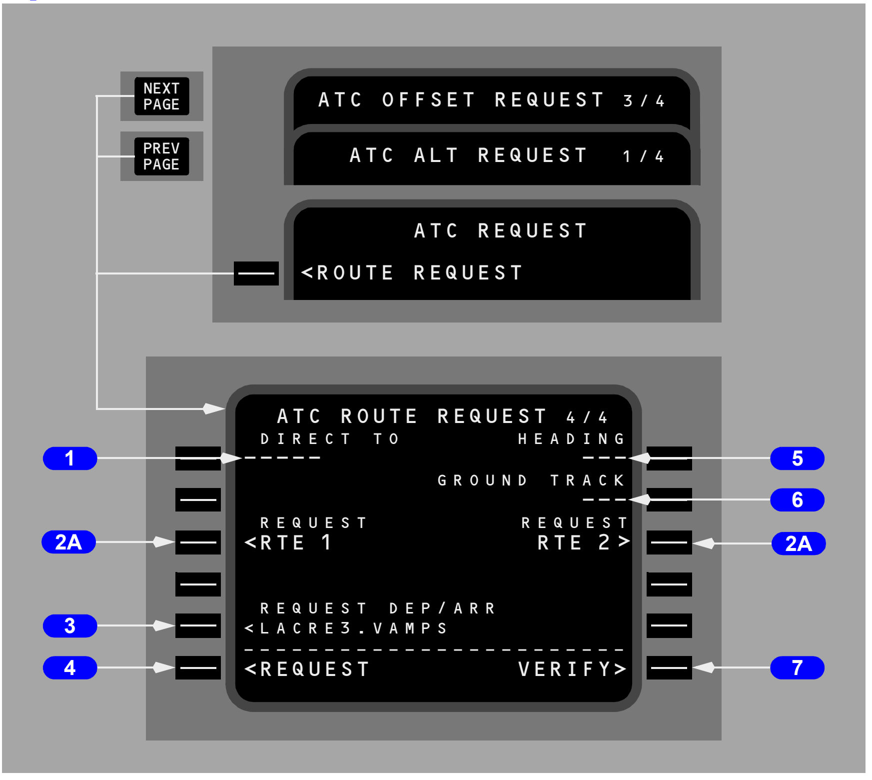
ATC Route Request Page 4/4

The ATC ROUTE REQUEST page 4/4 allows downlink requests for route changes.

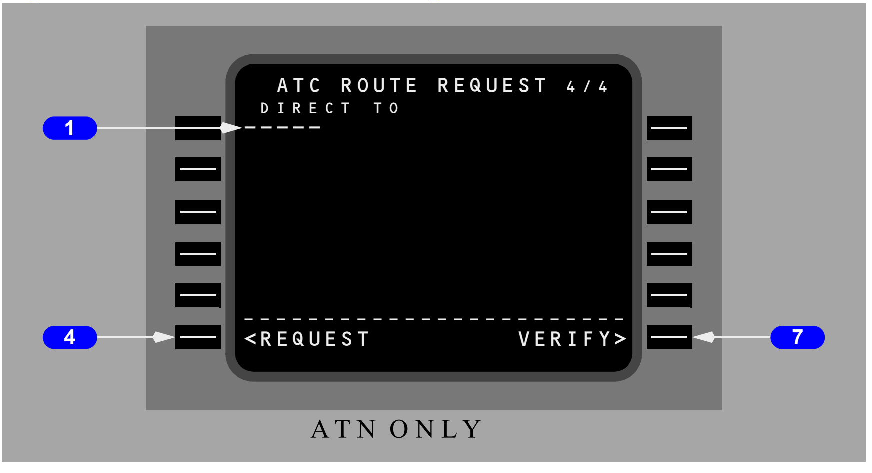
[Option -below U11]



[Option - U11 and above]



[Option - U14 and above with FANS2 option enabled]



1 DIRECT TO

Entry selects a message requesting a clearance direct to the position.

Valid entries are: fix name, navaid, airport, latitude–longitude, or place bearing/distance.

Entry may be deleted.

[Option - below U11]

2 Route REQUEST (REQUEST RTE)

Push – selects route stored in RTE for route request. When RTE has a pending modification, the modified route is requested.

Selection may be deleted.

[Option - U11 to U14]

2A Route 1 or 2 REQUEST (REQUEST RTE 1 or 2)

Push – selects route stored in RTE 1 or 2 for route request. When RTE 1 or 2 has a pending modification, the modified route is requested.

Selection may be deleted.

3 Request Departure/Arrival/Transition (REQUEST DEP/ARR)

Initially displays dashes or selections made on DEP/ARR page.

Valid entry is departure or arrival (6 alpha-numeric characters max).

Valid entry is departure or arrival and transition (up to 6 alpha-numeric characters for the procedure, followed by a period, followed by up to 5 alpha-numeric characters for the transition).

[Option - U11 to U14]

A route to be searched for an origin or destination airport will be selected in the following order:

- Pending modified or pending active route
- Active route
- Inactive route 1
- Inactive route 2

Entry may be deleted.

Push – displays selected entry in large font and selects a message element requesting the selected entry.

4 REQUEST

Push – displays ATC REQUEST page.

5 **HEADING**

Entry selects a message requesting the specified heading.

Valid entry is XXX (heading).

Entry may be deleted.

6 **GROUND TRACK**

Entry selects a message requesting the specified ground track.

Valid entry is XXX (ground track).

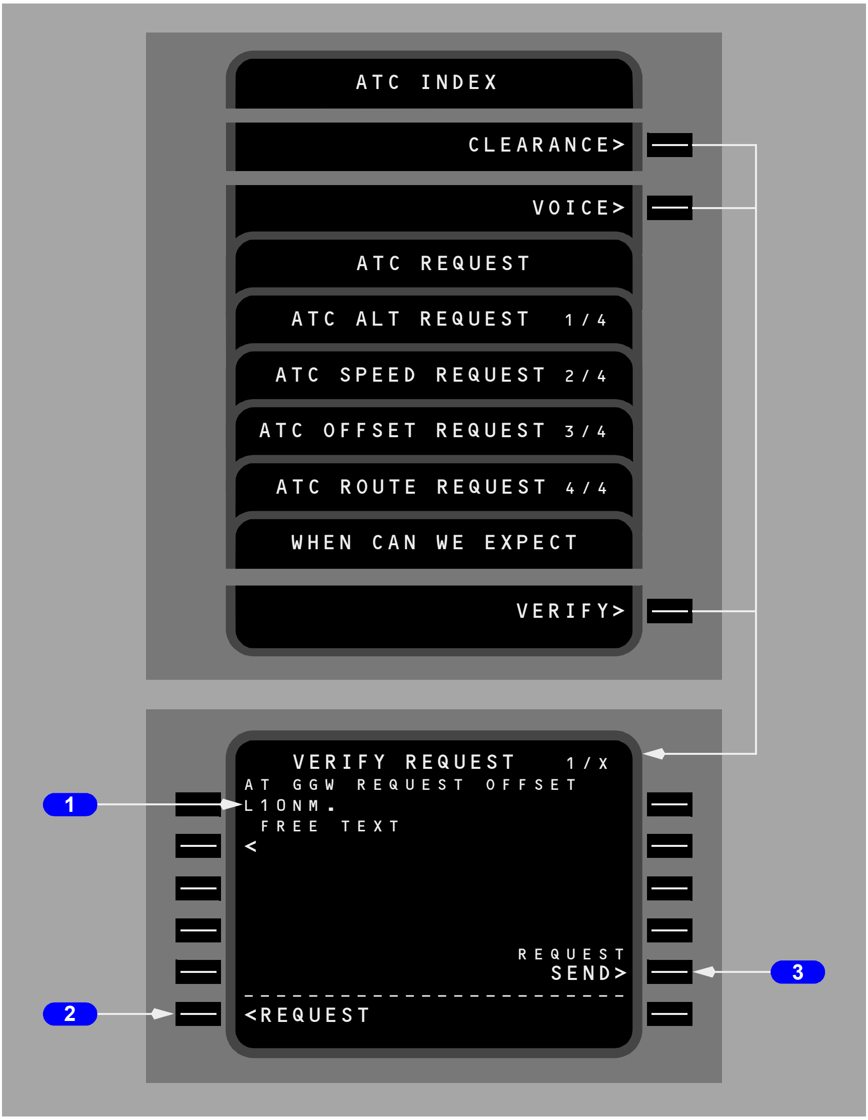
Entry may be deleted.

7 **VERIFY**

Push – displays VERIFY REQUEST page.

Verify Request Page X/X

The VERIFY REQUEST pages display the request for review before it is sent.



1 Lines 1 – 5

Pages 1/X to X/X display data which reflect the request and provide at least one line for free text entry.

Any entered free text included in downlink request.

2 **ATC INDEX, REQUEST, WHEN CAN WE**

Displays ATC INDEX when page accessed from ATC INDEX page.

Displays REQUEST when page accessed from ATC REQUEST page.

Displays WHEN CAN WE when page accessed from WHEN CAN WE EXPECT page.

REQUEST –

Push – displays ATC REQUEST page.

ATC INDEX –

Push – displays ATC INDEX page.

WHEN CAN WE –

Push – displays WHEN CAN WE EXPECT page.

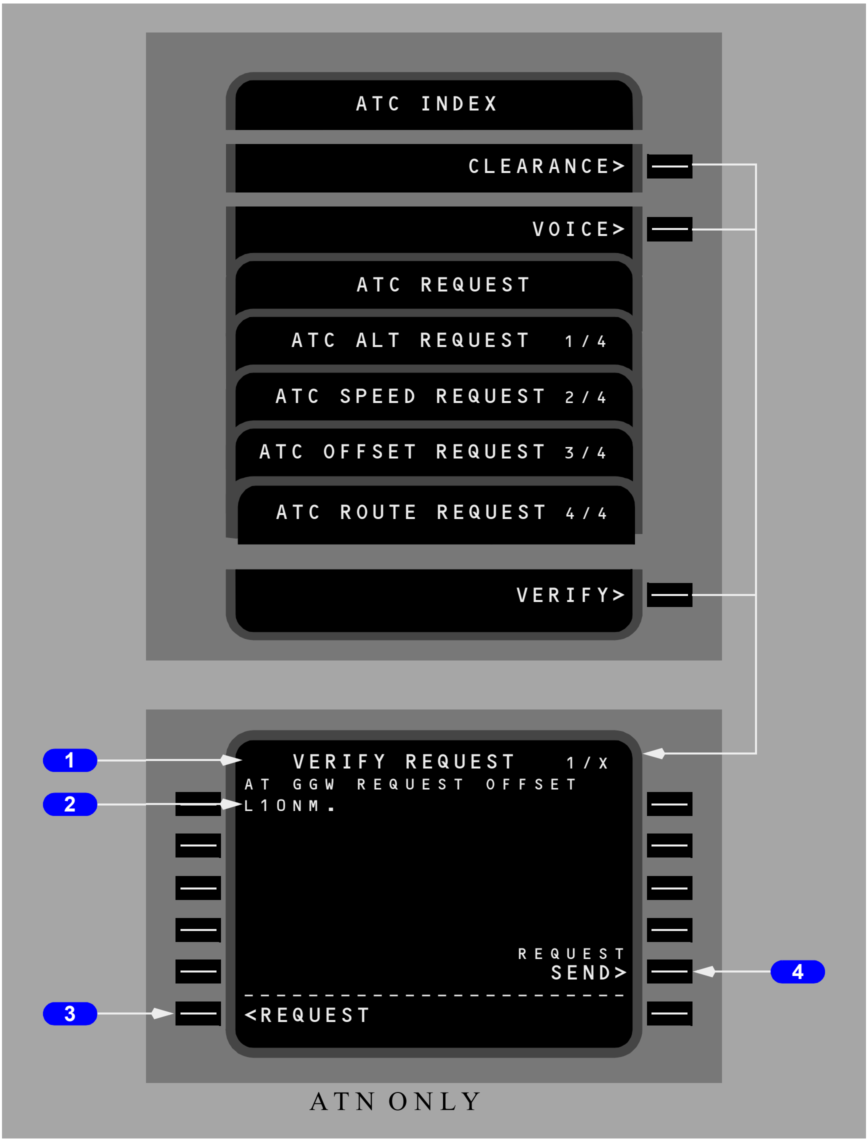
3 **REQUEST SEND**

Displays on last VERIFY REQUEST page.

Push –

- initiates ATC request
- creates ATC LOG entry of transmitted message
- displays SENDING
- displays XXXXZ ATC REQUEST page upon network acknowledgement
- displays NO ATC COMM when data link READY and no ATC connection
- displays NO COMM for no available communications media.

[Option - U14 and above with FANS2 option enabled]



1 VERIFY REQUEST (ATN)

The VERIFY REQUEST page displays the text of the message which will be downlinked to ATC for an altitude, speed, offset, or route clearance request.

If this page is accessed via the VERIFY prompt on the ATC REQUEST, ATC ALT REQUEST, ATC SPEED REQUEST, ATC OFFSET REQUEST, or ATC ROUTE REQUEST pages, then only those message elements associated with the requests formulated via these pages are displayed.

Note: Upon inter-center transfer from an ATN Center to a FANS Center and vice versa, the VERIFY REQUEST page will revert to the ATC INDEX page.

2 Lines 1 – 5

Pages 1/X to X/X display data which reflect the message elements for the altitude, speed, offset, or route clearance request.

3 ATC INDEX or REQUEST

Displays ATC INDEX when page accessed from ATC INDEX page.

Displays REQUEST when page accessed from ATC REQUEST page.

REQUEST –

Push – displays ATC REQUEST page.

ATC INDEX –

Push – displays ATC INDEX page.

4 REQUEST SEND

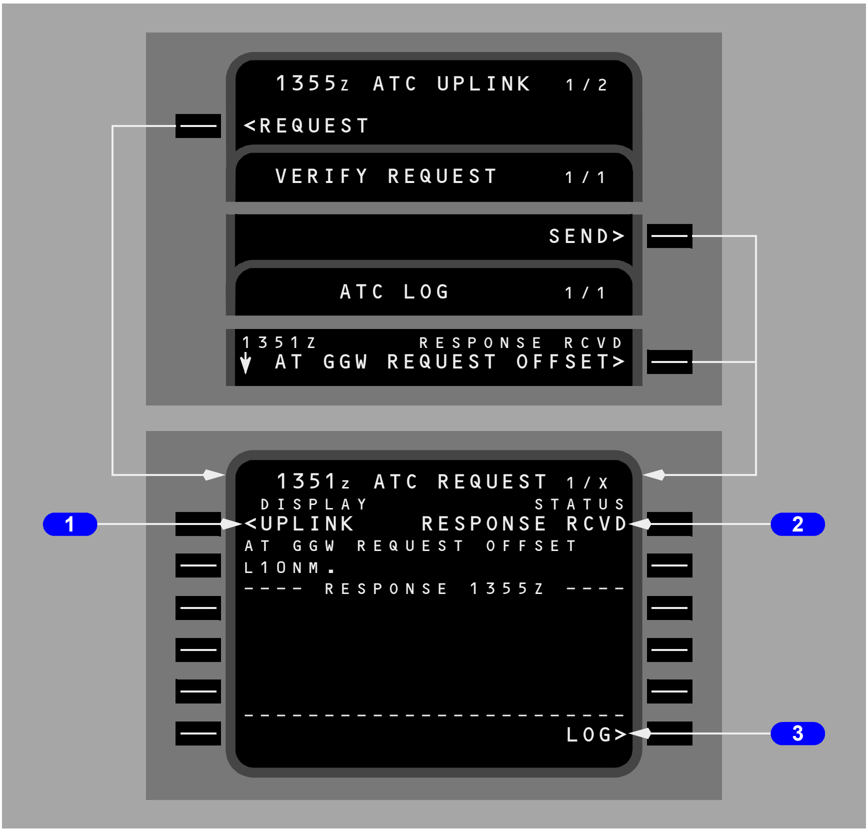
Displays on last VERIFY REQUEST page.

Push –

- results in the creation of a REQUEST message containing the information displayed on the VERIFY REQUEST page and will initiate transmission of the REQUEST message to the active ATC center.
- creates ATC LOG entry of transmitted message
- displays SENDING
- displays XXXXZ ATC REQUEST page upon network acknowledgement
- displays NO COMM when data link status is NO COMM
- displays VOICE when data link status is VOICE
- displays FAIL when data link status is FAIL
- displays READY when data link READY and not ATN READY connection
- displays NO ATC COMM when data link READY and no ATC connection
- displays NO ATC COMM when data link ATN READY and no ATC connection
- displays NO COMM for no available communications media.

XXXXZ ATC Request Page X/X

The ATC REQUEST pages display the transmitted request. XXXXZ is the time request was transmitted.



1 Lines 1 – 5

Pages 1/X to X/X display data transmitted to ATC at the time in page title.

Page 1/X line 1 displays UPLINK when ATC response to displayed downlink request exists.

Time of ATC uplink response displays following text:

UPLINK –

Push – displays the XXXXZ ATC UPLINK 1/X page displaying ATC response to displayed request.

2 Message Status

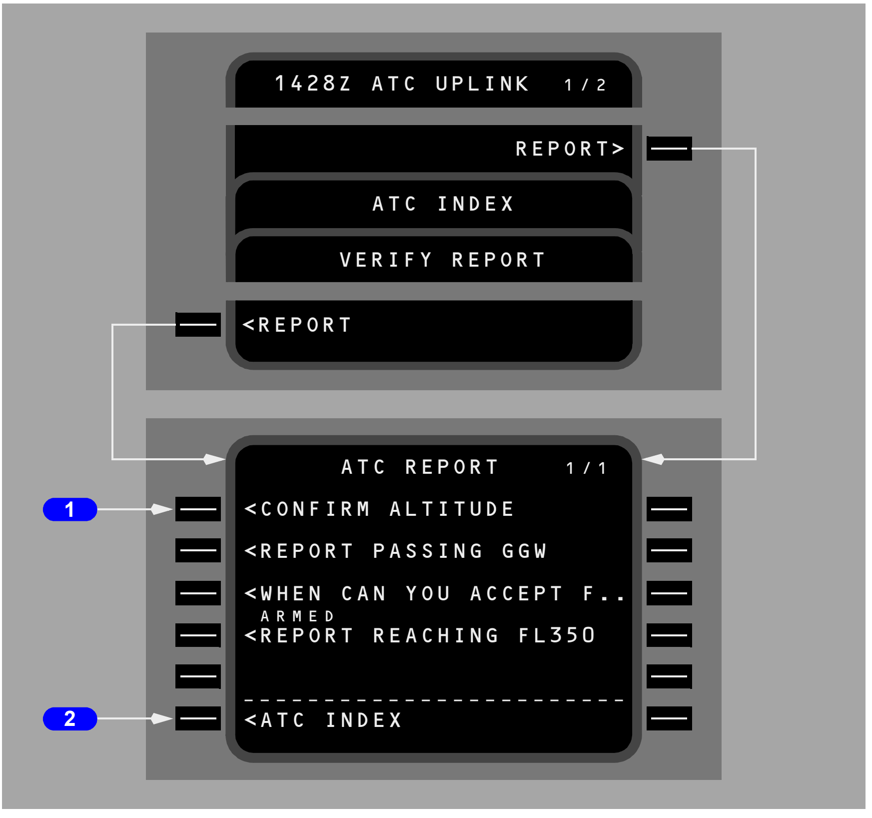
Displays request downlink message status from ATC LOG page.

3 LOG

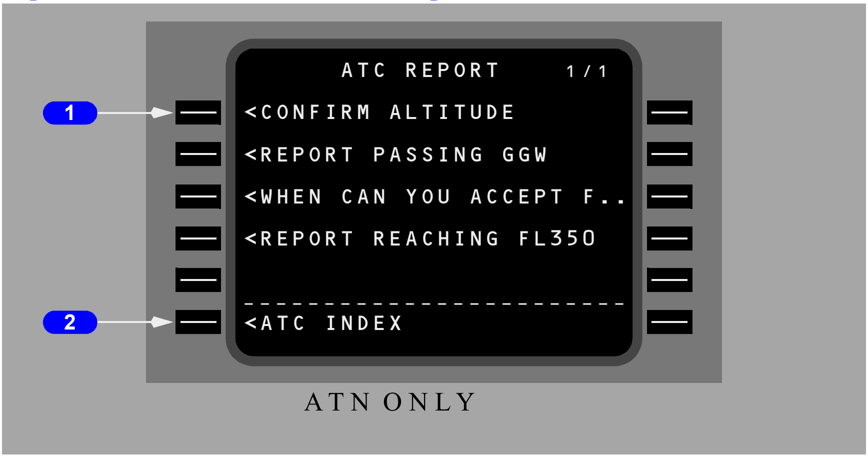
Displays ATC LOG page.

ATC Report Page X/X

The ATC REPORT pages provide access to VERIFY REPORT pages for ATC requested reports and confirmations. The ATC REPORT pages can display a maximum of 10 reports after which the ATC REPORT LIST FULL scratch pad message is displayed.



[Option - U14 and above with FANS2 option enabled]



1 Lines 1 – 5

Pages 1/X to X/X lines 1 to 5 display uplinked report or confirmation requests transmitted by ATC.

Long messages are abbreviated and followed by two periods.

[Option - U3 and higher]
Title displays ARMED when report armed for automatic transmission.

Report or confirmation request –

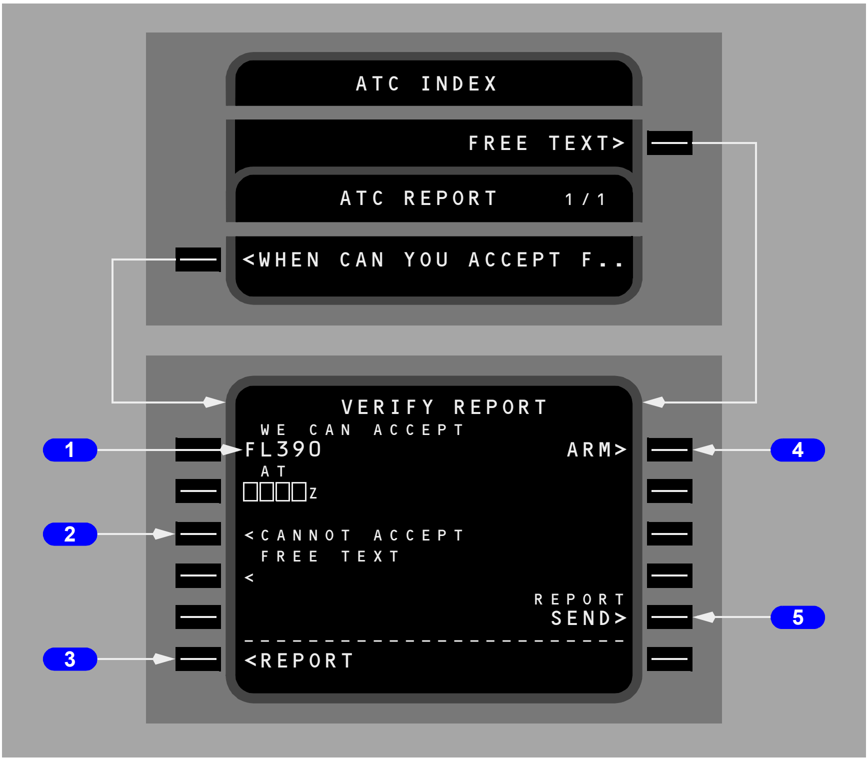
Push – displays ATC requested report or confirmation VERIFY REPORT page.

2 INDEX

Push – displays ATC INDEX page.

Verify Report Page

The VERIFY REPORT page displays reports in clearance language and allows review/modification and entry of free text before report is sent.



[Option - U14 and above with FANS2 option enabled]

1 Lines 1 – 4

Display message text and data for each message.

Display boxes for pilot entry.

Entry includes data in report message.

Entry may be deleted.

[Option - U13 and above]
At least one line is available for free text entry.

2 CANNOT ACCEPT

Displays in response to WHEN CAN YOU ACCEPT uplinks.

Push – selects a CANNOT ACCEPT message.

Selection may be deleted.

3 ATC INDEX, REPORT

Displays ATC INDEX when page accessed from ATC INDEX page.

Displays REPORT when page accessed from ATC REPORT page.

ATC INDEX –

Push – displays ATC INDEX page.

ATC REPORT –

Push – displays ATC REPORT page.

4 ARM

ARM is displayed when an armable report is created.

Push –

- arms report for transmission when condition is satisfied
- displays ARMED
- ARMED may be deleted to disarm transmission of report.

[Option - all but FANS 2 Datalink option]
5 SEND

SEND is displayed after box prompts are filled in.

Push –

- transmits ATC REPORT
- creates ATC LOG entry of transmitted message
- displays SENDING
- displays XXXXZ ATC REPORT page upon network acknowledgement

- displays NO ATC COMM when data link READY and no ATC connection
- displays NO COMM for no available communications media.

[Option - U14 and above with FANS2 option enabled]

5 REPORT SEND

Displays on last VERIFY REPORT page.

Push –

- results in the creation of a report message containing the information displayed on the VERIFY REPORT page and initiates transmission of the report message to the active ATC center.
- creates ATC LOG entry of transmitted message
- displays SENDING
- displays NO COMM when data link status is NO COMM
- displays VOICE when data link status is VOICE
- displays FAIL when data link status is FAIL
- displays READY when data link READY and not ATN READY connection
- displays NO ATC COMM when data link READY and no ATC connection
- displays NO ATC COMM when data link ATN READY and no ATC connection
- displays NO COMM for no available communications media.

XXXXZ ATC Report Page

XXXXZ ATC REPORT page displays the transmitted report. XXXXZ is the time the report was transmitted.

1 Lines 1 – 5

Pages 1/X to X/X display message transmitted to ATC at time of page title. Line 1 is blank on page 1/X.

2 Message STATUS

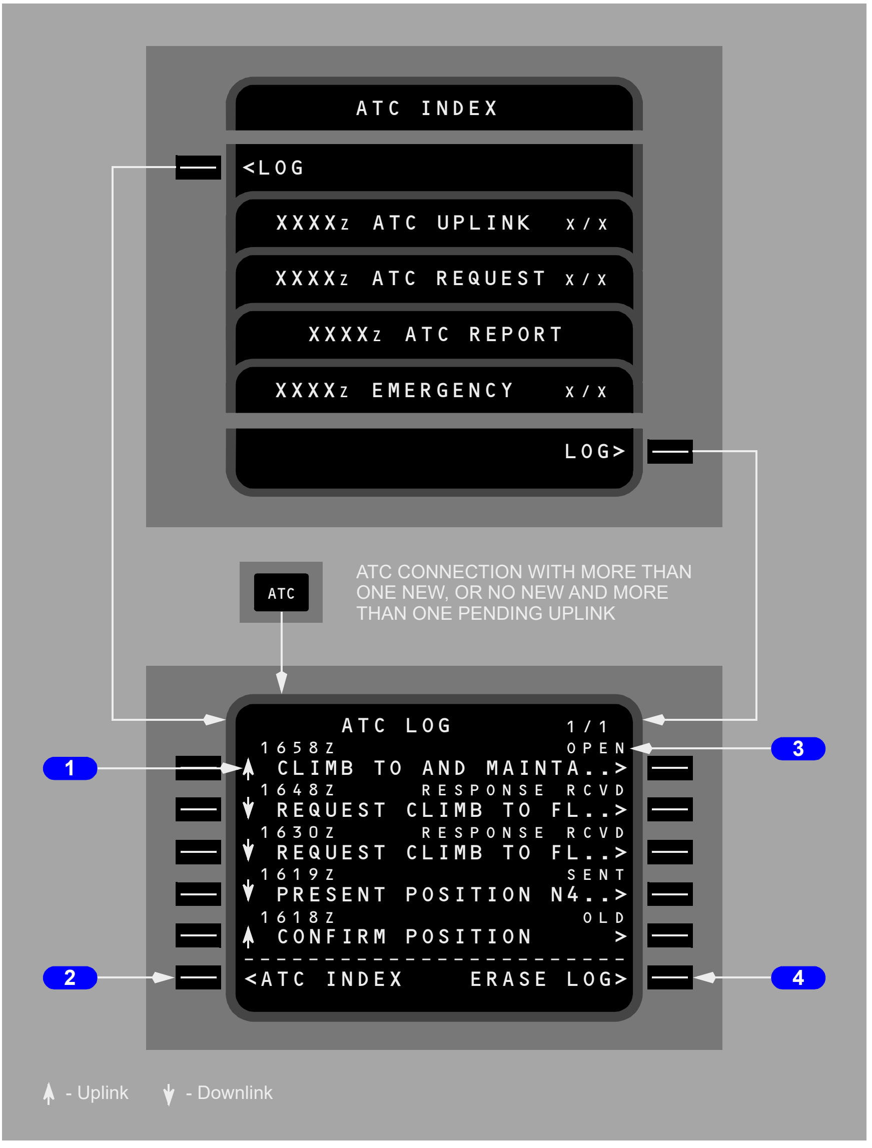
Displays ATC report status from ATC LOG page.

3 LOG

Push – Displays ATC LOG page.

ATC Log Page X/X

The ATC LOG pages display stored uplinks and downlinks. Log automatically erases after flight completion.



1 **Lines 1 – 5**

Displays text of uplink and downlink messages. Long messages are abbreviated and followed by two periods. Messages are displayed in order of receipt or transmission.

Deleting a line deletes the log entry.

Title displays message receipt (uplink) or transmission (downlink) time.

2 **ATC INDEX**

Push – Displays ATC INDEX page.

3 **Message Status**

Title displays one of seven possible uplink or six possible downlink states:

Uplink –

- NEW – message not reviewed by crew; message considered pending
- OLD – message reviewed by crew and message does not require response; message considered non–pending
- OPEN – message reviewed by crew, message requires response, crew has not sent response or has sent STANDBY; message considered pending
- ACCEPTED – message reviewed by crew, message requires response, positive response sent, network acknowledgement of positive response received; message considered non–pending
- REJECTED – message reviewed by crew, message requires response, negative response sent, network acknowledgement of negative response received; message considered non–pending
- ABORTED – message pending when all connections were terminated or transfer of communications occurred; message considered non–pending.

Downlink –

- SENDING – SEND prompt selected, network acknowledgement not yet received, message considered pending. Displays SENDING in field 5R on page downlink was initiated
- SENT – SEND prompt selected, network acknowledgement received, message does not require response; message considered non–pending
- OPEN – SEND prompt selected, network acknowledgement received, message requires response, response not received or STANDBY response received, message considered pending
- DEFERRED – SEND prompt selected, network acknowledgement received, message requires response, REQUEST DEFERRED response received; message considered pending

- RESPONSE RCVD – SEND prompt selected, network acknowledgement received, message requires response, response other than STANDBY or REQUEST DEFERRED received; message considered non–pending
- ABORTED – message pending when all connections terminated; message considered non–pending.

Push – displays XXXXZ: ATC UPLINK, ATC REQUEST, ATC REPORT, or EMERGENCY page related to line selected.

4 **ERASE LOG**

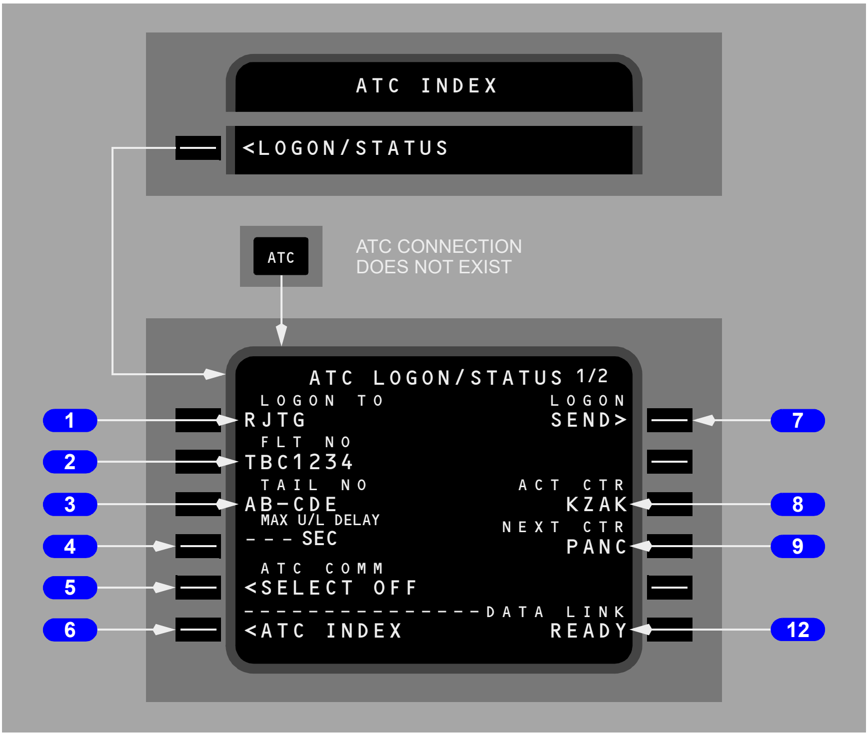
Push –

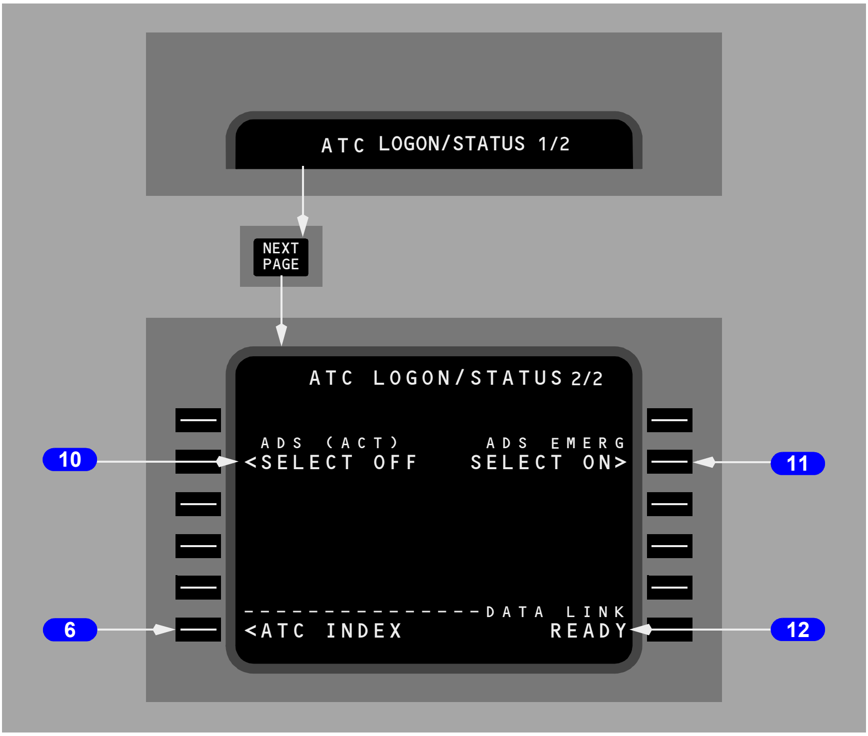
- arms deletion of all non–pending messages in the ATC Log
- displays CONFIRM
- selection of CONFIRM deletes all non–pending messages in the ATC log
- leaving the ATC Log page when CONFIRM is displayed cancels the ERASE selection.

ATC Logon/Status Page

[Option - U10.6 to U13]

The ATC LOGON/STATUS pages are used to initiate an ATC connection. The two pages display ADS, ATC COMM, and data link status.





1 **LOGON TO**

Initial display is boxes.

Valid entry is a four letter ATC identifier.

Entry of an identifier, a flight number, and tail number displays SEND in 1R when data link status is ready.

Deletion of identifier displays boxes and blanks SEND.

Displays dashes when ATC COMM established.

2 **Flight Number (FLT NO)**

Displays flight number from route page.

Valid entry is flight number.

Display clears at flight completion.

3 **Tail Number (TAIL NO)**

Displays airplane tail number.

Valid entry is aircraft registration number (tail number) including dash (–) characters, if applicable.

4 Max Uplink Delay (MAX U/L DELAY)

Allows the entry of 1 to 999 seconds as directed by ATC for use by the FMC to determine if the uplink is delayed more than the entered time..

5 ATC COMM

Display is blank when no ATC connection exists.

Displays SELECT OFF when ATC connection exists.

Push – terminates active ATC data link connections.

6 ATC INDEX

Push – displays ATC INDEX page.

7 LOGON SEND

Push –

- sends logon message to ATC center
- displays SENT
- displays RESEND if no response from ATC after 10 minutes
- displays ACCEPTED or REJECTED after ATC response.

8 Active Center (ACT CTR)

Displays four character identifier of active ATC center.

9 Next Center (NEXT CTR)

Displays four character identifier of next ATC center when known; otherwise, blank.

10 ADS (ARM), (ACT), (INOP), (OFF)

ADS (ARM) –

- ADS on and no ADS connection exists
- displays SELECT OFF prompt.

Push –

- terminates all ADS connections and ADS reporting
- prevents ATC from requesting ADS reporting
- displays ADS (OFF)
- displays ADS SELECT ARM prompt.

ADS (ACT) –

- ADS armed and one or more ADS connection exists
- displays SELECT OFF prompt.

Push –

- terminates all ADS connections and ADS reporting
- prevents ATC from requesting ADS reporting
- displays ADS (OFF)
- displays ADS SELECT ARM prompt.

ADS (INOP)

- ADS selected off
- no prompt displayed
- aircraft registration number (tail number) has not been entered

ADS (OFF)

- ADS selected off
- displays ADS SELECT ARM prompt.

Push –

- arms ADS reporting
- displays SELECT OFF prompt.

11 ADS Emergency (EMER)

Displays SELECT ON when ADS is not in emergency mode.

Displays SELECT OFF when ADS is in emergency mode.

Display is blank when ADS selected off.

SELECT ON –

Push – initiates ADS emergency mode.

SELECT OFF –

Push – terminates ADS emergency mode.

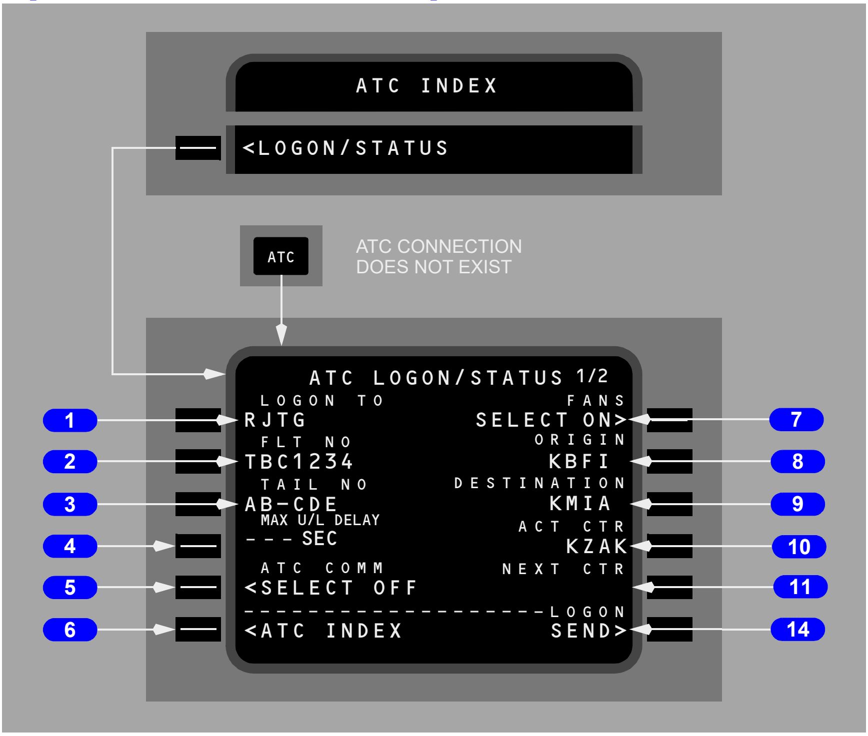
12 DATA LINK Status

Displays status: READY, NO COMM, VOICE, or FAIL.

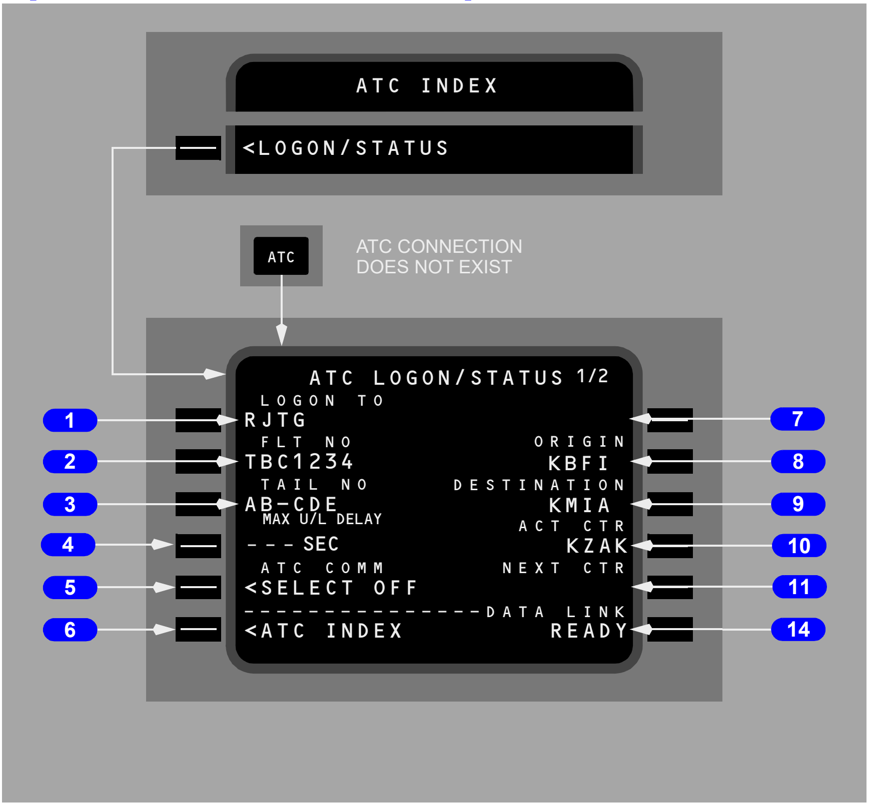
ATC Logon/Status Page

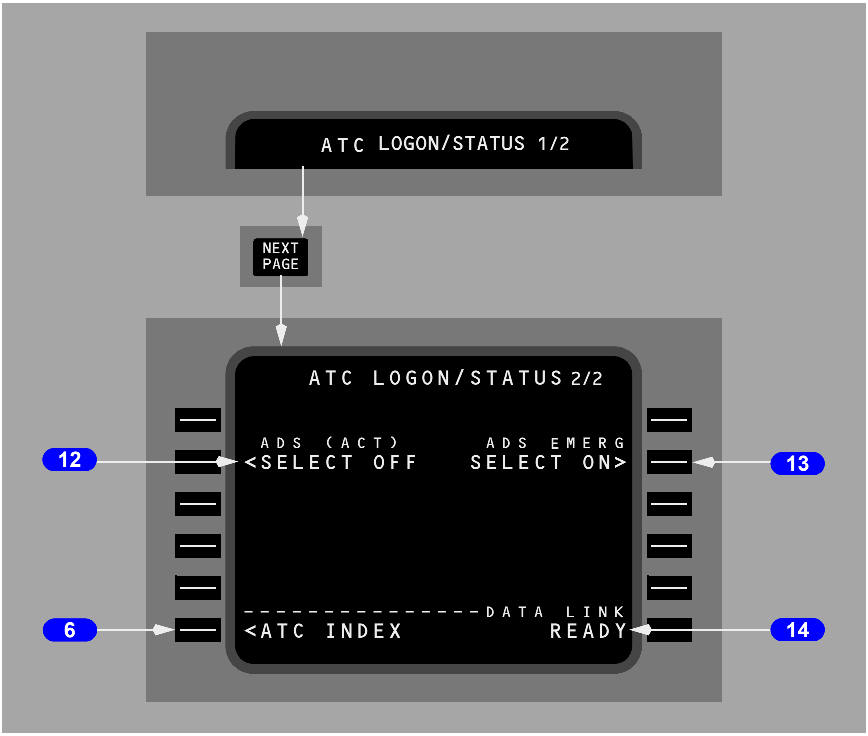
[Option - U14 and above]
The ATC LOGON/STATUS pages are used to initiate an ATC connection. The two pages display ADS, ATC COMM, and data link status.

[Option - U14 and above with FANS2 option enabled]



[Option - U14 and above without FANS2 option enabled]





1 LOGON TO

Entry of a four to eight characters ATC center identifier causes the FMC to use the ATC database to determine if the entered center is an Aeronautical Telecommunications Network (ATN) center.

- If an ATC database is not installed and more than a 4-character long station name is entered, INVALID ENTRY is displayed in the scratchpad.
- If an ATC database is installed and the entered 4-character center is not in the ATC database, the FMC assumes the entered center is a FANS center.
- If the entered center exists in the ATC database and FANS ON/OFF is selected OFF on the ATC Log on/Status page, its associated ground address is used for the ATN logon downlink.

If the data link status is READY, a valid entry will be four alpha characters.

- The FMC assumes the entered center is a FANS center.

When a FANS center is entered with a flight number displayed in field 2L along with a tail number in field 3L the result will be a display of the logon SEND prompt in 6R, if the data link status is READY or ATN READY or ATN ONLY.

When an ATN center is entered with a flight number displayed in field 2L, a tail number in field 3L, an origin in field 2R, and a destination in field 3R the result will be a display of the logon SEND prompt in 6R, if the data link status is ATN READY or ATN ONLY.

- When a four character center (that is in the ATN Database) is entered and a flight number is displayed in field 2L along with a tail number in field 3L the result is a display of the FANS SELECT ON prompt in 1R, if the data link status is ATN READY.
- Entry of an ATC center over a displayed ATC center resets the 6R display to SEND> if SENDING, RESEND, SENT, ACCEPTED, or REJECTED was displayed in field 6R at the time of entry.

Selection of DELETE to 1L when an ATC center identifier is displayed will display:

- Box prompts - if a Logon was not accepted before.
- Dashes - if a Logon was accepted before.

When present position is invalid, the data line displays blanks.

1 LOGON TO

Entry of a four to eight characters ATC center identifier causes the FMC to use the ATC database.

- If an ATC database is not installed and more than a 4-character long station name is entered, INVALID ENTRY is displayed in the scratchpad.
- If an ATC database is installed and the entered 4-character center is not in the ATC database, the FMC assumes the entered center is a FANS center.

If the data link status is READY, a valid entry will be four alpha characters.

- The FMC assumes the entered center is a FANS center.

When a FANS center is entered with a flight number displayed in field 2L along with a tail number in field 3L the result will be a display of the logon SEND prompt in 6R, if the data link status is READY.

Selection of DELETE to 1L when an ATC center identifier is displayed will display:

- Box prompts - if a Logon was not accepted before.
- Dashes - if a Logon was accepted before.

When present position is invalid, the data line displays blanks.

2 Flight Number (FLT NO)

Entry of a valid flight number over the default when a FANS ATC center identifier is displayed in field 1L and a tail number is displayed in 3L results in display of the logon SEND prompt in 6R, if the data link status is READY or ATN READY.

Entry of a valid flight number over the default when an ATN ATC center identifier is displayed in field 1L, a tail number is displayed in 3L, an origin is displayed in field 2R, and a destination is displayed in field 3R results in display of the logon SEND prompt in 6R, if the data link status is ATN READY or ATN ONLY.

Entry of a flight number can be manually entered or by loading of an AOC flight number uplink.

The flight number entered into this field is propagated to the flight number field on the route page 1/X, the PROGRESS page title, and the POS REPORT page title.

The data line defaults to the flight number entered on the route page 1/X.

Display clears at flight completion.

2 Flight Number (FLT NO)

Entry of a valid flight number over the default when a FANS ATC center identifier is displayed in field 1L and a tail number is displayed in 3L results in display of the logon SEND prompt in 6R, if the data link status is READY.

Entry of a flight number can be manually entered or by loading of an AOC flight number uplink.

The flight number entered into this field is propagated to the flight number field on the route page 1/X, the PROGRESS page title, and the POS REPORT page title.

The data line defaults to the flight number entered on the route page 1/X.

Display clears at flight completion.

3 Tail Number (TAIL NO)

Displays airplane tail number.

Valid entry is aircraft registration number (tail number) including dash (–) characters, if applicable.

4 Max Uplink Delay (MAX U/L DELAY)

Allows the entry of 1 to 999 seconds as directed by ATC for use by the FMC to determine if the uplink is delayed more than the entered time.

5 ATC COMM

Display is blank when no ATC connection exists.

Displays SELECT OFF when ATC connection exists.

Push – terminates active ATC data link connections.

6 ATC INDEX

Push – displays ATC INDEX page.

[Option - U14 and above with FANS2 option enabled]

7 FANS SELECT ON/OFF

Selection of the 1R line select key when SELECT ON> is displayed puts the logon in FANS Mode (i.e. use FANS logon).

Selection of the 1R line select key when SELECT OFF> is displayed shall put the logon in ATN Mode (i.e. use FANS logon).

[Option - U14 and above with FANS2 option enabled]

7 NO TITLE IF FANS-2 OPTION DISABLED

8 ORIGIN

Entry of an Origin can be from manual entry or propagated from the Route page.

The newly entered Origin on the Route page will be propagated to this page and overwrite the current data on this field.

An Origin manually entered into this field will not be propagated to the Origin field on the route page.

9 DESTINATION

Entry of an Destination can be from manual entry or propagated from the Route page.

The newly entered Destination on the Route page will be propagated to this page and overwrite the current data on this field.

A Destination manually entered into this field will not be propagated to the Destination field on the route page.

If no Destination has been entered on the route page, then four box prompts will be displayed.

10 Active Center (ACT CTR)

Displays four to eight character identifier of active ATC center.

11 Next Center (NEXT CTR)

Displays four to eight character identifier of next ATC center when known; otherwise, blank.

12 ADS (ARM), (ACT), (INOP), (OFF)

ADS (ARM) –

- ADS on and no ADS connection exists
- displays SELECT OFF prompt.

Push –

- prevents ATC from requesting ADS reporting
- displays ADS (OFF)
- displays ADS SELECT ARM prompt.

ADS (ACT) –

- ADS armed and one or more ADS connection exists
- displays SELECT OFF prompt.

Push –

- terminates all ADS connections and ADS reporting
- prevents ATC from requesting ADS reporting
- displays ADS (OFF)
- displays ADS SELECT ARM prompt.

ADS (INOP)

- ADS selected off
- no prompt displayed
- aircraft registration number (tail number) has not been entered

ADS (OFF)

- ADS selected off
- displays ADS SELECT ARM prompt.

Push –

- arms ADS reporting
- displays SELECT OFF prompt.

13 ADS Emergency (EMER)

Displays SELECT ON when ADS is not in emergency mode.

Displays SELECT OFF when ADS is in emergency mode.

Display is blank when ADS selected off.

SELECT ON –

Push – initiates ADS emergency mode.

SELECT OFF –

Push – terminates ADS emergency mode.

[Option - U14 and above with FANS2 option enabled]

14 Data Link Status, Logon SEND prompt, and Logon Status Field

Selection of the 6R line select key when the logon SEND or RESEND prompt is displayed will initiate transmission of the logon message downlink to the ATC center specified in field 1L.

DATA LINK display states: READY, ATN READY, ATN ONLY, NO COMM, VOICE and FAIL.

When the data link status is READY or ATN READY and either of the following conditions occur:

- a FANS ATC center entry is made into 1L when 2L displays a flight number and 3L displays a tail number, or
- an entry is made into 2L when 1L displays a FANS ATC center identifier and 3L displays a tail number.

Then the line title changes from DATA LINK to LOGON and the data line displays SEND > at 6R.

When the data link status is ATN READY or ATN Only and either of the following conditions occur:

- a ATN ATC center entry is made into 1L when 2L displays a flight number, 3L displays a tail number, 2R displays an Origin, and 3R displays a Destination, or
- an entry is made into 2L when 1L displays an ATN ATC center identifier, 3L displays a tail number, 2R displays an Origin, and 3R displays a Destination.

Then the line title changes from DATA LINK to LOGON and the data line displays SEND > at 6R.

After selection of the logon SEND prompt and before a network acknowledgment/logical acknowledgement to the logon requested downlink message has been received and before network timeout, the data line changes to SENDING. If the logon request downlink message is not received within the time-out period then the data line changes to RESEND.

After a positive acknowledgment message to the logon request downlink message has been received from ATC within logon timeout period, the data line changes to ACCEPTED.

After a negative acknowledgment message to the logon request downlink message has been received from ATC within a logon timeout period, the data line changes to REJECTED.

Note: Termination of the active ATC COMM connection either by means of receipt of an END SERVICE uplink (whether or not a transfer of comm occurs) or selection of the ATC COMM OFF prompt in field 5L, has no affect on the 6R display state.

[Option - U14 and above without FANS2 option enabled]

14 Data Link Status, Logon SEND prompt, and Logon Status Field

Selection of the 6R line select key when the logon SEND or RESEND prompt is displayed will initiate transmission of the logon message downlink to the ATC center specified in field 1L.

DATA LINK display states: READY, NO COMM, VOICE and FAIL.

When the data link status is READY and either of the following conditions occur:

- a FANS ATC center entry is made into 1L when 2L displays a flight number and 3L displays a tail number, or
- an entry is made into 2L when 1L displays a FANS ATC center identifier and 3L displays a tail number.

Then the line title changes from DATA LINK to LOGON and the data line displays SEND > at 6R.

After selection of the logon SEND prompt and before a network acknowledgment/logical acknowledgement to the logon requested downlink message has been received and before network timeout, the data line changes to SENDING. If the logon request downlink message is not received within the time-out period then the data line changes to RESEND.

After a positive acknowledgment message to the logon request downlink message has been received from ATC within logon timeout period, the data line changes to ACCEPTED.

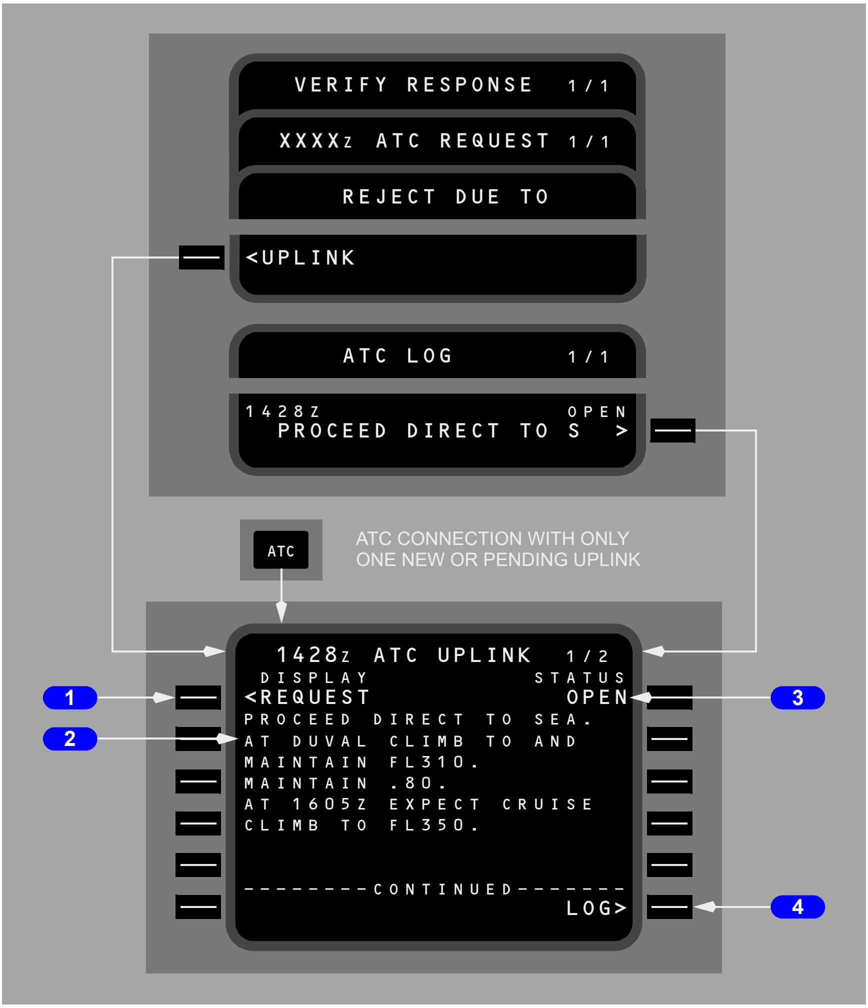
After a negative acknowledgment message to the logon request downlink message has been received from ATC within a logon timeout period, the data line changes to REJECTED.

Note: Termination of the active ATC COMM connection either by means of receipt of an END SERVICE uplink (whether or not a transfer of comm occurs) or selection of the ATC COMM OFF prompt in field 5L, has no affect on the 6R display state.

XXXXZ ATC Uplink Page 1/X

The ATC UPLINK pages display messages uplinked by ATC. The pages provide the capability to respond to uplinked messages and to load clearances.

[Option - all but U14 and U14.1]



1 REQUEST

Displays REQUEST when displayed uplink is in response to a downlink request not deleted from the ATC log.

Push – displays the related XXXXZ ATC REQUEST page.

Title displays message receipt time.

2 Message Text

Lines 2 to 5 of XXXXZ ATC uplink page 1/X display text of uplinked ATC message.

3 STATUS

Displays status of ATC uplink message from ATC log page.

4 LOG, REPORT

Displays LOG when uplink message does not include a REPORT, CONFIRM, or WHEN CAN YOU ACCEPT request.

Displays REPORT when uplink message includes a REPORT, CONFIRM, or WHEN CAN YOU ACCEPT request.

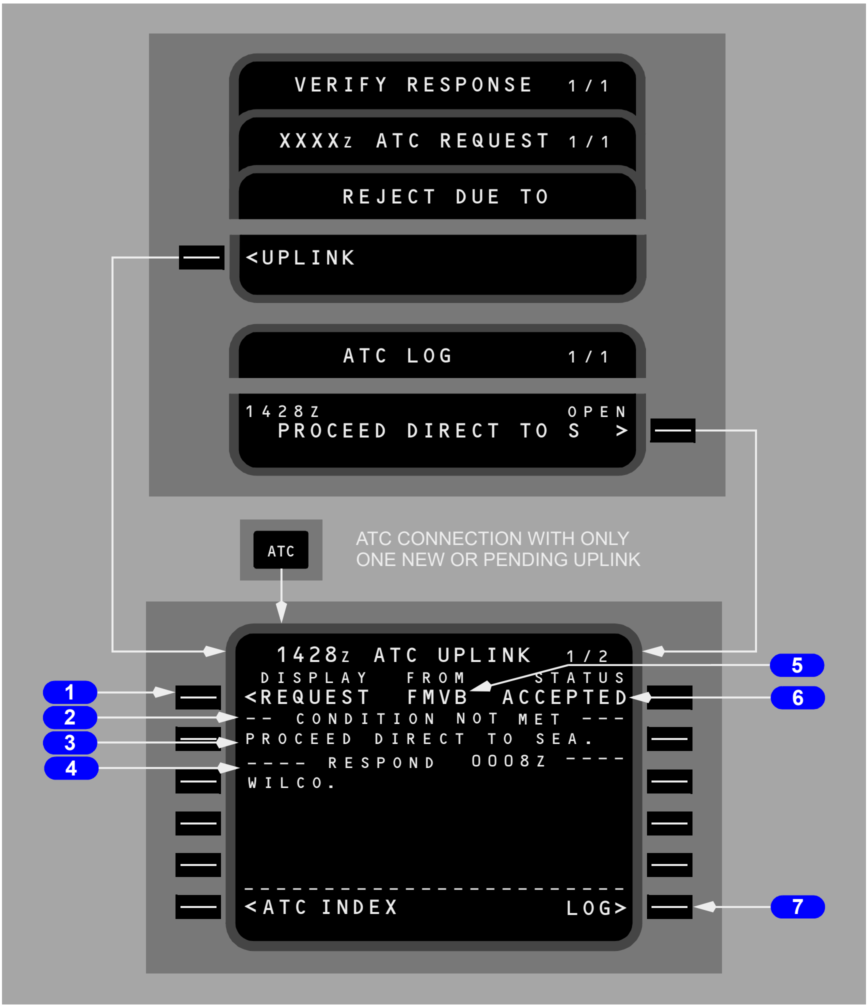
LOG –

Push – displays ATC LOG page.

REPORT –

Push – displays ATC REPORT page.

[Option - U14 and above]



1 REQUEST prompt and ATC Center (first page only)

Displays REQUEST when displayed uplink is in response to a downlink request not deleted from the ATC log.

Push – displays the related XXXXZ ATC REQUEST page.

Title displays message receipt time.

2 Conditional Clearances

Conditional clearances are uplinks that contain a conditional location, altitude, or time for execution of a clearance/instruction. The system is able to handle up to 3 accepted conditional clearances.

If an accepted conditional clearance is executed early, the FMC displays the following:

- “CLEARANCE COND NOT MET” scratchpad message.
- “CONDITION NOT MET” displayed in the 2L/2R line title.

The annunciation of early execution of a conditional clearance is triggered by:

- If the MCP altitude changes more than +/- 150 feet from the current altitude prior to satisfying the condition (time or position), then a conditional altitude clearance is considered to have been executed early.
- If an offset is executed including deleting an existing offset before the specified [time], then the conditional offset clearance is considered to have been executed early.
- If the direct waypoint becomes the active waypoint prior to satisfying the condition (time or altitude), then a conditional direct clearance is considered to have been executed early.

Note: The annunciation of early execution of a conditional clearance is not provided for a conditional heading clearance.

When the airplane satisfies the condition associated with a conditional clearance, a “clearance condition met” message is displayed as follows:

- “CLEARANCE COND MET” scratchpad message.
- “CONDITION MET” displayed in the 2L/2R line title.

The annunciation of execution of a conditional clearance is triggered by:

- the condition is considered satisfied when the current time reaches the specified time.
- the condition is considered satisfied when the specified waypoint is sequenced in the FMS active route.
- the condition is considered satisfied when the airplane reaches an altitude within +/- 150 ft of the specified altitude.
- The conditional clearance is manually deleted by selection of DELETE to 1L, 2L or 3L on the CONDITIONAL CLEARANCE page.

3 Message Text

Lines 2 to 5 of XXXXZ ATC uplink page 1/X display text of uplinked ATC message.

4 **RESPONSE XXXXZ**

XXXXZ is the time at which the flight crew initiated transmission of the response to ATC.

The text of the response message is displayed beginning in the first available line (header or data line) following the RESPONSE XXXXZ line.

- If the crew response was to ACCEPT the uplink, then WILCO, ROGER, or AFFIRM, as appropriate for the associated uplink, is displayed.
- If the crew response was to REJECT the uplink, then UNABLE or NEGATIVE, as appropriate for the associated uplink, is displayed.
- If the crew response was to REJECT the uplink and a reject reason was selected or entered as free text on the REJECT DUE TO page, then the text of the reject reason is displayed following the response message element text in the order selected on the REJECT DUE TO page.
- If the UNLOADABLE CLEARANCE prompt was selected on the REJECT DUE TO page, then UNLOADABLE CLEARANCE is displayed.
- If the NOT CONSISTENT. RESEND prompt was selected on the REJECT DUE TO page, then NOT CONSISTENT. RESEND is displayed.
- If the DUE TO PERFORMANCE prompt was selected on the REJECT DUE TO page, then DUE TO AIRCRAFT PERFORMANCE is displayed.
- If the DUE TO WEATHER prompt was selected on the REJECT DUE TO page, then DUE TO WEATHER is displayed.
- If any free text was entered on the REJECT DUE TO page, then that text is displayed.

5 **ATC Center**

The data line displays the ATC Center, who uplinked the message, (4 characters in FANS, and 4-8 characters in ATN). For centers with more than 4 characters, only the first 4 characters will be displayed.

6 **STATUS**

Displays status of ATC uplink message from ATC log page.

7 **LOG, REPORT**

Displays LOG when uplink message does not include a REPORT, CONFIRM, or WHEN CAN YOU ACCEPT request.

Displays REPORT when uplink message includes a REPORT, CONFIRM, or WHEN CAN YOU ACCEPT request.

LOG –

Push – displays ATC LOG page.

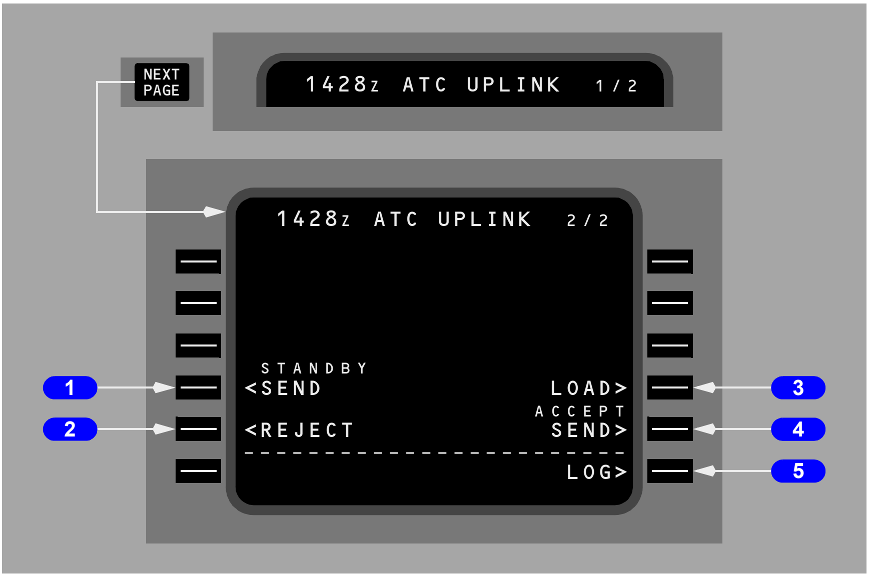
REPORT –

Push – displays ATC REPORT page.

XXXXZ ATC Uplink Page X/X

Last XXXXZ ATC UPLINK page continues text of uplinked ATC message. Page provides capability to respond to uplinked messages and to load clearances.

[Option - all but U14 and U14.1]



1 STANDBY

Displays STANDBY when response is required until response has been made.

Push – sends standby response.

2 REJECT

Displays REJECT when UNABLE or NEGATIVE is a valid response until response has been made.

Push – displays REJECT DUE TO page.

3 LOAD

Displays LOAD when uplink message has loadable data.

[Option - below U11]
Push – loads data into route.

[Option - U11 to U13]
Push – loads data into route X.

4 ACCEPT

Displays ACCEPT when WILCO, ROGER, or AFFIRM is a valid response until response has been made.

Push – sends a WILCO, ROGER or AFFIRM response.

5 LOG, REPORT

Displays LOG when uplink message does not include a REPORT, CONFIRM, or WHEN CAN YOU ACCEPT request.

Displays REPORT when uplink message includes a REPORT, CONFIRM, or WHEN CAN YOU ACCEPT request.

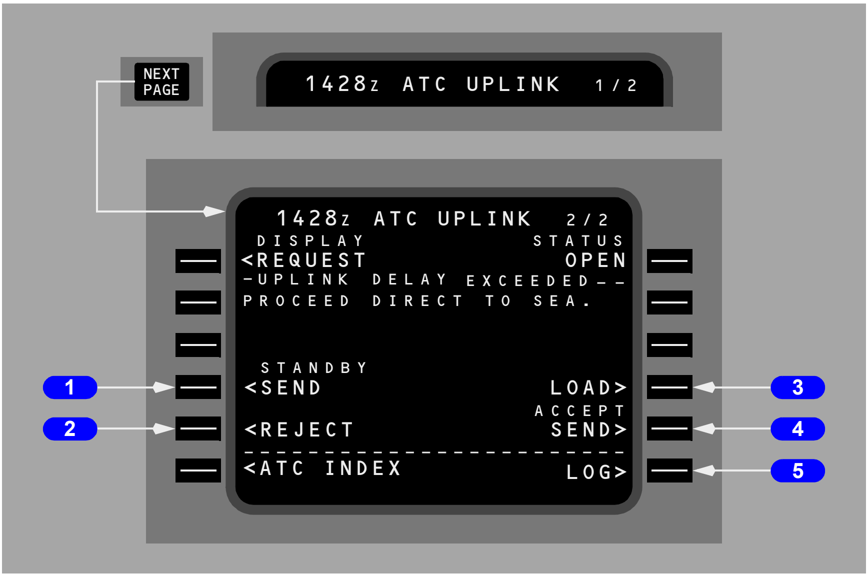
LOG –

Push – displays ATC LOG page.

REPORT –

Push – displays ATC REPORT page.

[Option - U14 and above]



1 STANDBY

Displays STANDBY when response is required until response has been made.

Push – sends standby response.

2 REJECT

Displays REJECT when UNABLE or NEGATIVE is a valid response until response has been made.

Push – displays REJECT DUE TO page.

3 LOAD

Displays LOAD when uplink message has loadable data.

Push – loads data into route X.

4 ACCEPT

Displays ACCEPT when WILCO, ROGER, or AFFIRM is a valid response until response has been made.

Push – sends a WILCO, ROGER or AFFIRM response.

5 LOG, REPORT

Displays LOG when uplink message does not include a REPORT, CONFIRM, or WHEN CAN YOU ACCEPT request.

Displays REPORT when uplink message includes a REPORT, CONFIRM, or WHEN CAN YOU ACCEPT request.

LOG –

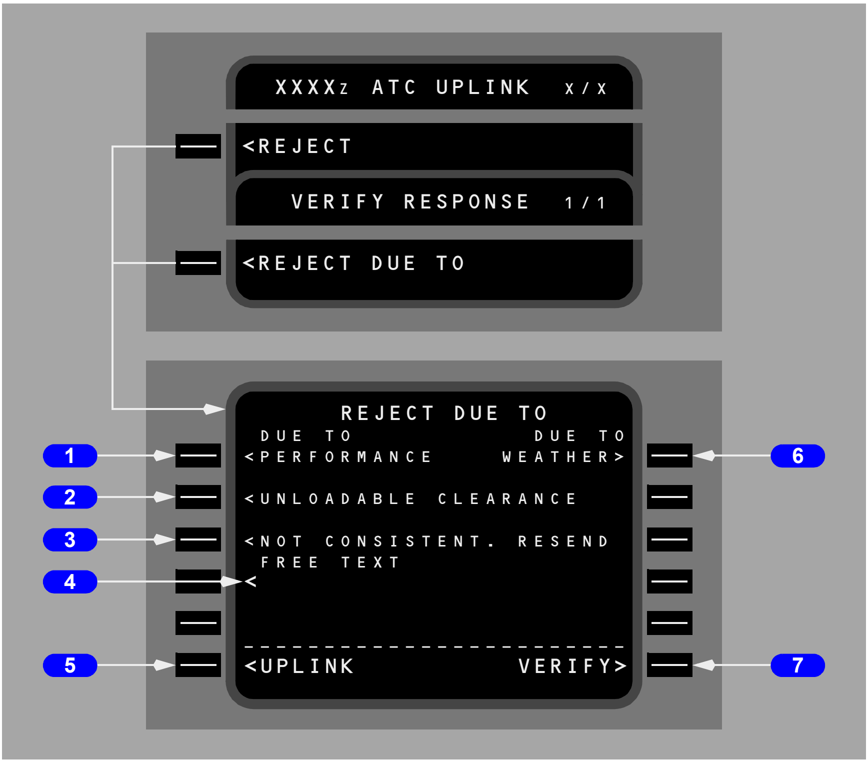
Push – displays ATC LOG page.

REPORT –

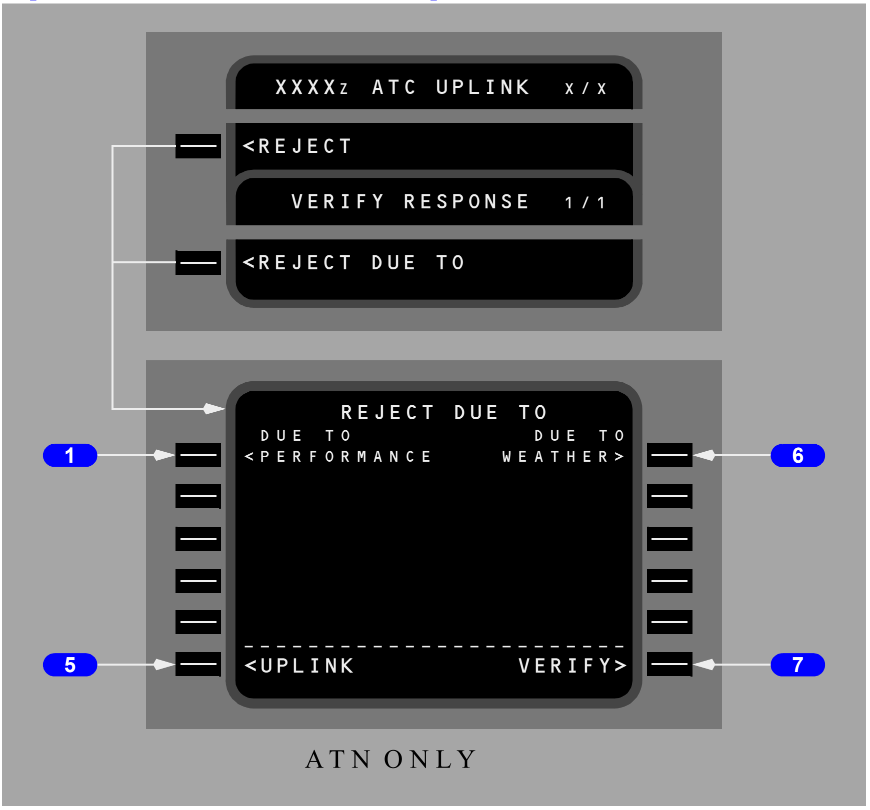
Push – displays ATC REPORT page.

Reject Due To Page

The REJECT DUE TO page is used to include a reason for rejection of an ATC UPLINK message.



[Option - U14 and above with FANS2 option enabled]



1 **DUE TO PERFORMANCE**

Initially displays PERFORMANCE in small font.

Push – selects DUE TO AIRCRAFT PERFORMANCE message element in response downlink message.

2 **UNLOADABLE CLEARANCE**

Initially displays UNLOADABLE CLEARANCE in small font.

Push – selects UNLOADABLE CLEARANCE message element in response downlink message.

3 **NOT CONSISTENT. RESEND**

Initially displays NOT CONSISTENT. RESEND in small font.

Push – selects NOT CONSISTENT. RESEND message element in response downlink message.

4 **FREE TEXT**

Text entered on line 4 is included in response message.

Initial display is blank with a caret.

5 **UPLINK**

Push – displays XXXXZ ATC UPLINK page.

6 **DUE TO WEATHER**

Initially displays WEATHER in small font.

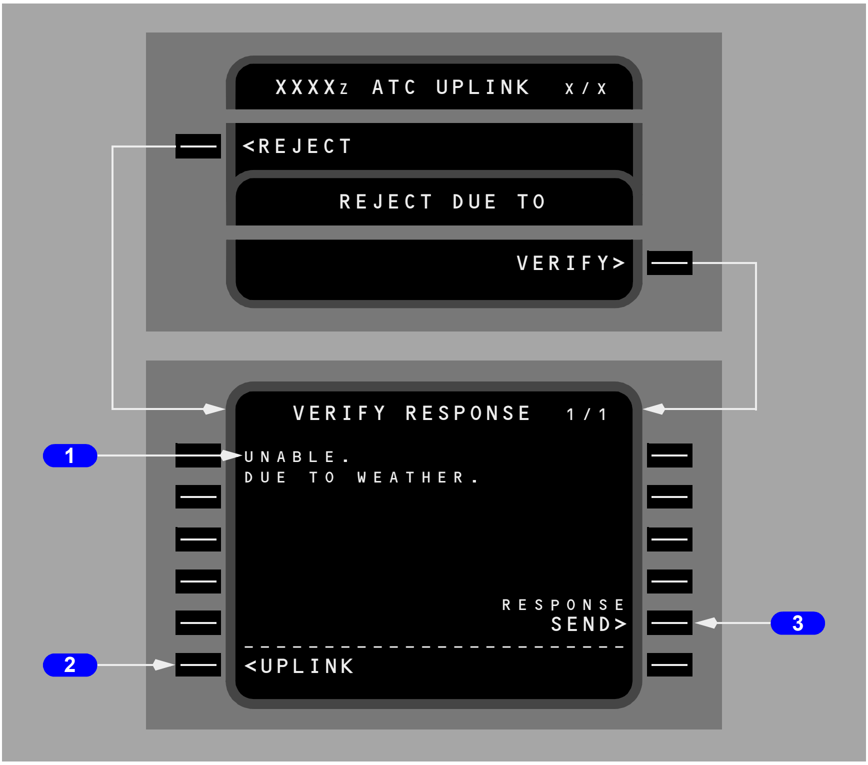
Push – selects DUE TO WEATHER message element in response downlink message.

7 **VERIFY**

Push – displays VERIFY RESPONSE page.

Verify Response Page

The VERIFY RESPONSE page provides capability to review content of rejection messages.



1 Lines 1 – 5

Displays UNABLE or NEGATIVE, as appropriate, for associated uplink.

If reject reason was selected or entered as free text on the REJECT DUE TO page, the text of the reject message is displayed in the order selected. Examples include: DUE TO PERFORMANCE, DUE TO WEATHER, UNLOADABLE CLEARANCE, NOT CONSISTENT, or free text entered on 4L.

2 UPLINK, REJECT DUE TO

UPLINK –

Push – displays XXXXZ ATC UPLINK page.

REJECT DUE TO –

Push – displays REJECT DUE TO page.

[Option - without FANS2 enabled]

3 RESPONSE SEND

Push –

- transmits downlink response to ATC uplink message
- appends text of downlink response to end of uplink message
- displays SENDING
- displays XXXXZ ATC UPLINK page upon network acknowledgement
- displays NO ATC COMM when data link READY and no ATC connection
- displays NO COMM for no available communications media.

[Option - U14 and above and FANS2 enabled]

3 RESPONSE SEND

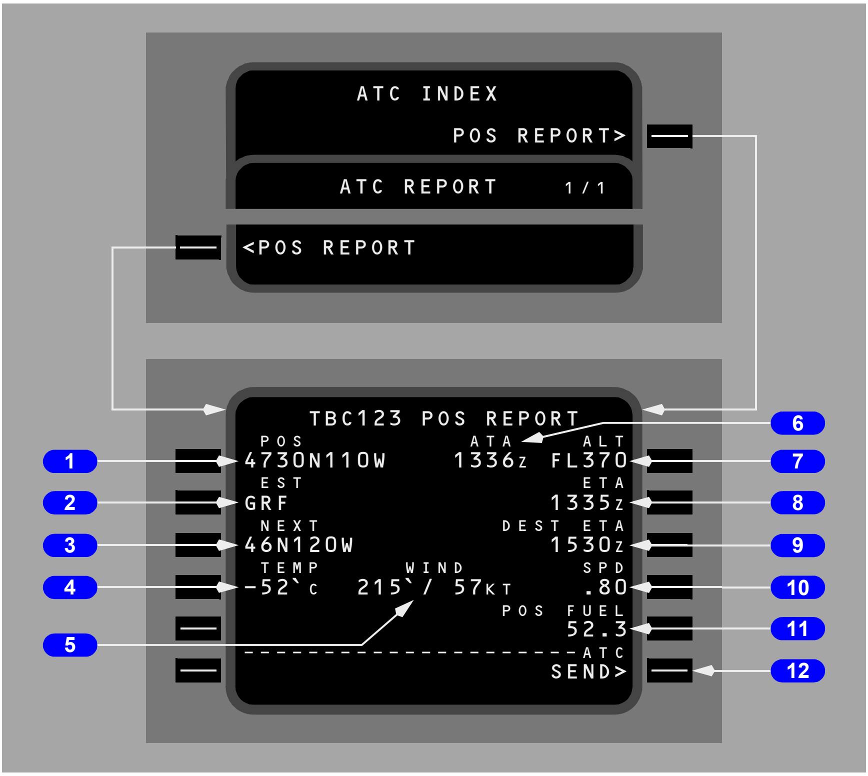
Displays on last VERIFY RESPONSE page.

Push –

- creates a rejection response message containing the information displayed on the VERIFY RESPONSE page and will initiate transmission of the response message to the active ATC center.
- creates ATC LOG entry of transmitted message
- displays SENDING
- displays NO COMM when data link status is NO COMM
- displays VOICE when data link status is VOICE
- displays FAIL when data link status is FAIL
- displays READY when data link READY and not ATN READY connection
- displays NO ATC COMM when data link READY and no ATC connection
- displays NO ATC COMM when data link ATN READY and no ATC connection
- displays NO COMM for no available communications media.

XXXX Position Report Page

The XXXX POS REPORT page allows review and sending of position reports to ATC. XXXX is the flight number.



1 LAST Waypoint (POS)

Displays waypoint identifier for last sequenced leg.

2 TO Waypoint (EST)

Displays waypoint identifier of current leg.

Valid entries are waypoint identifiers in the navigation database or defined geographic points.

Entry overrides displayed waypoint.

Deletion of entry returns current leg waypoint.

3 NEXT Waypoint

Displays waypoint identifier of leg following the TO leg.

Valid entries are waypoint identifiers in the navigation database or defined geographic points.

Entry overrides displayed waypoint.

Deletion of entry returns default waypoint.

4 Temperature (TEMP)

Displays current static air temperature.

5 WIND

Displays current wind direction and magnitude.

6 Actual Time of Arrival (ATA)

Displays ATA at last sequenced waypoint.

7 Altitude (ALT)

Displays altitude at last sequenced waypoint.

8 Estimated Time of Arrival (ETA)

Displays ETA at TO waypoint.

Valid entry is HHMM (HH is hours and MM is minutes).

Entry overrides displayed time.

Deletion of entry returns default time.

9 Destination Estimated Time of Arrival (DEST ETA)

Displays ETA at destination.

Valid entry is HHMM (HH is hours and MM is minutes).

Entry overrides displayed time.

Deletion of entry returns default time.

10 Speed (SPD)

Displays current Mach number.

Valid entry is between.61-.82 Mach.

Entry overrides displayed Mach number.

Deletion or page change returns default Mach number.

11 FUEL (POS FUEL)

Displays fuel remaining when the POS REPORT page 1L waypoint was sequenced.

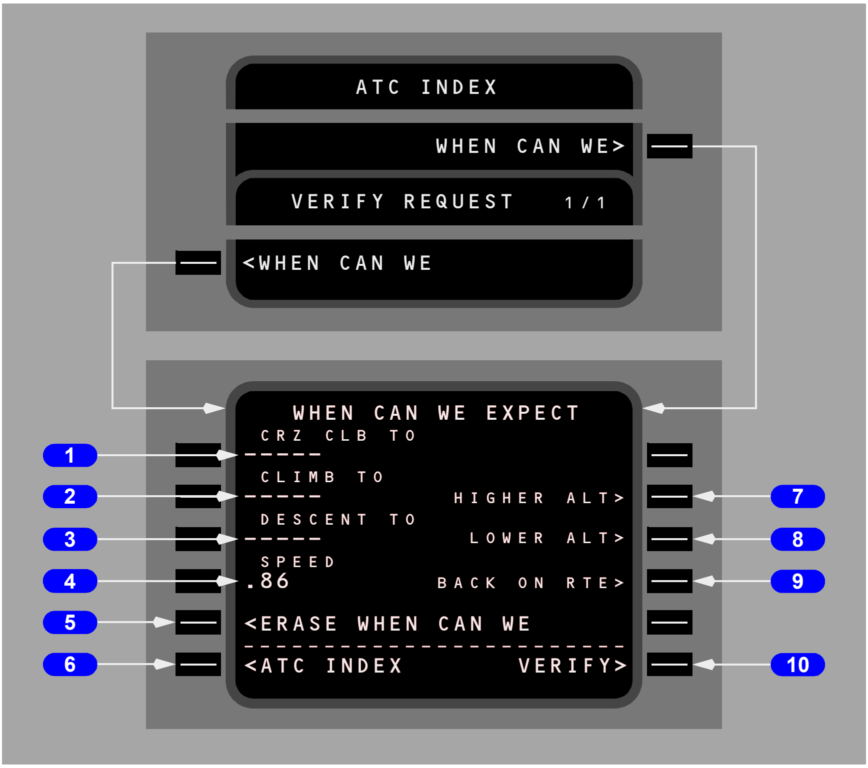
12 ATC SEND

Push –

- sends downlink position report to ATC
- creates ATC LOG entry of transmitted message
- displays SENDING
- displays SENT upon network acknowledgement
- displays NO ATC COMM when data link READY and no ATC connection
- displays NO COMM for no available communications media.

When Can We Expect Page

The WHEN CAN WE EXPECT page allows query to ATC about when to expect a certain clearance.



1 Cruise Climb To (CRZ CLB TO)

Entry of an altitude selects a message querying ATC when to expect a cruise climb to the entered altitude.

Valid entry is XXX or FLXXX (flight level), XXXXX (feet), or XXXXXm (meters).

Entry may be deleted.

2 CLIMB TO

Entry of an altitude selects a message querying ATC when to expect a climb to the entered altitude.

Valid entry is XXX or FLXXX (flight level), XXXXX (feet), or XXXXXm (meters).

Entry may be deleted.

3 **DESCENT TO**

Entry of an altitude selects a message querying ATC when to expect a descent to the entered altitude.

Valid entry is XXX or FLXXX (flight level), XXXXX (feet), or XXXXXm (meters).

Entry may be deleted.

4 **SPEED**

Entry of a speed selects a message querying ATC when to expect the entered speed.

Valid entry is IAS or Mach.

Entry may be deleted.

5 **ERASE WHEN CAN WE**

Push – erases all entered or selected data and returns default values.

6 **ATC INDEX**

Push – displays ATC INDEX page.

7 **HIGHER Altitude (ALT)**

Push – selects a message querying ATC when to expect a higher altitude.

Selection may be deleted.

8 **LOWER Altitude (ALT)**

Push – selects a message querying ATC when to expect a lower altitude.

Selection may be deleted.

9 **BACK ON Route (RTE)**

Push – selects a message querying ATC when to expect to be cleared back on route.

Selection may be deleted.

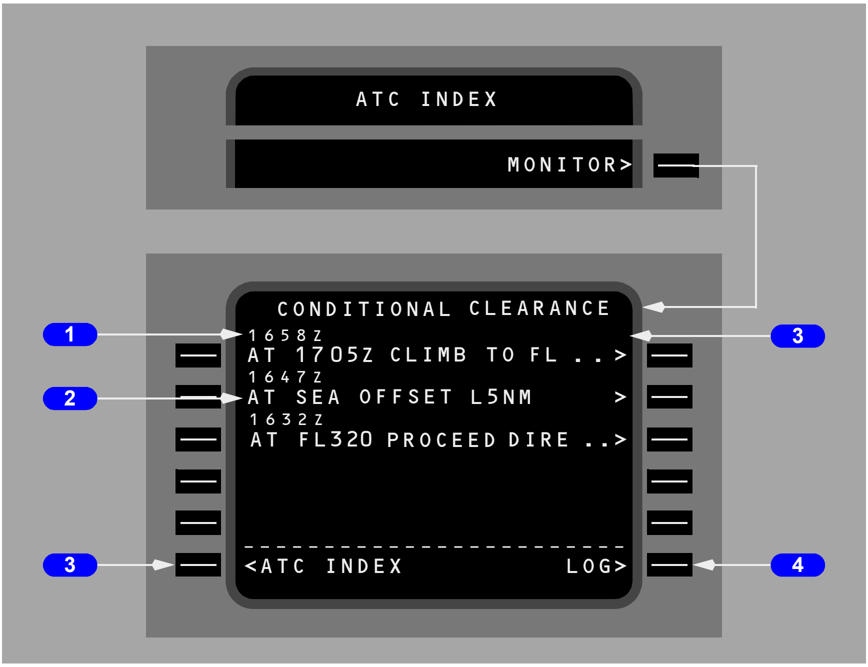
10 **VERIFY**

Push – displays VERIFY REQUEST page.

CONDITIONAL CLEARANCE page

[Option - U14 and abobe]

The CONDITIONAL CLEARANCE page provides a log of all conditional clearance uplinks that are being monitored by the system. Conditional clearances are uplinks that contain a conditional location, altitude, or time for execution of a clearance/instruction.



1 XXXXZ (time)

Time of message receipt.

2 Conditional Clearances

The system is able to handle up to 3 accepted conditional clearances.

If an accepted conditional clearance defined by uplink elements is executed early, the FMC displays the following:

- a “CLEARANCE COND NOT MET” scratchpad message.
- "CONDITION NOT MET" displayed in the 2L/2R line of the xxxxZ ATC UPLINK page.

Conditional clearances will be considered executed early when:

- the MCP altitude changes more than +/- 150 feet from the current altitude prior to satisfying the condition (time or position).
- an offset is executed including deleting an existing offset before the specified [time].

When the airplane satisfies the condition associated with a conditional clearance, a “clearance condition met” message displays the following:

- “CLEARANCE COND MET” scratchpad message.
- "CONDITION MET" displayed in the 2L/2R line of the xxxxZ ATC UPLINK page.
- the current time reaches the specified time.
- the specified waypoint is sequenced in the FMS active route.
- the airplane reaches an altitude within +/- 150 ft of the specified altitude.

3 ATC INDEX

Displays the ATC INDEX page.

4 LOG

Displays the ATC LOG page 1/X.

Introduction

Completion of the FMC preflight requires data entry in all minimum required data locations. Completing all required and optional preflight data entries ensures the most accurate performance possible.

[Option – With company data link]
Data link can be used to load preflight data from airline ground stations. Using data link reduces the required crew actions. Manual crew entries replace existing data. Data link can also be used to load takeoff data onto the TAKEOFF REF pages.

Preflight Page Sequence

The normal preflight sequence follows paging prompts on each CDU page.

The normal FMC power–up page is the identification page. Preflight flow continues in this sequence:

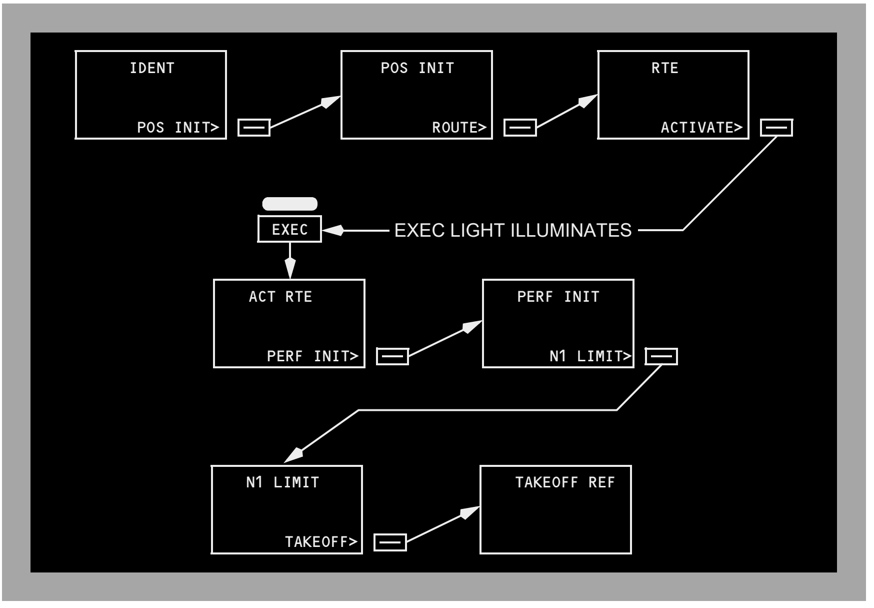
- identification (IDENT) page
- position initialization (POS INIT) page
- route (RTE) page
- DEPARTURES page (no automatic prompt)
- performance initialization (PERF INIT) page

[Option – FMC U10.1 and later]
- with U10.1 or later installed:
  - N1 LIMIT page
  - takeoff reference (TAKEOFF REF) page.

Some of these pages are also used in flight.

Minimum Preflight Sequence

[Option – FMC U10.1 and later]



During preflight, a prompt in the lower right of the CDU page automatically directs the crew through the minimum requirements for preflight completion. Pushing the prompt key for the next page in the flow presents new entry requirements. Additional entries are made on pages to refine the performance and route calculations. If a required entry is missed, a prompt on the TAKEOFF page leads the crew to the preflight page that is missing data.

The airplane inertial position is required for FMC preflight and flight instrument operation.

A route must be entered and activated. The minimum route information is origin and destination airports and a route leg.

Performance information requires the airplane weight and cruising altitude.

Supplementary Pages

Supplementary pages are sometimes required. These pages must be manually selected. Manual selection interrupts the normal automatic sequence. Discussions of each normal page include methods to display the page when the automatic sequence is interrupted.

When the route includes SIDs and STARs, they can be entered into the preflight using the DEPARTURES or ARRIVALS pages.

Route discontinuities are removed, the route is modified, and speed/altitude restrictions are entered on the RTE LEGS page. The RTE LEGS page is described in the FMC Takeoff and Climb and FMC Cruise sections of this chapter.

[Option – With alternate destination prediction]
Alternate airports are added on the ALTERNATE DESTS page. The ALTERNATE DESTS page is described in the FMC Descent/Approach section of this chapter.

Waypoint, navigation, airport, and runway data is referenced on the REF NAV DATA page or the SUPP NAV DATA page. The REF NAV DATA page and SUPP NAV DATA page are described in the FMC Cruise section of this chapter.

VNAV performance is improved if the forecast winds and temperatures are entered during the preflight.

A single wind and temperature for cruise may be entered on the PERF INIT page. Wind and temperature data for specific cruise waypoints are entered on the RTE DATA page. The RTE DATA page is described in the FMC Cruise section. Wind and temperature for descent is entered on the DES FORECASTS page. The DES FORECASTS page is described in the FMC Descent section.

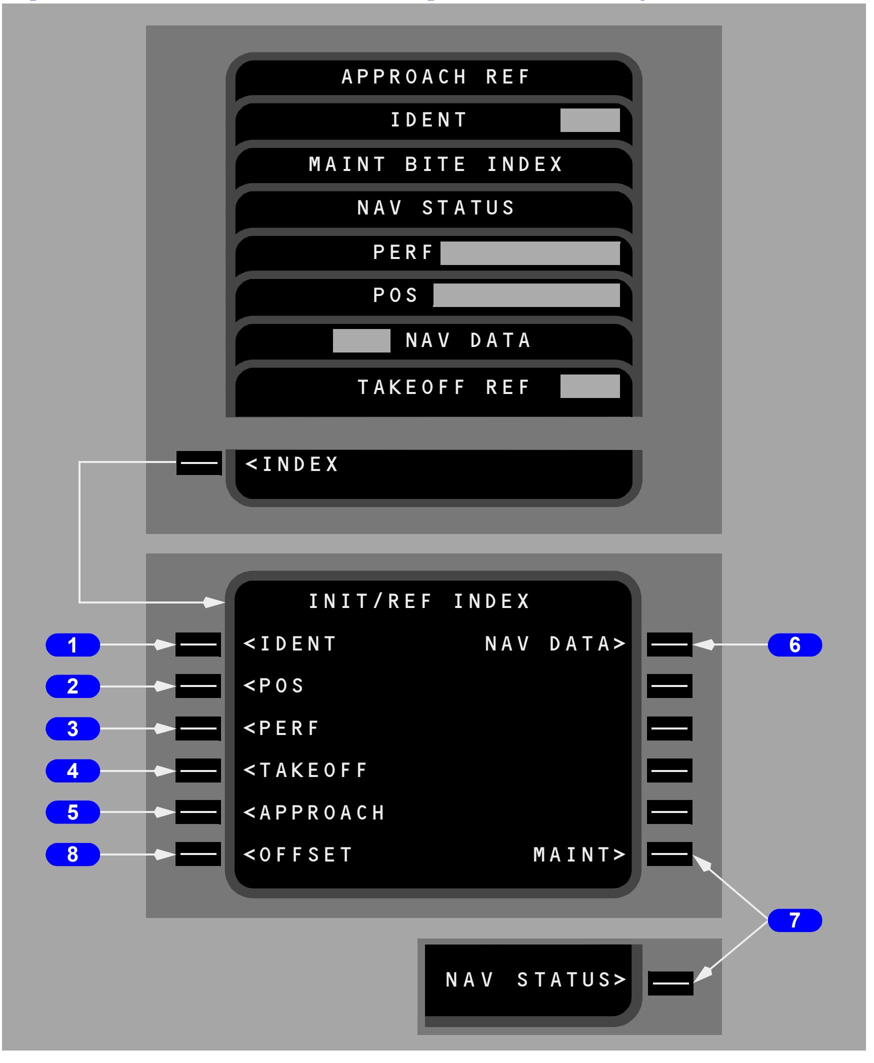
Preflight Pages

The preflight pages are presented in the sequence used during a typical preflight.

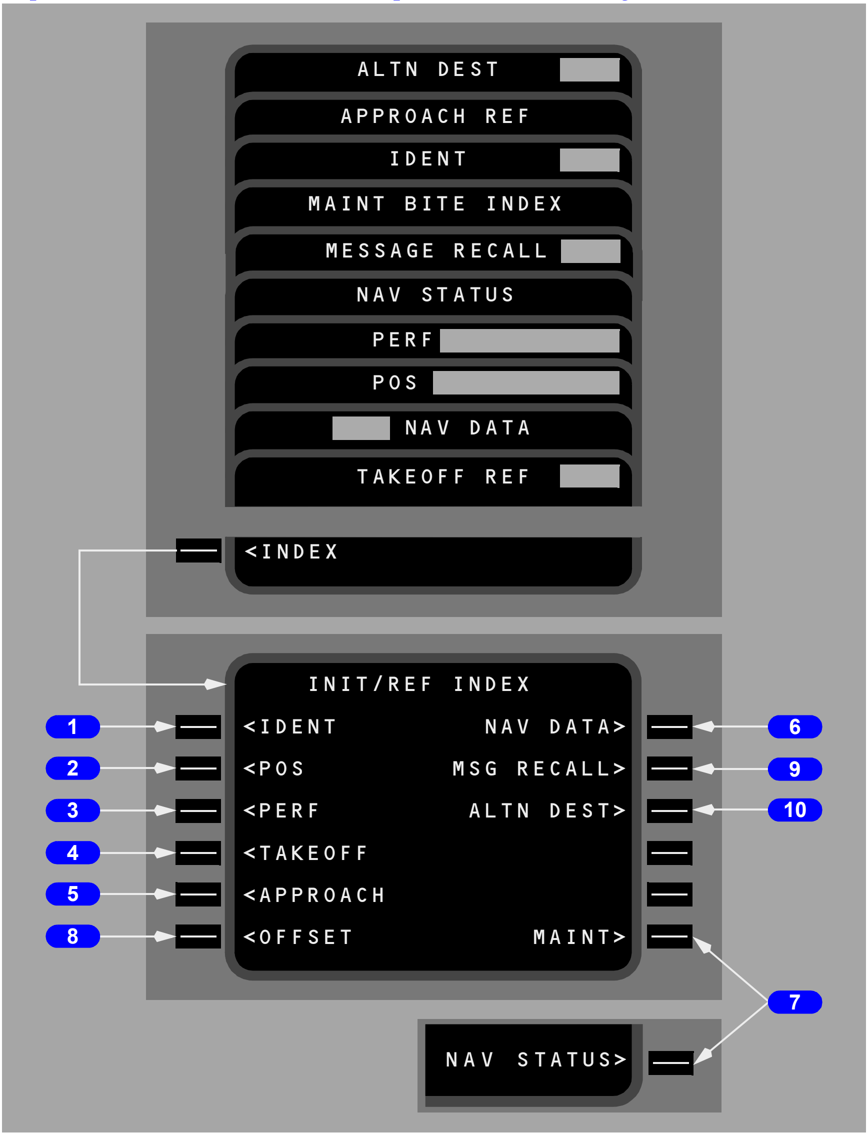
Initialization/Reference Index Page

The initialization/reference index page provides manual selection of FMC pages. It provides access to pages used during preflight and not normally used in flight.

[Option – Without alternate destination prediction or message recall]



[Option – With alternate destination prediction and message recall]



1 **IDENT**

Push – displays the IDENT page, the first page in the automatic preflight sequence.

2 **Position Initialization (POS)**

- Push – displays the POS INIT page used for IRS initialization.
- POS INIT page is also used to enter/update magnetic heading for an IRS which is in the ATT mode.

3 **Performance Initialization (PERF)**

Push – displays the PERF INIT page for initialization of data required for VNAV operations and performance predictions.

4 **Takeoff Reference (TAKEOFF)**

Push – displays the TAKEOFF REF page to enter takeoff reference information and V speeds.

5 **APPROACH**

Push – displays the APPROACH REF page for entry of the approach VREF speed.

6 **Navigation Data (NAV DATA)**

Push – displays the REF NAV DATA page to display information about waypoints, navaids, airports, and runways. On the ground, displays the SUPP NAV DATA page if SUPP is entered in the scratchpad prior to selection.

7 **Maintenance (MAINT) or Navigation Status (NAV STATUS)**

- MAINT – On ground only.
  Push – displays maintenance pages for maintenance use.
- NAV STATUS – Replaces MAINT prompt when in air.
  Push – displays NAV STATUS page which shows status of navigation aids being tuned by the FMC. Replaces MAINT prompt when in air.

8 **OFFSET**

Push – displays the LATERAL OFFSET page for initiating a lateral offset.

[Option – With message recall]
9 **Message Recall (MSG RECALL)**

Push – displays the MESSAGE RECALL page to view active messages.

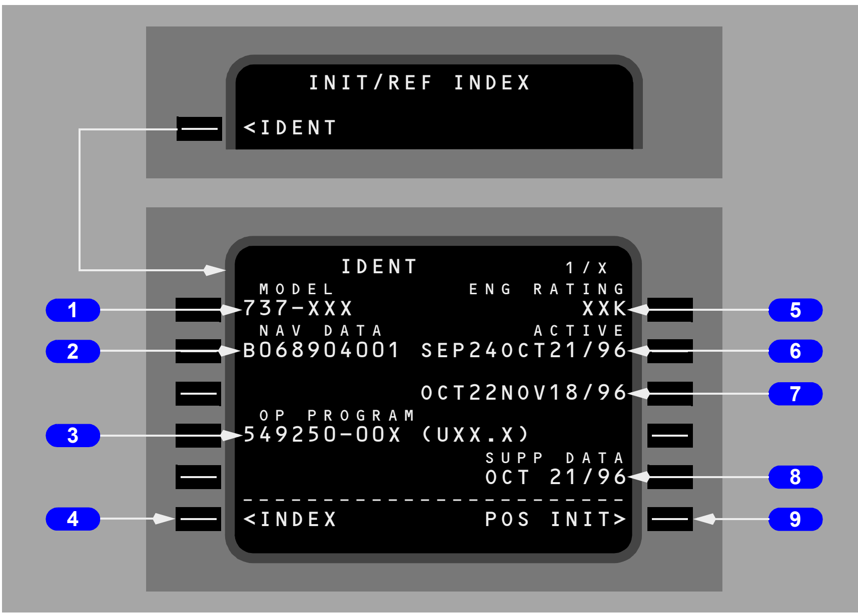
[Option – With alternate destination prediction]
10 **Alternate Destinations (ALTN DEST)**

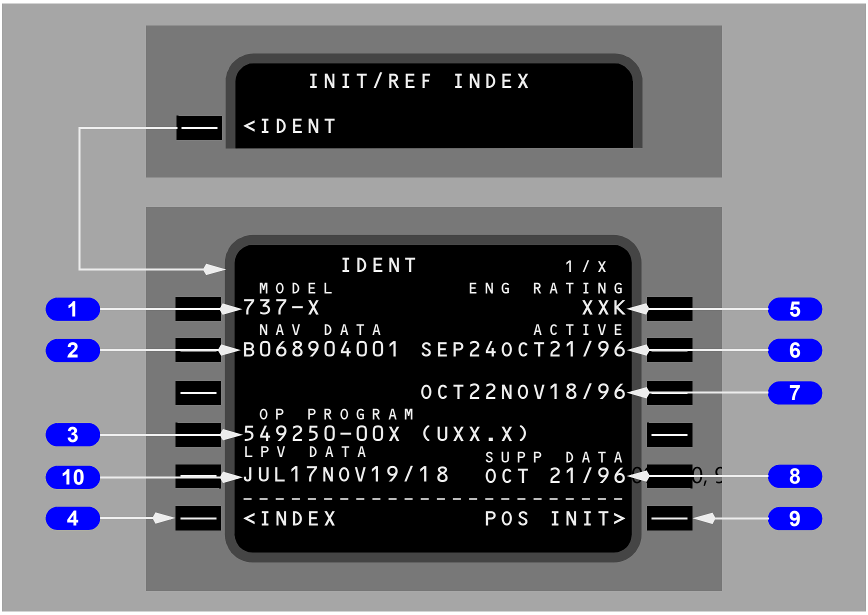
Push – displays the ALTERNATE DESTS page used for alternate airport planning and diversions.

Identification Page

Most of the data on this page is for crew verification. Active date accepts manual entries.

The crew verifies FMC data and selects a navigation database on the identification page.





1 MODEL

Displays the airplane model from the FMC performance database (e.g., 737–600, 737–700, 737–800 or 737-900).

Airplanes with winglets will have a W appended to the model number (e.g. 737-600W, 737-700W, 737-800W or 737-900W).

Note: A model with a .1 appended to it indicates an airplane with a Short Field Performance package and a one-position tail skid (e.g. 737-800.1 or 737-800W.1).

2 Navigation Data (NAV DATA)

Displays the navigation database identifier.

3 Operational Program (OP PROGRAM)

Displays the Boeing software part number and update version. Update version installed at delivery:

[Option – FMC U10.8A]
- Update 10.8A (U10.8A)

[Option – FMC U11.0]
- Update 11.0 (U11.0)

[Option – FMC U12.0
- Update 12.0 (U12.0)

[Option – FMC U13.0
- Update 13.0 (U13.0)

[Option – FMC U14.0]
- Update 14.0 (U14.0)

4 INDEX

Push – displays the INIT/REF INDEX page.

5 Engine Rating (ENG RATING)

Displays the engine thrust stored in the FMC performance database (e.g., 20K, 22K, 24K, 26K or 27K).

6 ACTIVE Date Range

Displays the effectivity date range for the active navigation database.

Database activation is accomplished by pushing the proper date range prompt to copy that date into the scratchpad. The scratchpad date may then be transferred to the ACTIVE database line. The previous active date moves down to the inactive date line.

The ACTIVE label appears above the active navigation database date. No label appears above the inactive navigation database date. The navigation database date can be changed only on the ground. Changing the navigation database removes all previously entered route data.

When an active database expires in flight, the expired database continues to be used until the active date is changed after landing.

7 Inactive Date Range

Displays the effectivity date range for the inactive navigation database.

8 Supplemental Data (SUPP DATA)

Displays the effective date of supplemental data. Blank if supplemental database is empty.

9 Position Initialization (POS INIT)

Push – displays the POS INIT page.

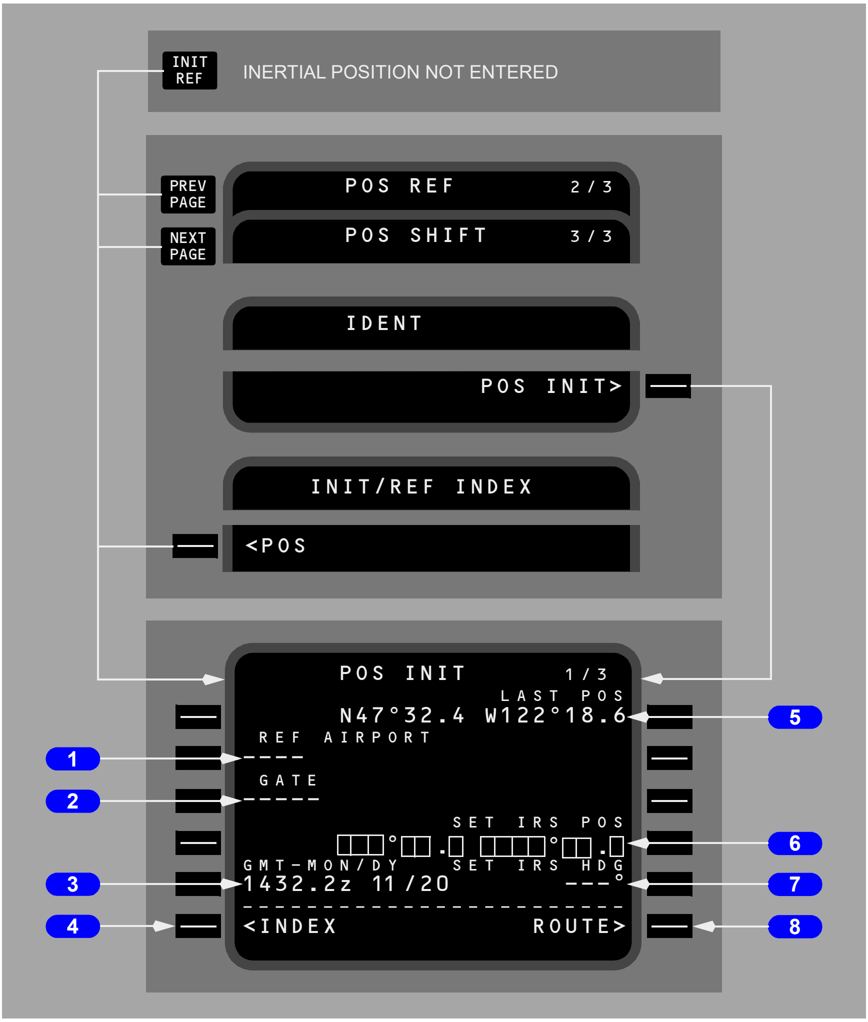
10 LPV Database Date Range

Displays the date range for the MMR LPV database. The LPV DATA field will be blanked if the MMR LPV database dates from the two MMRs do not match.

The FMC will post a "MMR LPV DATA OUT OF DATE" scratchpad message if the MMR LPV database affectivity date does not match the MMR's time source at power up on the ground or if the FMC detects different MMR LPV databases, by date, in each of the MMRs.

Position Initialization Page 1/3

The position initialization page 1/3 allows airplane present position entry for IRS alignment and FMC initialization. The same page is used to enter/update the magnetic heading for an IRS which is in the ATT mode. There are three POS pages.



1 Reference Airport (REF AIRPORT)

The reference airport entry allows entry of the current airport for display of the airport latitude/longitude.

Optional entry.

Valid entries are ICAO four letter airport identifiers.

Displays the latitude and longitude of the reference airport.

Removes previous GATE entry.

Entry blanks at lift–off.

2 GATE

The gate entry allows further refinement of the latitude/longitude position.

Optional entry after the reference airport is entered.

Valid entry is a gate number at the reference airport.

Displays the latitude and longitude of the reference airport gate from the navigation database.

Changes to dashes when a new reference airport is entered.

Entry blanks at lift–off.

3 GMT – Month/Day (GMT – MON/DY)

[Option – With GPS]
Displays GPS time and date. If the GPS time is not valid, GMT starts at 0000.0Z when the FMC is first powered. MON/DY is blank. Manually enter the correct GMT.

4 INDEX

Push – displays the INIT/REF INDEX page.

5 Last Position (LAST POS)

Displays the last FMC computed position.

6 Set IRS Position (SET IRS POS)

The set inertial position entry is required to initialize the IRS. Select the most accurate latitude/longitude for the initialization. A displayed latitude/longitude can be selected or a manual entry can be used.

If an entry is not made before the IRS finishes the initial alignment, the scratchpad message ENTER IRS POS is displayed.

Failure of the manually entered position to pass the IRS internal check displays the scratchpad message ENTER IRS POS.

Enter airplane position latitude and longitude.

Box prompts are displayed when either IRS is in the ALIGN mode and IRS present position has not been entered.

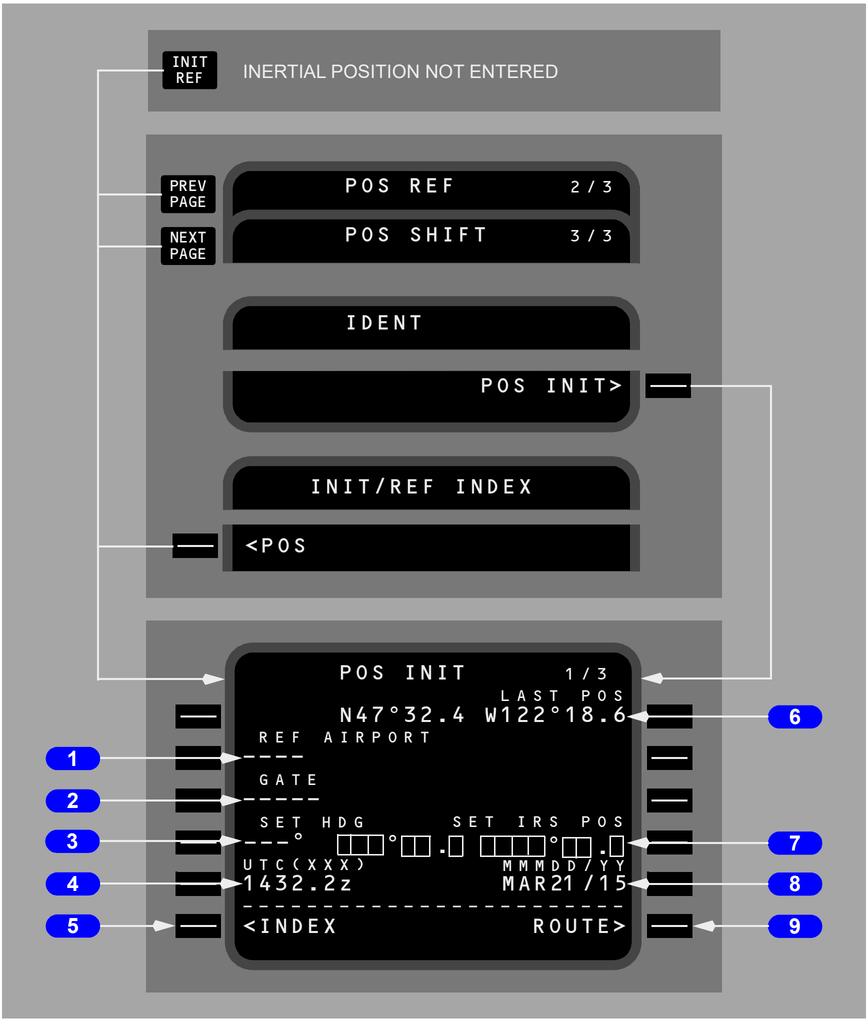
Blanks when the IRS transitions from the alignment to the navigation mode.

7 Set IRS Heading (SET IRS HDG)

Enter/update magnetic heading for any IRS which is in ATT mode. Line blanks when IRS not in ATT mode.

8 ROUTE

Push – displays the ROUTE page.



1 Reference Airport (REF AIRPORT)

The reference airport entry allows entry of the current airport for display of the airport latitude/longitude.

Optional entry.

Valid entries are ICAO four letter airport identifiers.

Displays the latitude and longitude of the reference airport.

Removes previous GATE entry.

Entry blanks at lift–off.

2 GATE

The gate entry allows further refinement of the latitude/longitude position.

Optional entry after the reference airport is entered.

Valid entry is a gate number at the reference airport.

Displays the latitude and longitude of the reference airport gate from the navigation database.

Changes to dashes when a new reference airport is entered.

Entry blanks at lift–off.

3 Set IRS Heading (SET HDG)

Enter/update magnetic heading for any IRS which is in ATT mode. Line blanks when IRS not in ATT mode.

4 UTC

[Option – With GPS]
Displays GPS time. If the GPS time is not valid, UTC starts at 0000.0Z when the FMC is first powered. Manually enter the correct UTC. If GPS time is not available, then entry of UTC time is required.

5 INDEX

Push – displays the INIT/REF INDEX page.

6 Last Position (LAST POS)

Displays the last FMC computed position.

7 Set IRS Position (SET IRS POS)

The set inertial position entry is required to initialize the IRS. Select the most accurate latitude/longitude for the initialization. A displayed latitude/longitude can be selected or a manual entry can be used.

If an entry is not made before the IRS finishes the initial alignment, the scratchpad message ENTER IRS POS is displayed.

Failure of the manually entered position to pass the IRS internal check displays the scratchpad message ENTER IRS POS.

Enter airplane position latitude and longitude.

Box prompts are displayed when either IRS is in the ALIGN mode and IRS present position has not been entered.

Blanks when the IRS transitions from the alignment to the navigation mode.

8 Date (MMMDD/YY)

Enter/update if blank or incorrect date is shown.

9 ROUTE

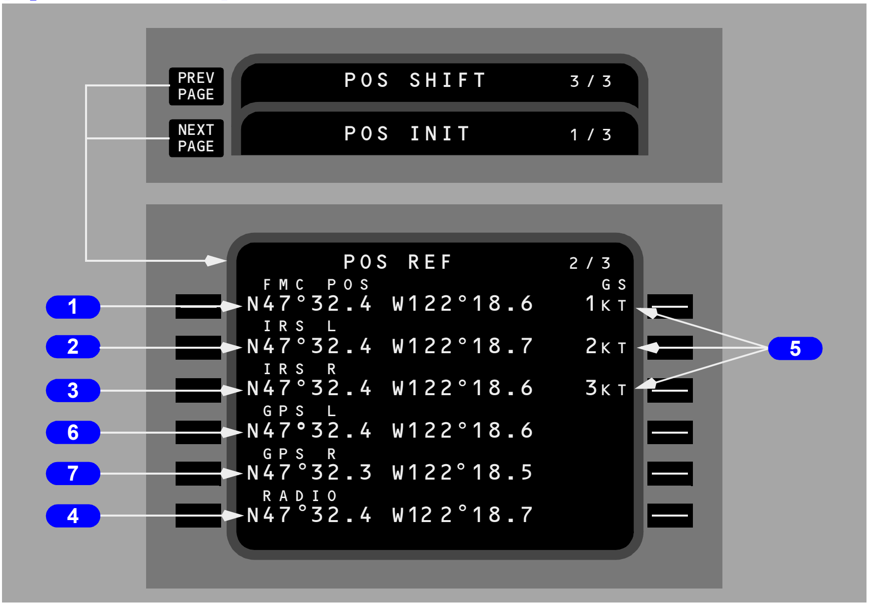
Push – displays the ROUTE page.

Position Reference Page 2/3

[Option – With GPS]
Position reference page 2 displays the airplane positions as calculated by the FMC, IRS, GPS, and radio navigation receivers.

This page displays latitude/longitude. All position displays are in actual latitude and longitude, as calculated by the respective system. Ground speed is displayed for the FMC and each IRS.

[Option – With GPS]



1 **FMC Position (FMC POS)**

Displays the FMC calculated latitude/longitude.

Blank if FMC position is invalid.

2 **IRS L**

Displays the latitude/longitude position as determined by the left IRS.

Blank if IRS position is invalid.

3 **IRS R**

Displays the latitude/longitude position as determined by the right IRS.

Blank if IRS position is invalid.

4 RADIO

Displays the latitude/longitude position as determined by the navigation radios.

Blank if on the ground or if radio position is invalid in flight.

5 Groundspeed (GS)

Displays the ground speed for FMC and IRS.

Blank if ground speed of related system is invalid.

[Option – With GPS]

6 GPS L

Displays the latitude/longitude position as determined by the left GPS.

Blank if GPS position is invalid.

[Option – With GPS]

7 GPS R

Displays the latitude/longitude position as determined by the right GPS.

Blank if GPS position is invalid.

Route Page 1/X

The route is entered and displayed in air traffic control format.

[Option – FMC U10.3 and later]
The first route page displays origin and destination data. Route segments are displayed on subsequent route pages.

Individual portions of the route may be manually entered by the flight crew. An pre–defined route may be loaded using the CO ROUTE line. CO ROUTE entries must correspond to a company defined route in the navigation database.

[Option – With company data link]
The route may also be uplinked.

[Option – With company data link and FMC U11.0and later]
The route x (1 or 2) may also be uplinked.

Route 2 Feature
[Option – FMC U11.0 and later]
RTE 2 adds the capability of a second route to the existing FMC software and adds new prompts to the RTE and RTE LEGS pages that allows access to the second route. The DEP/ARR Index page is updated to access the Departures and Arrivals for the second route.

RTE 2 adds the capability to Activate, Predict and Erase a second route. The Active Route can also be copied "COPY" into the second route. All flight planning capabilities, are available for the second route with the exception of Lateral Offsets and Direct To processing. The RTE 2 Feature also adds the capability of entering a departure runway in the air. The ERASE capability allows the crew to deactivate an activated plan. This allows the crew to use the second route as a "what if" predictor.

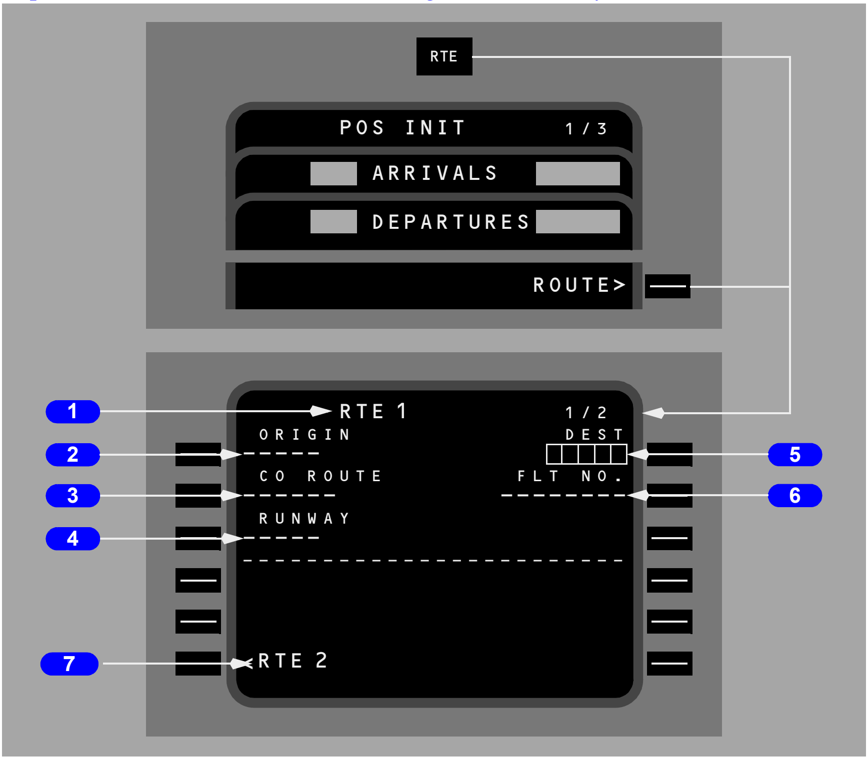
[Company data link]
Messages that reference a route, have been update to reflect the route to which they apply (i.e., PARTIAL ROUTE LOADED has been changed to PARTIAL ROUTE X LOADED).

[Company and ATC data link]
The ACARS and FANS functions are include with the second Route.

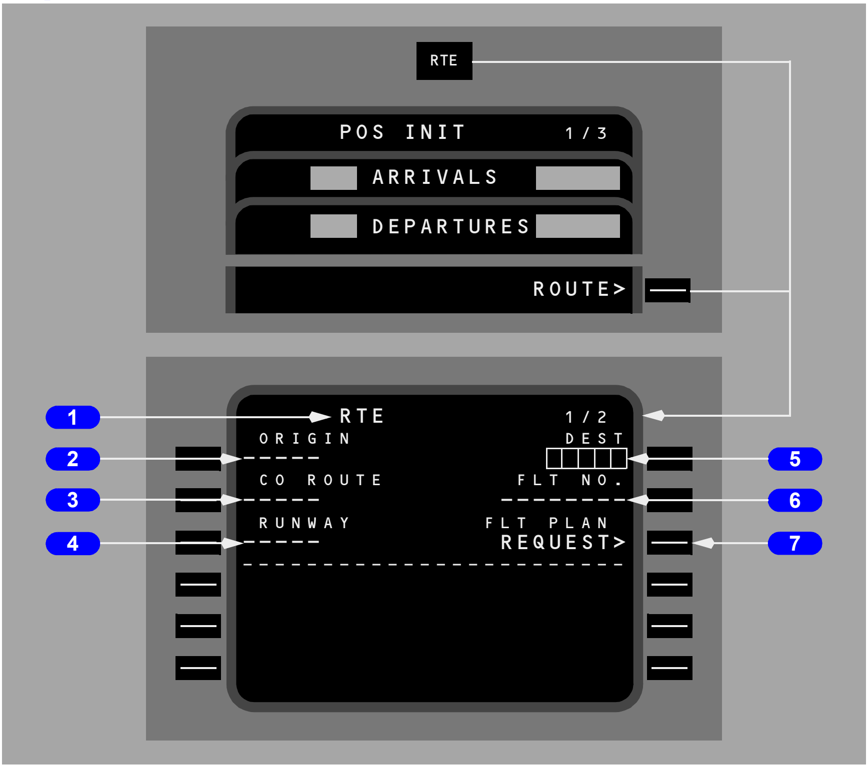
Adding the second Route requires a separate set of Inactive Performance Data for "what if" predictions. This is accomplished by adding an inactive state to the Perf Init page when the Inactive Plan is activated. When an Inactive Plan becomes activated, the ACT PERF INIT is demoted back to an INACT PERF INIT page. Demoting means that the ACT will no longer be displayed in the title and ERASE for the ACTIVATED plan will be displayed in 6L.

Perf Init Data can be entered (and completed) at any time; there is no change in this operation. The change is that the completed Perf Init data is not applied to any route until the route is ACTIVATED. Changes made to Perf Init data after the RTE is activated will be removed when the ACTIVATED route is ERASEd. If the ACTIVATED route is EXECd, the inactive Perf Init becomes part of the Active Route (no change from current requirements).

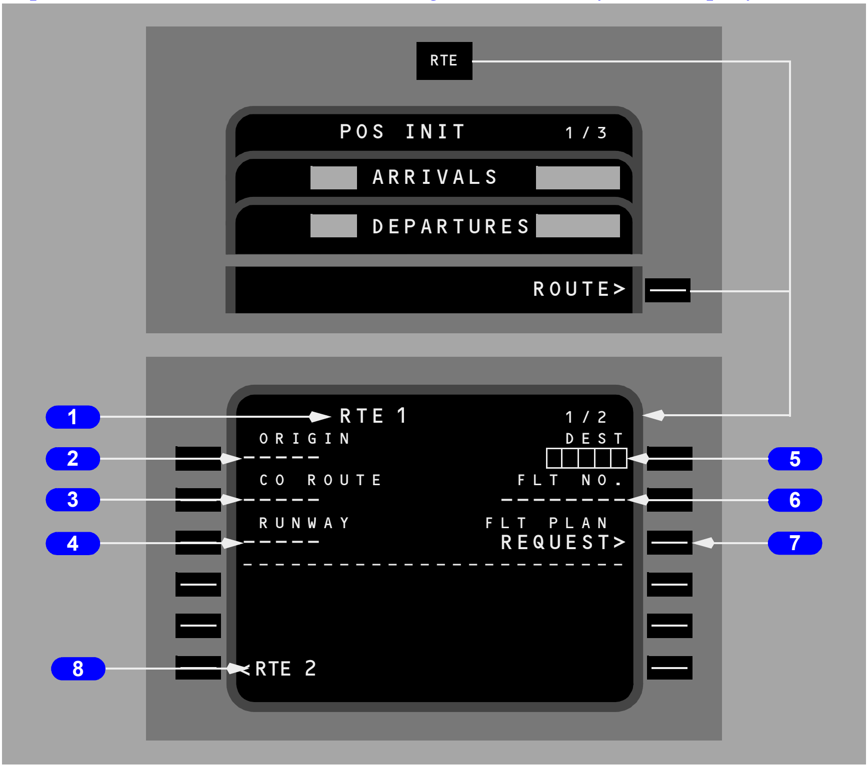
[Option – FMC U11.0 and later with flight number entry]



[Option – FMC U10.3 thru U10.8A, with flight number entry and company data link]



[Option – FMC U11.0 and later, with flight number entry and company data link]



1 Page Title

The word ACT appears to the left of the title when the route has been activated and executed.

The word MOD appears to the left of the normal title when the route is modified and the change is not executed.

Multiple route pages are indicated by the page sequence number to the right of the title.

2 ORIGIN

Enter the ICAO airport identifier for the origin.

An entry is required for route activation.

Valid entries must be in the navigation database.

[Option – FMC U10.3 and later]
Entry is allowed for all phases of flight. Entry of a new origin erases the previous route.

New entries on an active route display MOD in the route title.

Enables direct selection of departure and arrival procedures for the origin airport.

Automatically entered as part of a company route.

3 Company Route (CO ROUTE)

A company route can be called from the navigation database by entering the route identifier. The data provided with a company route can include origin and destination airports, departure runway, SID, and STAR, and the route of flight. All company route data is automatically entered when the route identifier is entered.

An entry is optional for activation of the route.

Enter a company route identifier.

Valid entry is any crew entered company route name. If the name is not contained in the NAV database, the scratchpad message NOT IN DATA BASE is displayed.

Entry of a new company route replaces the previous route.

4 RUNWAY

Line title does not display until after entry of origin airport.

Enter the desired runway for the origin airport.

An entry is optional for activation of the route.

Entries must be in the navigation database.

New entries on an active route display MOD in the route title.

Can be entered from the DEPARTURES page.

Entry is deleted upon takeoff.

5 Destination (DEST)

Enter the ICAO airport identifier for the destination of the route.

An entry is required for route activation.

Entries must be in the navigation database.

New entries on an active route display MOD in the route title.

Enables direct selection of arrival procedures for the destination airport.

Automatically entered as part of a company route.

Entry and execution of a new destination clears any runway and runway dependent approach procedure of the previous destination. If the active leg is part of the affected procedure, then all subsequent (inactive) legs are cleared.

[Option – With flight number entry]

6 Flight Number (FLT NO.)

Enter the company flight number.

Entry is optional for activation of the route.

Limited to 8 characters.

Crew entered.

Flight number is included in the PROGRESS page title.

The flight number entry is applied to both RTE 1 and RTE 2. The value of the flight number field will be the same for both routes. An entry into the flight number field on RTE 1 will propagate to the flight number field on RTE 2 and vice versa. The two flight number fields will always be the same.

[Option – With Elementary Surveillance]
As installed:
Transponder transmits flight number to ATC.

[Option – With company data link]

7 FLT PLAN REQUEST

Push – transmits a data link request for a flight plan route uplink

[Option – FMC U11.0 and later]
Push – transmits a data link request for a flight plan route X uplink

7 Route 1 or 2 (RTE X)

Push - displays first or second route, depending on which route is currently being displayed at the Page Title position.

[Option – FMC U11.0 and later]

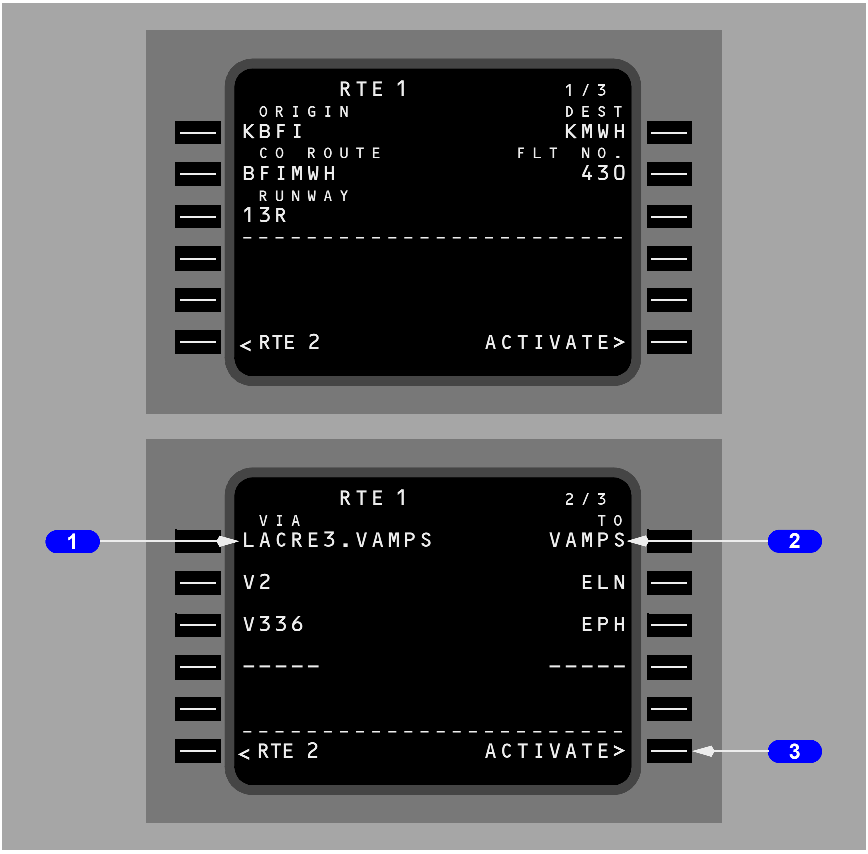
8 Route 1 or 2 (RTE X)

Push - displays first or second route, depending on which route is currently being displayed at the Page Title position.

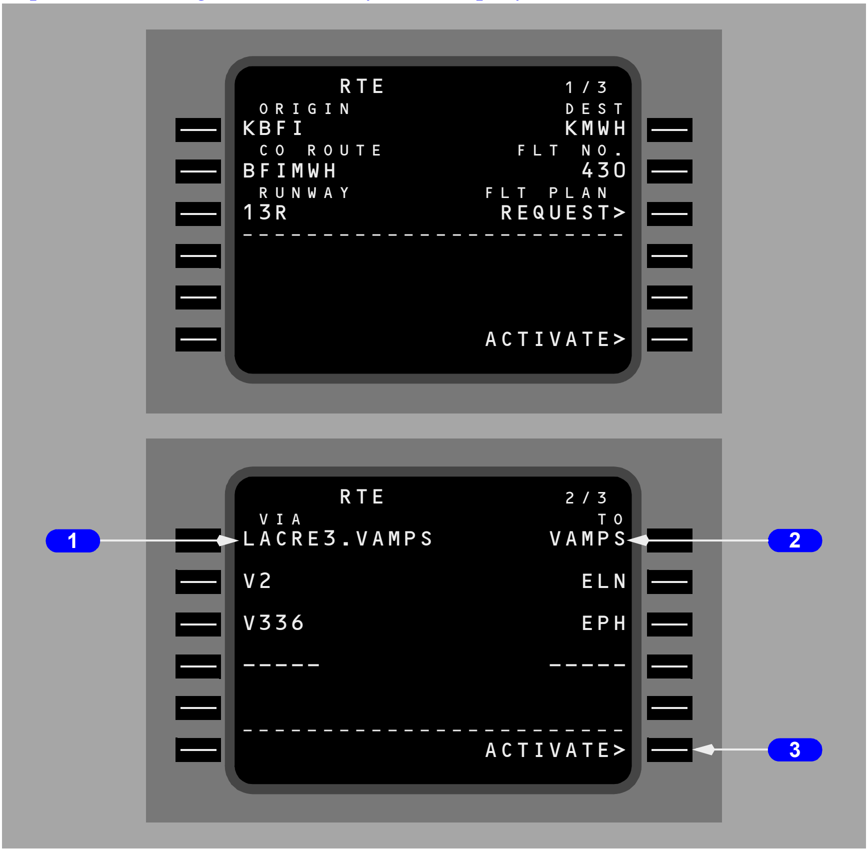
Route Pages 1/X and 2/X with Data Entries

[Option – FMC U10.3 and later]

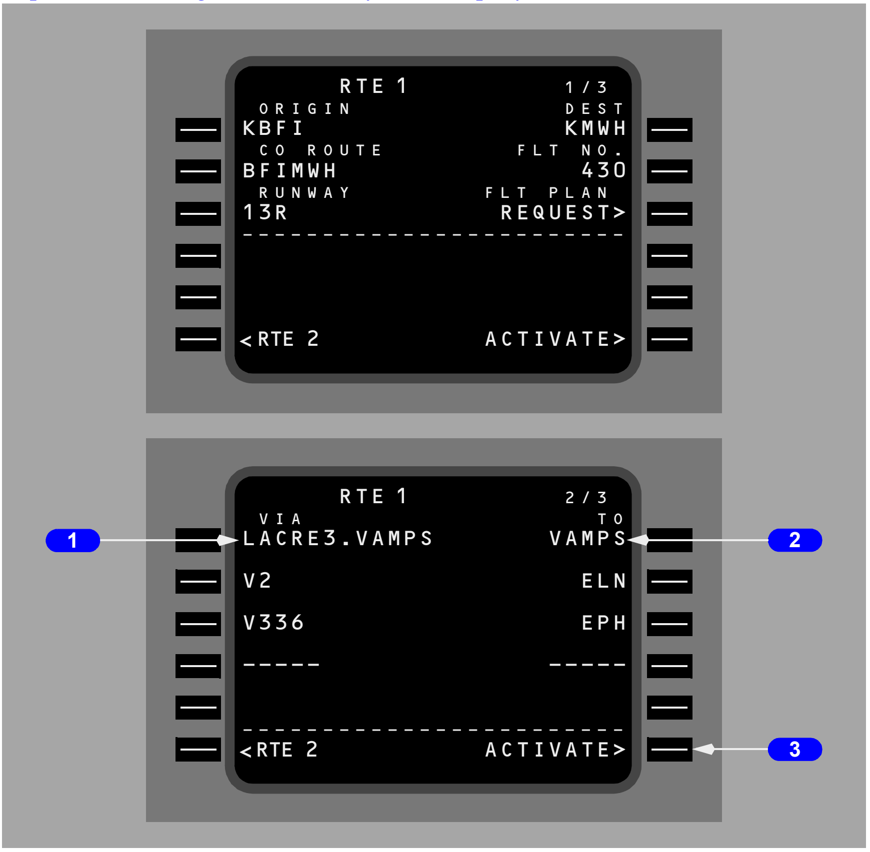
[Option – FMC U11.0 and later, with flight number entry]



[Option – With flight number entry and company data link]



[Option – With flight number entry and company data link]



[Option - U13 and below]

1 VIA

The VIA column displays the route segment to the waypoint or termination displayed in the TO column. Enter the path which describes the route segment between the previous waypoint and the segment termination.

Enter an airway in the VIA column and box prompts are displayed in the TO column if the previous TO line contains a waypoint on the airway.

Valid entries can also include procedures or DIRECT. Procedures are normally entered through selections on DEPARTURES and ARRIVALS pages. DIRECT is normally entered as a result of entering a TO waypoint first.

Valid airways must:

- contain the fix entered in the TO waypoint, and
- contain the previous TO waypoint, or

Dashed prompts change to DIRECT if the TO waypoint is entered first.

Dash prompts appear for the first VIA beyond the end of the route.

Invalid VIA entries display the scratchpad entry INVALID ENTRY.

Invalid VIA entries are:

- airways and company routes which do not contain the TO waypoint of the previous line
- airways or company routes that are not in the navigation database.

When entering airways, the beginning and ending waypoints determine if the entry is valid. The route segment must contain the waypoint entered in the TO position. The TO waypoint of the previous route segment must be the same as the beginning point of the current route segment, or a route discontinuity is created between the segments.

Entry of a SID or transition automatically enters the VIA and TO data for the route segments of the SID. A SID automatically links to the next route segment when the final SID waypoint is part of the route segment.

LACRE3.VAMPS is an example of a SID selection made on the DEPARTURES page.

V2 is an example of airway entry.

[Option - U14 and above for VIA]

1 VIA

The VIA column displays the route segment to the waypoint or termination displayed in the TO column. Enter the path which describes the route segment between the previous waypoint and the segment termination.

Enter an airway in the VIA column and box prompts are displayed in the TO column if the previous TO line contains a waypoint on the airway.

Valid entries can also include procedures or DIRECT. Procedures are normally entered through selections on DEPARTURES and ARRIVALS pages. DIRECT is normally entered as a result of entering a TO waypoint first.

Valid airways must:

- contain the fix entered in the TO waypoint, and
- contain the previous TO waypoint, or

Dashed prompts change to DIRECT if the TO waypoint is entered first.

Dash prompts appear for the first VIA beyond the end of the route.

Invalid VIA entries display the scratchpad entry INVALID ENTRY.

Invalid VIA entries are:

- airways not entered in sequence and company routes which do not contain the TO waypoint of the previous line
- airways or company routes that are not in the navigation database.

If an airway is entered and the TO field preceding the airway does not contain a waypoint, but the VIA field preceding the airway contains an airway. Then the preceding and entered airways are examined to determine if a point is present at which the airways cross. Also determined is:

- if the airways do not cross, the entry is rejected and the INVALID ENTRY message displayed in the scratchpad.
- if multiple crossing points are found, the point closest to the entry waypoint of the preceding airway and in the direction of the destination airport is chosen.
- if the crossing point is not a named fix contained in the Navigation Data Base, the crossing point is created as a temporary waypoint on both airways with an identifier of the entered airway preceded by an ’X’ (e.g., XJ35W).
- if the airways do cross, then the preceding airway and the entered airway are combineed by the crossing waypoint being placed in the TO field preceding the entered airway.
- if the airways do cross and the TO field following the entered airway contains a waypoint, it is then compared to the waypoints included in the airway string.
  - if the waypoint displayed in the following TO field is contained in the airway, the airway will be linked to that waypoint.
  - if the waypoint displayed in the TO field following the airway is not contained in the airway, the waypoint is pushed down in the route string and a discontinuity is displayed between the airway and the waypoint.

Entry of a SID or transition automatically enters the VIA and TO data for the route segments of the SID. A SID automatically links to the next route segment when the final SID waypoint is part of the route segment.

LACRE3.VAMPS is an example of a SID selection made on the DEPARTURES page.

V2 is an example of an airway entry.

The FMC will downlink system generated airway crossing waypoints for an airway/airway intersection as a latitude/ longitude position.

2 TO

Enter the end point of the route segment specified by the VIA entry.

Entry of a waypoint in the TO column without first entering a VIA airway displays DIRECT in the VIA column.

Box prompts indicate that an entry is required.

Valid waypoint entries for a DIRECT route segment are any valid waypoint, fix, navaid, airport, or runway.

Valid waypoint entries for airways are waypoints or fixes on the airway.

Dash prompts appear on the first TO waypoint following the end of the route.

3 ACTIVATE

Pushing the ACTIVATE key arms the route for execution as the active route. When the EXEC key is pushed, the route becomes the active route and the ACTIVATE prompt is replaced with the next required preflight page prompt.

Push – prepares the selected route for execution as the active route.

Activation of a route is required for completion of the preflight.

Displayed on inactive route pages.

After route activation, the ACTIVATE prompt is replaced by:

- PERF INIT, when the required performance data is incomplete, or
- TAKEOFF when the required performance data is complete.

[Option – FMC U11.0 and later]

3 ACTIVATE

Pushing the ACTIVATE key arms RTE X for execution as the active route. When the EXEC key is pushed, RTE X becomes the active route and the ACTIVATE prompt is replaced with the next required preflight page prompt.

Push – prepares the selected route for execution as the active route.

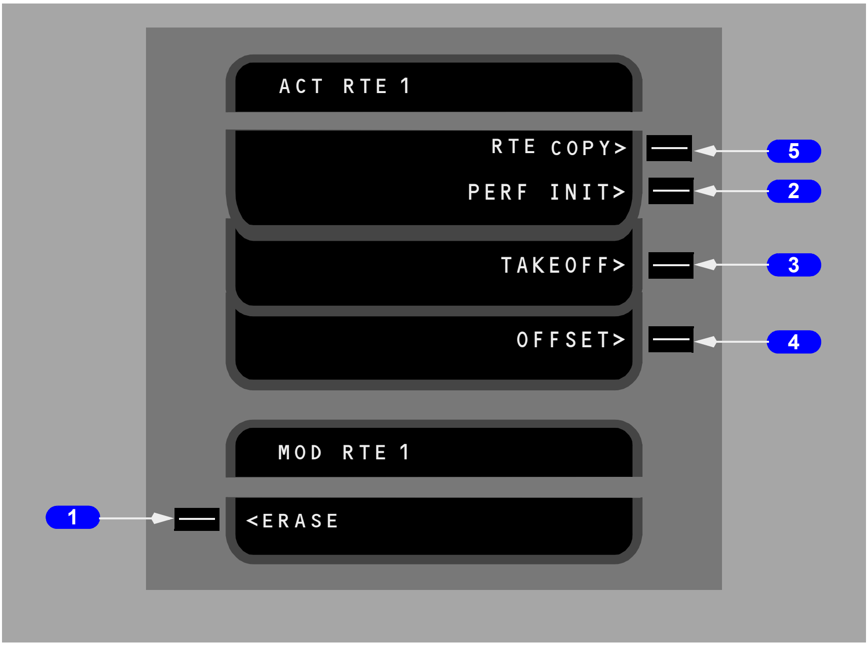
Execution of a route is required for completion of the preflight.

After RTE X activation the ACTIVATE prompt is blanked and the ERASE prompt replaces the RTE X prompt at LSK 6L.

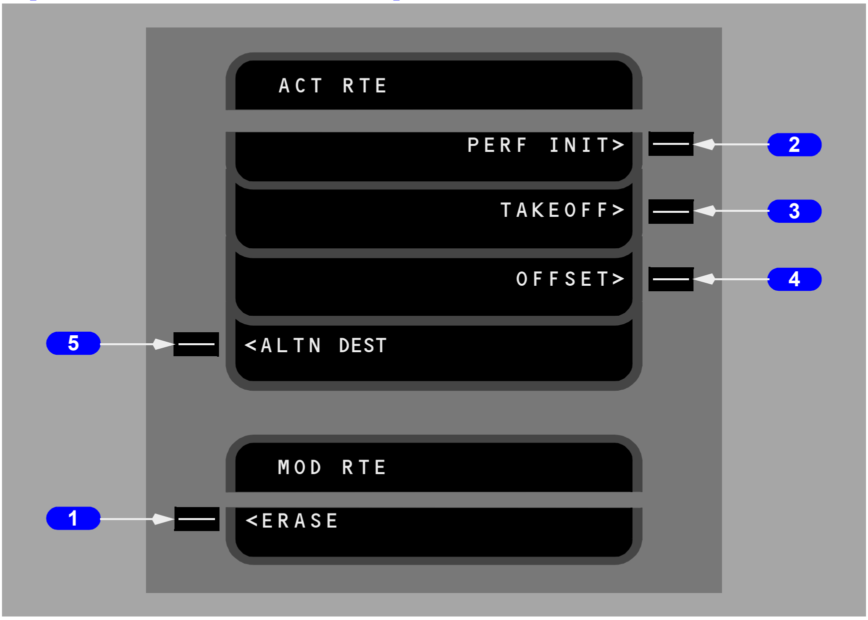
After the EXEC key is selected the RTE COPY prompt becomes available at LSK 5R and LSK 6L displays the following prompts:

- PERF INIT, when the required performance data is incomplete, or
- TAKEOFF when the required performance data is complete.

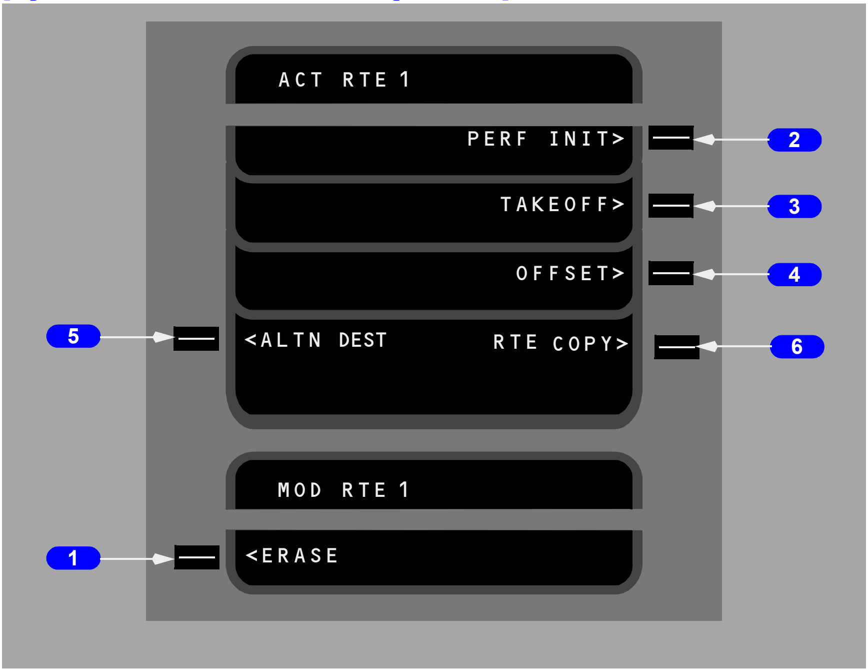
Additional Route Page Prompts for an Activated Route

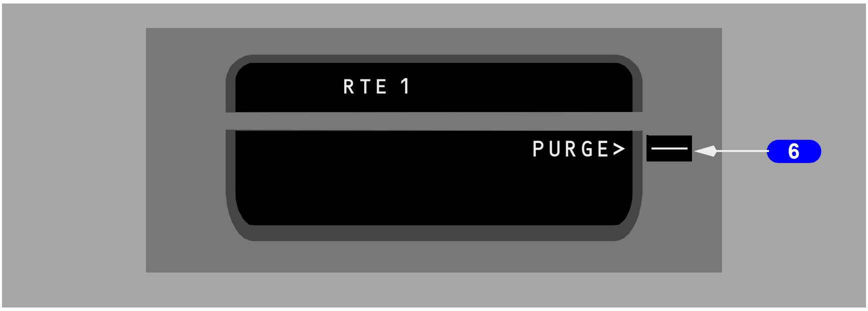


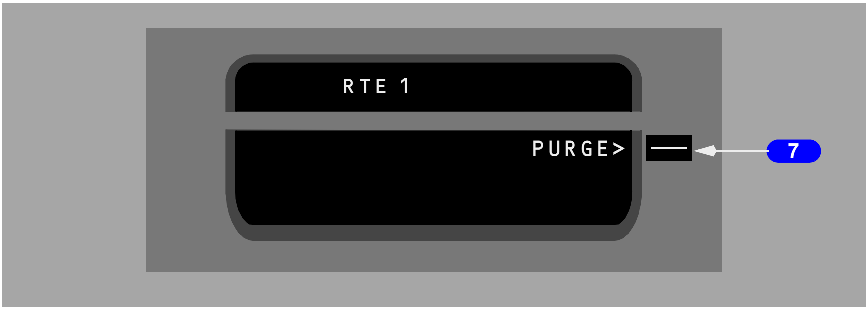
[Option – With alternate destination prediction]



[Option – With alternate destination prediction]







1 ERASE

Push – removes all pending modifications.

Displayed only during modifications.

2 Performance Initialization (PERF INIT)

Push – displays PERF INIT page.

Displayed only on the ground when required entries on the PERF INIT page are incomplete.

3 TAKEOFF

Push – displays TAKEOFF REF page 1/2.

Displayed only on the ground when all required entries on the PERF INIT page are complete.

4 OFFSET

Push – displays LATERAL OFFSET page.

Displayed only in flight.

[Option – With alternate destination prediction]
5 Alternate Destination (ALTN DEST)

Push – displays ALTERNATE DESTS page 1/6.

[Option – FMC U11.0 and later]
5 Route Copy (RTE COPY)

Push – results in the active route being copied into the alternate route, regardless of scratchpad contents.

After selection of the RTE COPY> prompt, COMPLETE is displayed in the data line in large font and RTE COPY is displayed in the line title in small font.

The RTE COPY in the line title and COMPLETE in the data line can be cleared:

- from the RTE Page or the DIR/INTC RTE LEGS page on both CDUs and then completing an EXECution or ERASE of a flight plan.
- from the RTE Page on both CDUs and then completing an EXECution or ERASE of a flight plan.
- by making another edit to the modified plan.
- by the other flight plan entering a pending activation state.

[Option – FMC U11.0 and later]

6 PURGE

PURGE> is displayed in the data line in large font when the route displayed is inactive and a flight plan uplink load pending condition exists. If an inactive route becomes active, the purge prompt is removed from the new active route and is displayed on the new inactive route.

Push–results in the clearing of the route uplink, regardless of scratchpad contents.

6 Route Copy (RTE COPY)

Push – results in the active route being copied into the alternate route, regardless of scratchpad contents.

After selection of the RTE COPY> prompt, COMPLETE is displayed in the data line in large font and RTE COPY is displayed in the line title in small font.

The RTE COPY in the line title and COMPLETE in the data line can be cleared:

- from the RTE Page on both CDUs and then completing an EXECution or ERASE of a flight plan.
- by making another edit to the modified plan.
- by the other flight plan entering a pending activation state.

[Option – FMC U11.0 and later]

7 PURGE

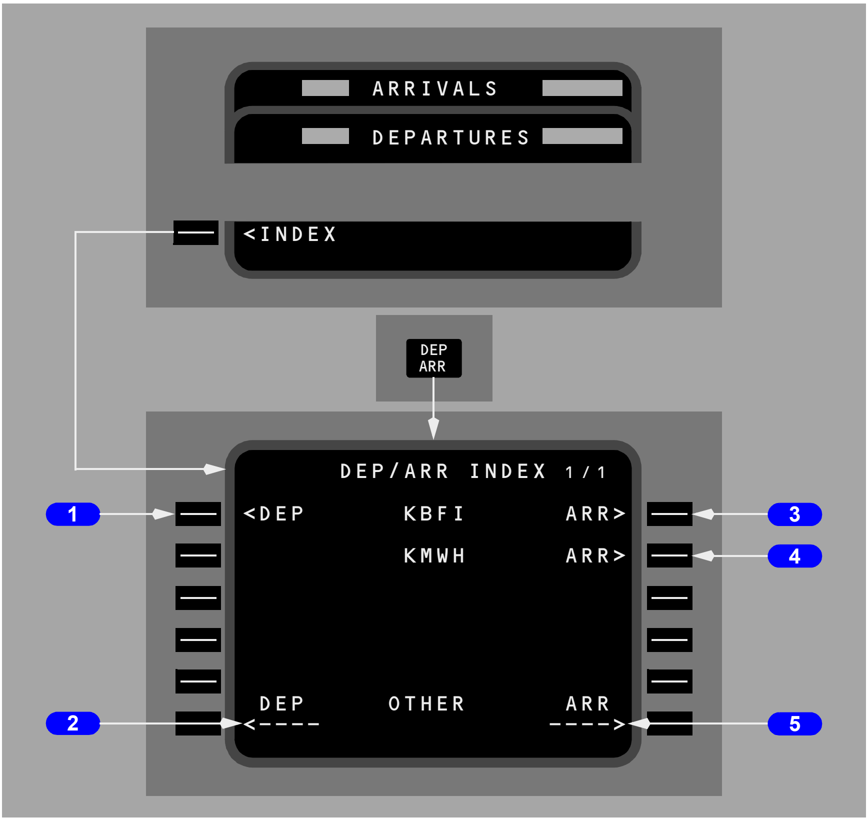
PURGE> is displayed in the data line in large font when the route displayed is inactive and a flight plan uplink load pending condition exists. If an inactive route becomes active, the purge prompt is removed from the new active route and is displayed on the new inactive route.

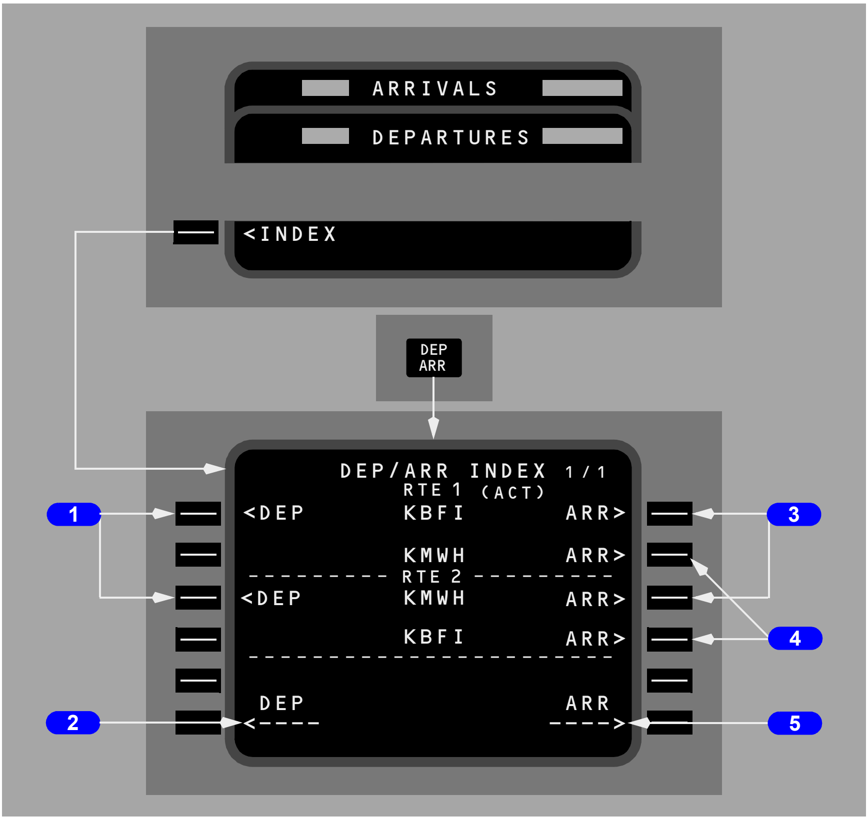
Push – results in the clearing of the route uplink, regardless of scratchpad contents.

Departure/Arrival Index Page

The departure and arrival index page is used to select the departure or arrival page for the origin and destination airports for each route. The index also allows reference to departure or arrival information for any other airport in the navigation database.

Departure and arrival prompts are available for the origin airport. Destination airports have only arrival prompts.





1 Departure (DEP) – Origin

Push – displays the departure page for origin airport.

[Option – FMC U11.0 and later]

1 Departure (DEP) – Origin

Push – displays the departure page for Route 1 origin airport.

Push – displays the departure page for Route 2 origin airport.

2 Departure (DEP) – OTHER

Displays the departure page for the airport entered into this line through the scratchpad.

DEP prompt for OTHER allows display of departure information about airports that are not an origin or destination. The displayed information can be viewed but cannot be selected, because the airport is not on the route.

3 Arrival (ARR) – Origin

Push – displays the arrival page for origin airport. Origin airport arrivals selection is used during a turn–back situation.

[Option – FMC U11.0 and later]
3 Arrival (ARR) – Origin

Push – displays the arrival page for Route 1 or Route 2 origin airport. Origin airport arrivals selection is used during a turn–back situation.

4 Arrival (ARR) – Destination

Push – displays the arrival page for destination airport.

[Option – FMC U11.0 and later]
4 Arrival (ARR) – Destination

Push – displays the arrival page for Route 1 or Route 2 destination airport.

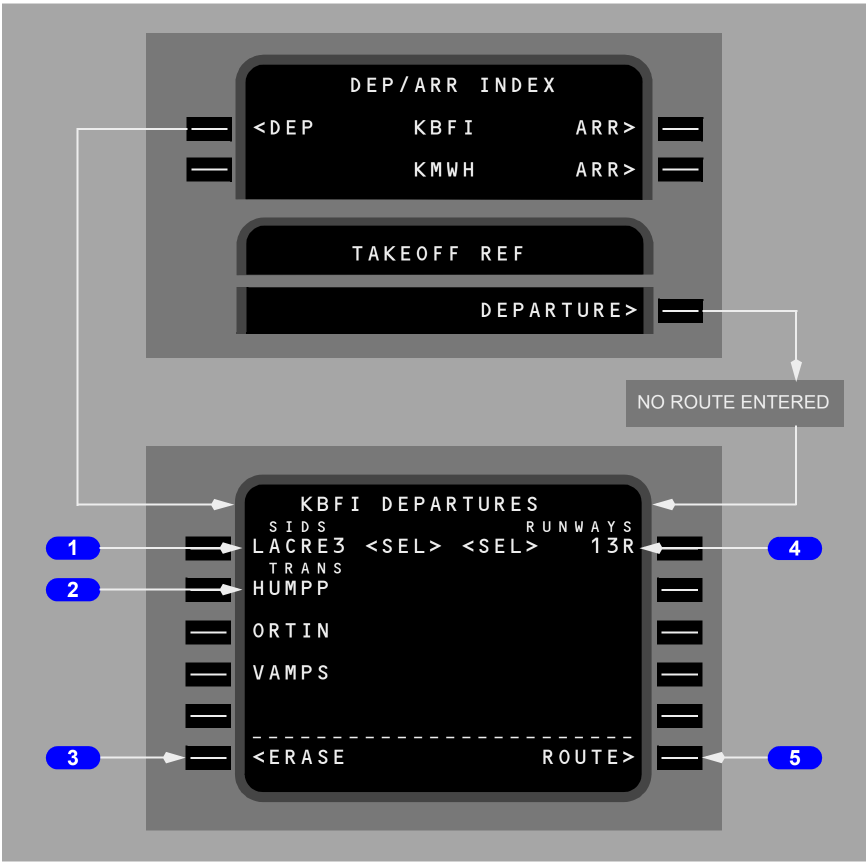
5 Arrival (ARR) – OTHER

Displays the arrival page for the airport entered into this line through the scratchpad.

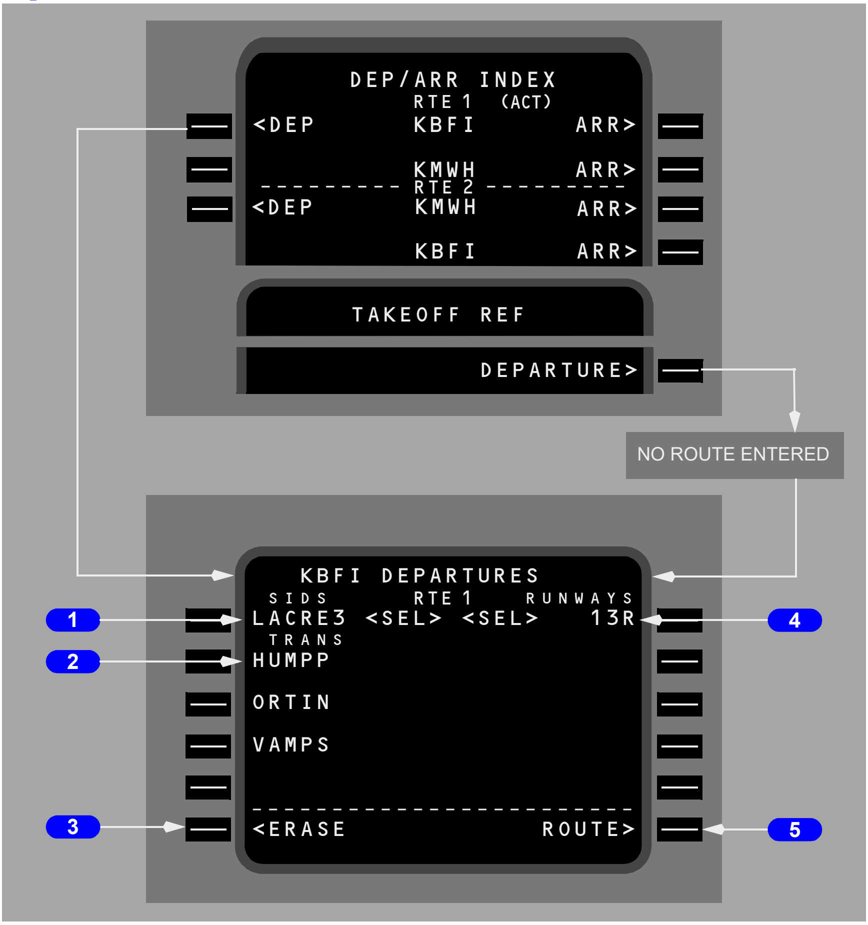
ARR prompt for OTHER allows display of arrival information about airports that are not an origin or destination. The displayed information can be viewed but cannot be selected, because the airport is not on the route.

Departures Page

The departures page is used to select the departure runway, SID, and transition for the route origin airport.



[Option – FMC U11.0 and later]



1 Standard Instrument Departures (SIDS)

Displays SIDS for the airport and runway selections.

[Option – With engine out SIDS]
Displays the engine–out SIDS for the airport and runway selections following the last SID display line or on the first line if there are no SIDS for the departure airport and runway.

Without the selection of a runway on the RTE page, the initial display contains all of the information for the airport runways and SIDS. As selections are made, incompatible options are removed. SID transitions are displayed after a SID is selected.

2 Transitions (TRANS)

Displays transitions compatible with the selected SID.

3 ERASE/INDEX

ERASE is displayed when a route modification is pending.

Push – removes route modifications that are not executed and restores the original route.

INDEX is displayed when no route modification is pending.

Push – displays the DEP/ARR INDEX page.

4 RUNWAYS

Displays a list of runways for the selected airport.

The runway selected on the RTE page is displayed as <SEL> or <ACT> when this page is displayed.

5 ROUTE

Push – displays the RTE page.

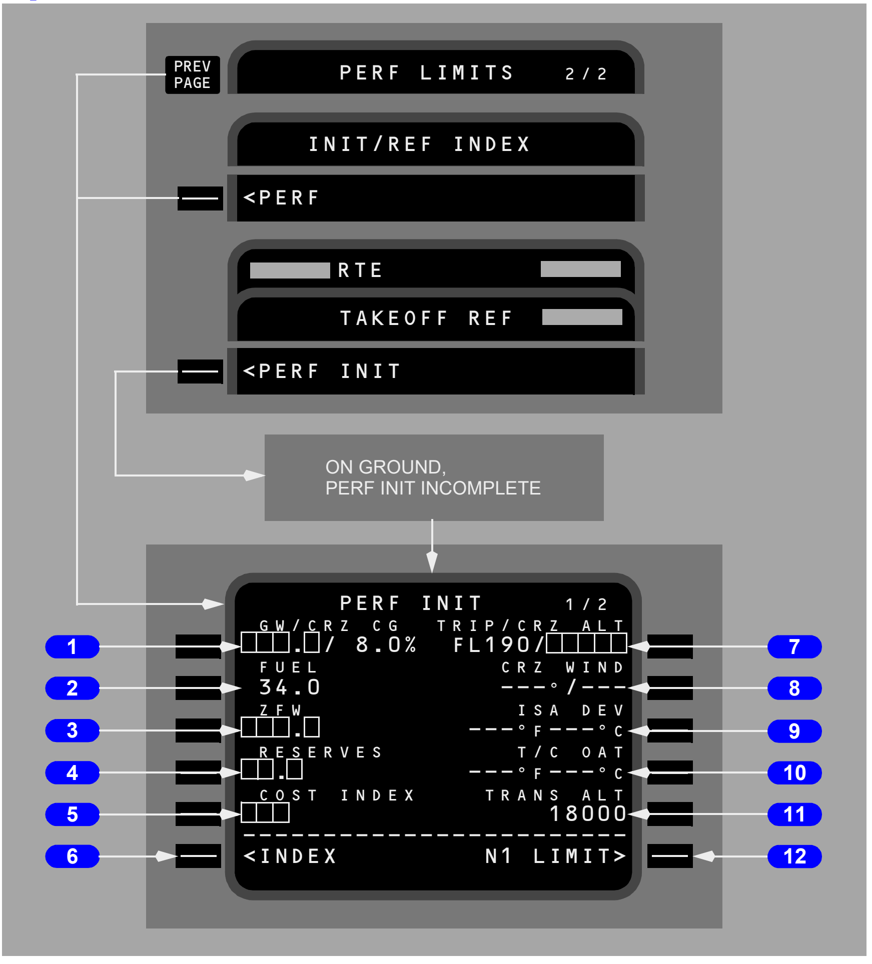
Selecting Options

Selecting an option displays <SEL> inboard of the option, and a route modification is created. When the modification is executed, the <SEL> becomes <ACT>. Leaving the page and returning displays all options and the <SEL> or <ACT> prompts.

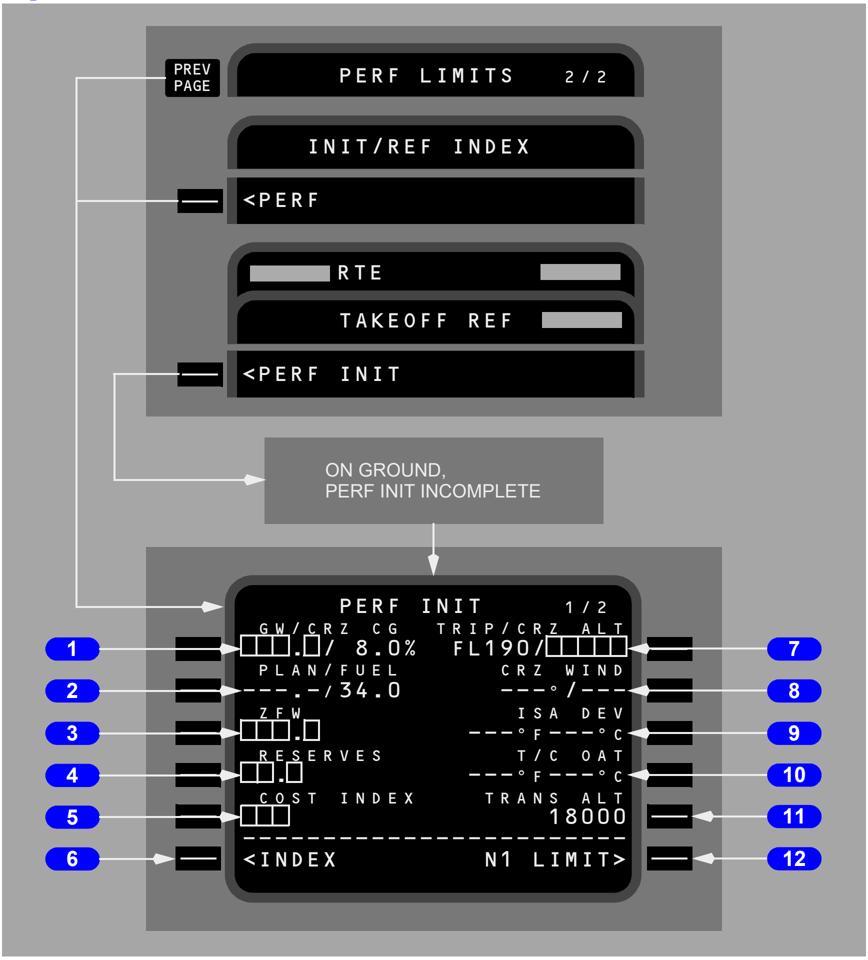
Performance Initialization Page

The performance initialization page allows the entry of airplane and route data to initialize performance calculations. This information is required for VNAV calculations.

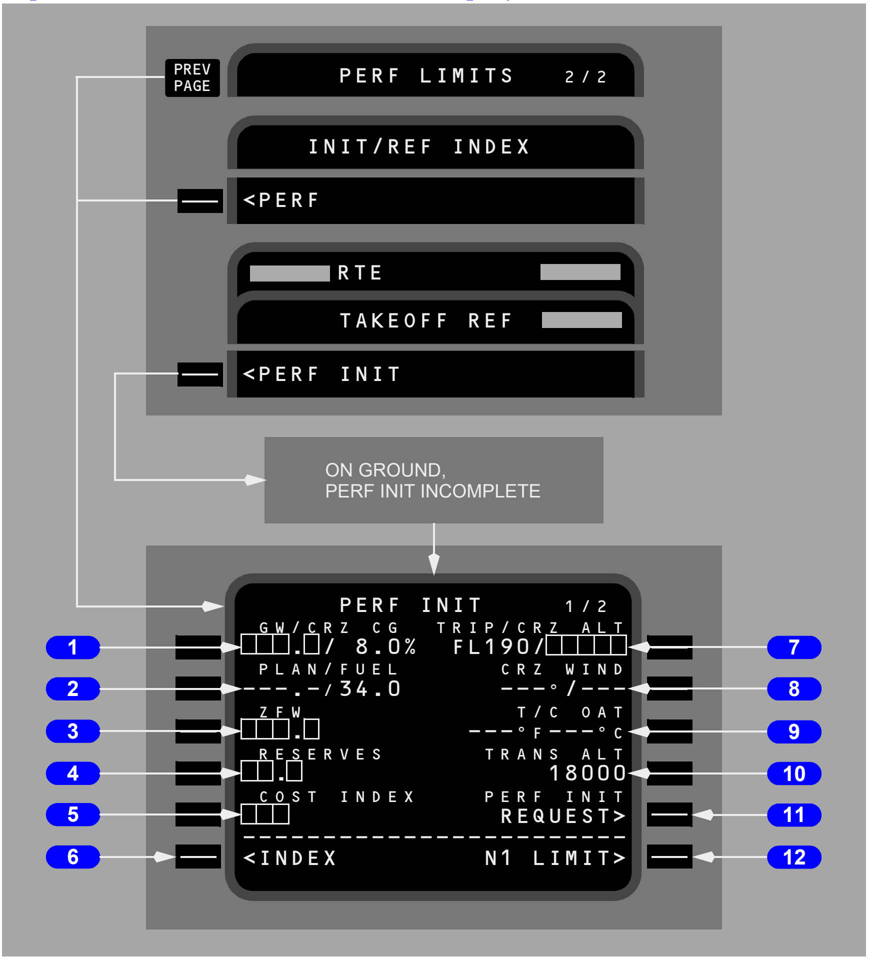
[Option – FMC U10.1 and above]



[Option – FMC U10.1 and above, with PLAN FUEL line]



[Option – FMC U10.1 and above, with company data link and PLAN FUEL line]



1 Gross Weight/Cruise Center of Gravity (GW/CRZ CG)

Airplane gross weight is required. The entry can be made by the flight crew or automatically calculated by the FMC, following entry of zero fuel weight.

Enter airplane gross weight.

Valid entries are xxx or xxx.x.

Automatically displays calculated weight when zero fuel weight is entered first.

Displays default or manually entered cruise CG. Entry of actual cruise CG may revise maximum altitude capability.

2 FUEL

Fuel on board is automatically displayed as received from the airplane fuel quantity indication system.

In flight, when the FMC is not receiving the required fuel data, the CDU displays dashes and allows manual entry of fuel weight. After manual entry, MAN (manual) appears next to the fuel weight. Manual entry of fuel weight should continue approximately every 30 minutes for the remainder of the flight to keep gross weight current.

[Option – With PLAN FUEL line]

2 PLAN/FUEL

Fuel on board is automatically displayed as received from the airplane fuel quantity indication system.

[Option – FMC U10.3 and above]

PLAN entry allows fuel predictions before actual fuel is known. Entry is blanked with flaps extended or in flight.

In flight, when the FMC is not receiving the required fuel data, the CDU displays dashes and allows manual entry of fuel weight. Manual entry of fuel weight should continue approximately every 30 minutes for the remainder of the flight to keep gross weight current.

3 Zero Fuel Weight (ZFW)

Airplane zero fuel weight is required. Normally the ZFW is entered from the airplane dispatch papers and the FMC calculates the airplane gross weight.

Enter the airplane zero fuel weight.

Valid entry is xxx or xxx.x.

Calculated zero fuel weight is automatically displayed if airplane gross weight is entered first and fuel on board is valid.

4 RESERVES

Enter fuel reserves for the route.

Entry is required to complete the preflight.

Valid entry is xx or xx.x.

5 COST INDEX

The cost index is used to calculate ECON climb and cruise speeds. The value reflects the relative impacts on overall trip cost of fuel cost as compared to other direct hourly operating costs.

Enter the cost index for ECON calculations.

Entry is required to enable use of VNAV mode.

Valid entries are 0 to 500. 0 causes the ECON speed to be MAX RANGE; 500 results in a minimum time flight.

Entry of a company route on RTE page causes any company stored value of cost index to be automatically displayed. A manual entry has priority.

6 INDEX

Push – displays the INIT/REF INDEX page.

7 Trip/Cruise Altitude (TRIP/CRZ ALT)

Trip altitude is automatically computed and displayed whenever entries have been made for the ORIGIN, DEST, GROSS WT, and COST INDEX. Otherwise, the field is blank.

Trip altitude is the predicted minimum cost altitude determined by operator constraints. Provides crew a reference for selecting a planned cruise altitude.

Cruise altitude is required.

Enter the cruise altitude for the route.

Automatically displays this cruise altitude on the CLB, CRZ, and RTE Legs pages.

8 Cruise Wind (CRZ WIND)

Cruise wind entry provides input to optimize FMC calculations.

Enter the forecast cruise wind.

Entry is propagated onto the RTE DATA page.

If no entry made, the FMC assumes zero wind for preflight predictions.

9 ISA Deviation (ISA DEV)

ISA deviation entry provides input to optimize FMC calculations.

Entry causes T/C OAT to be computed and displayed.

Enter ISA deviation for top of climb altitude.

If no entry made, FMC assumes zero deviation.

Note: FMC Update U10.7 and later takes advantage of sensed static air temperature (SAT) to automatically provide updating of the MAX altitude. The revised temperature model applies after climbing 5000 feet above the departure runway elevation. Calculation of MAX altitude uses the actual ISA deviation derived from the actual sensed SAT projected up to the MAX and OPT altitude solutions. The temperature model prior to U10.7 is still applied below 5000 feet. T/C OAT or ISA DEV, if entered on the PERF INIT page, is used for the preflight planning forecast of MAX/OPT altitude.

[Option – With company data link]

9 Top of Climb Outside Air Temperature (T/C OAT)

T/C OAT entry provides input to optimize FMC calculations.

Entry causes ISA DEV to be computed and displayed.

Enter top of climb OAT.

If no entry made, FMC assumes ISA value.

Note: FMC Update U10.7 and later takes advantage of sensed static air temperature (SAT) to automatically provide updating of the MAX altitude. The revised temperature model applies after climbing 5000 feet above the departure runway elevation. Calculation of MAX altitude uses the actual ISA deviation derived from the actual sensed SAT projected up to the MAX and OPT altitude solutions. The temperature model prior to U10.7 is still applied below 5000 feet. T/C OAT, if entered on the PERF INIT page, is used for the preflight planning forecast of MAX/OPT altitude.

10 Top of Climb Outside Air Temperature (T/C OAT)

T/C OAT entry provides input to optimize FMC calculations.

Entry causes ISA DEV to be computed and displayed.

Enter top of climb OAT.

If no entry made, FMC assumes ISA value.

[Option – With company data link]

10 Transition Altitude (TRANS ALT)

Displays 18,000 feet at FMC power up.

Changes automatically after selecting a departure procedure with a different transition altitude.

[Option – FMC U11.0 and later]
Changes automatically when entering flight plan data based on the following criteria if a pilot entered value has not already been entered:

- the FMC will use the transition altitude from the NDB stored for the SID if the flight plan is active and a SID has been selected and a transition altitude exists for the SID.
- if an active flight plan exists and no transition altitude exists on the SID or a SID has not been selected, then the FMC will use the transition altitude from the NDB stored for the ORIGIN airport.
- if the transition altitude is not available from any of the sources above, then the FMC will default the transition altitude to 18000 feet or the value contained in a loaded custom performance defaults data base.

Manual entry has priority.

11 Transition Altitude (TRANS ALT)

Displays 18,000 feet at FMC power up.

[Option – FMC U11.0 and later]
Changes automatically when entering flight plan data based on the following criteria if a pilot entered value has not already been entered:

- the FMC will use the transition altitude from the NDB stored for the SID if the flight plan is active and a SID has been selected and a transition altitude exists for the SID.
- if an active flight plan exists and no transition altitude exists on the SID or a SID has not been selected, then the FMC will use the transition altitude from the NDB stored for the ORIGIN airport.
- if the transition altitude is not available from any of the sources above, then the FMC will default the transition altitude to 18000 feet or the value contained in a loaded custom performance defaults data base.

Manual entry has priority.

[Option – With company data link]
11 PERF INIT REQUEST

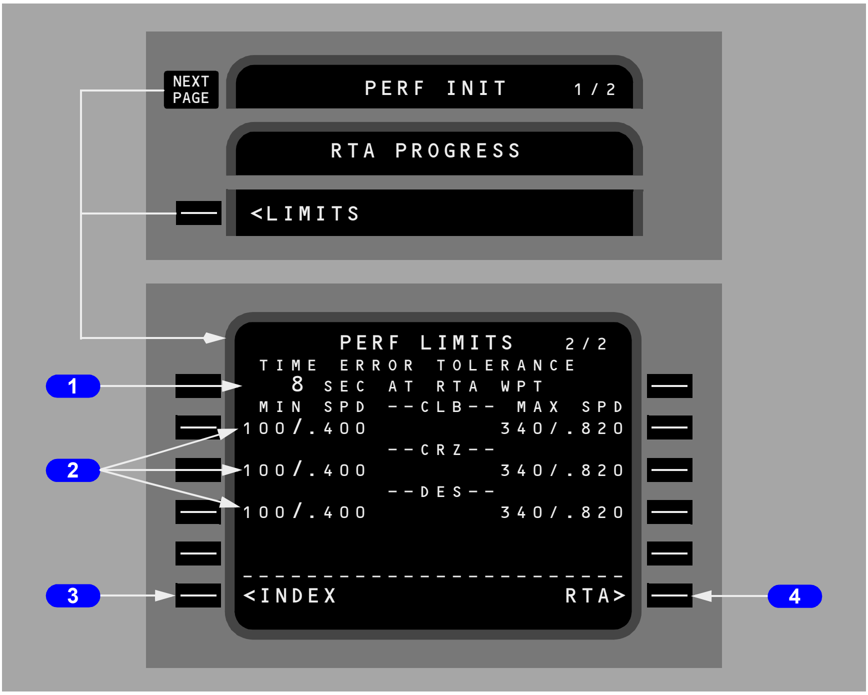
Push – transmits a data link request for a PERF INIT uplink

[Option – FMC U10.1 and later]
12 N1 LIMIT

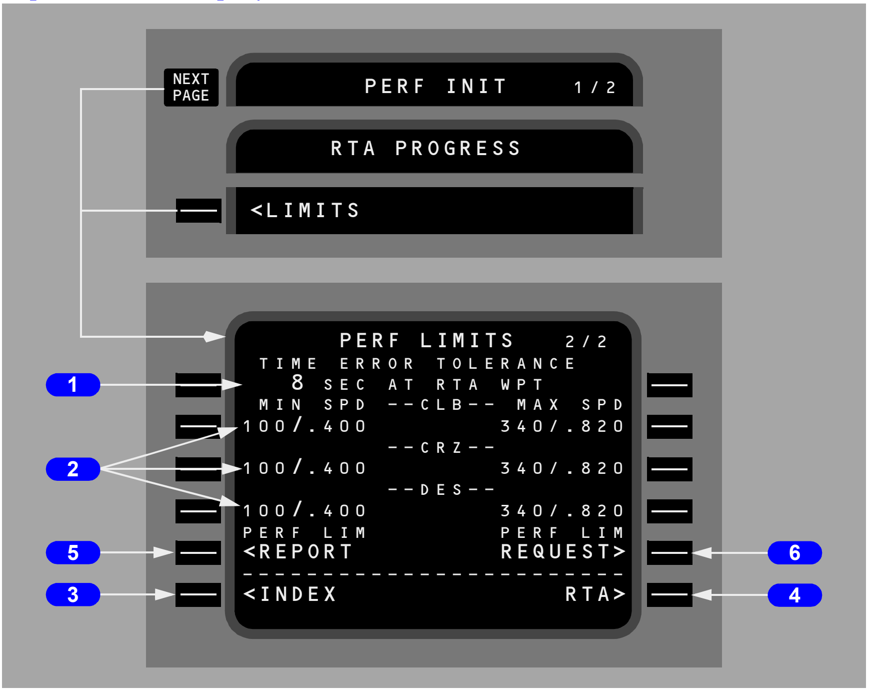
Push – displays the N1 LIMIT page.

Performance Limits Page

The performance limits page allows the entry of performance limits affecting RTA and ECON calculations.



[Option – With company data link]



1 **TIME ERROR TOLERANCE**

Used during RTA calculations to establish a boundary on computed speeds.

Valid entry range is from 5 to 30 seconds.

Default value is 30 seconds and is displayed in small font.

2 **Minimum Speed/Maximum Speed (MIN SPD/MAX SPD)**

Establishes lower and upper speed limits for each phase of flight.

Default is 100/.400 for lower limit and 340/.820 for upper limit. Default values are displayed in small font and entered values are displayed in large font.

Either CAS or Mach can be entered.

Limits both RTA and ECON modes in flight.

3 **INDEX**

Push – selects INIT /REF INDEX page.

4 **Required Time of Arrival (RTA)**

Push – selects RTA PROGRESS page.

[Option – With company data link]
5 **PERF LIM REPORT**

Push – transmits displayed performance limits to ground station.

[Option – With company data link]
6 **PERF LIM REQUEST**

Push – transmits a data link request for a performance limits uplink.

N1 LIMIT Page - Preflight

[Option – FMC U10.1 and later]

This section describes the preflight version of the N1 LIMIT page. See the FMC Takeoff and Climb section for a description of the in–flight version of the N1 LIMIT page.

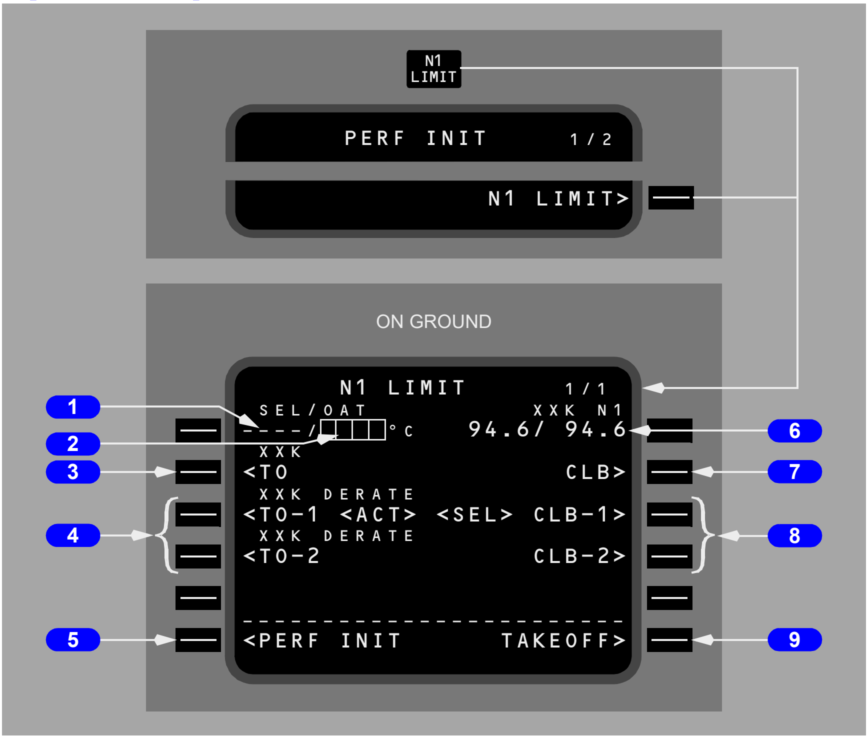
The N1 LIMIT page is used during preflight to manage takeoff and climb thrust. Temperature data is entered, allowing the FMC to make N1 computations for normal or reduced thrust takeoff. Fixed takeoff and climb thrust derates may be selected.

Note: If Probe Heat is applied to a non-aspirated TAT probe prior to OAT entry and the TAT temperature is excessively high, it can result in the FMC blanking the OAT box prompts on N1 LIMIT page. When Probe Heat is no longer applied, and after the TAT probe cools, the box prompts will return and an OAT entry may be made normally.

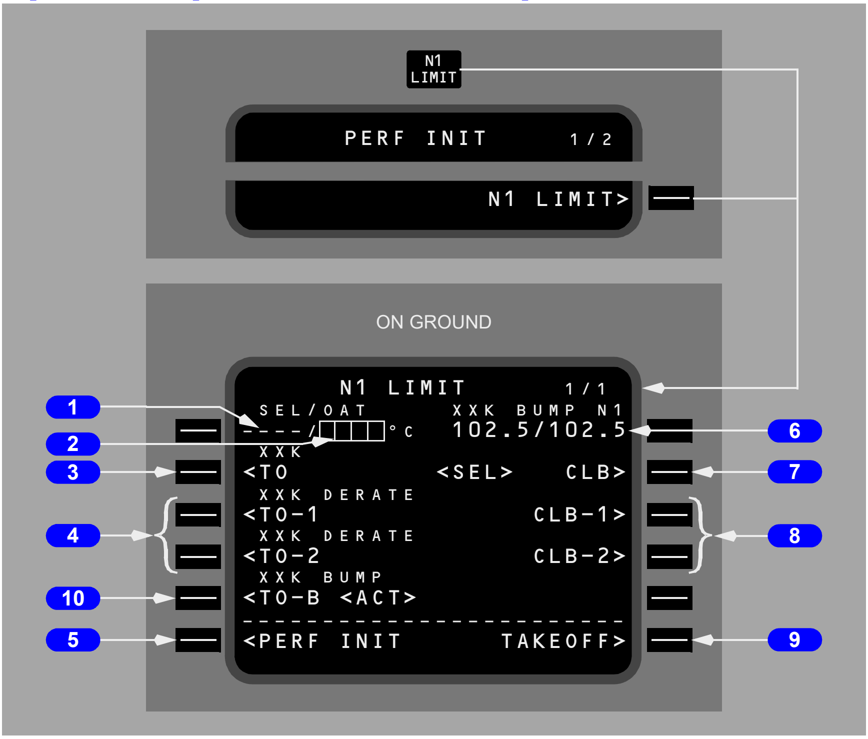
[Option – Takeoff bump thrust]

The N1 LIMIT page is also used to select a takeoff bump thrust setting to meet extra thrust requirements for takeoff at certain airports.

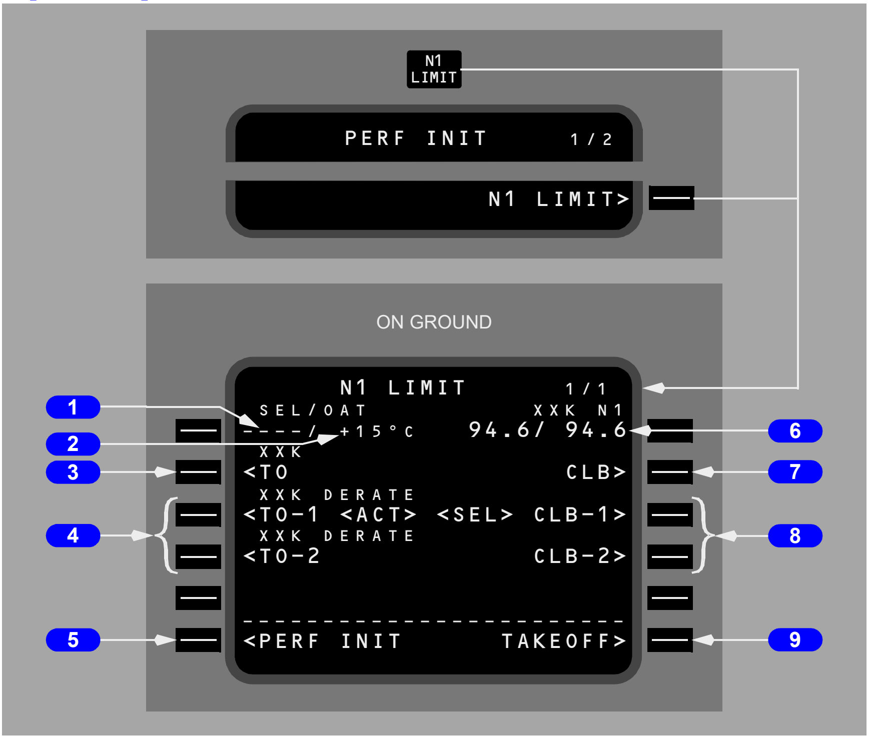
[Option – Non–aspirated TAT]



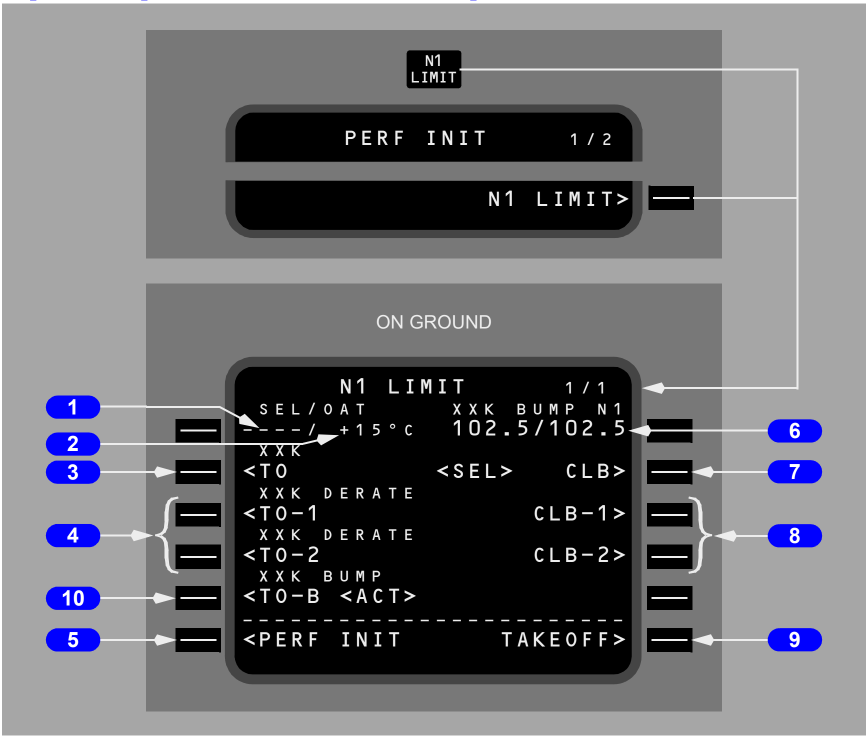
[Option – Non–aspirated TAT, with takeoff bump thrust]



[Option – Aspirated TAT]



[Option – Aspirated TAT, with takeoff bump thrust]



1 **Selected Temperature (SEL)**

Entry of an assumed temperature calculates a reduced thrust takeoff N1.

Entry can be made in degrees C or degrees F.

Maximum allowable entry is 70 degrees C (158 degrees F). The FMC, however, will limit the N1 to 25% takeoff reduction.

[Option – Aspirated TAT]

2 **Outside Air Temperature (OAT)**

Aspirated TAT displays the sensed OAT in small–size characters. Manual entry of actual takeoff OAT is displayed in large–sized characters.

Sensed or manually entered OAT is used by the FMC to calculate the takeoff N1 limits.

Entry can be made in degrees C or degrees F.

[Option – Non–aspirated TAT]

2 Outside Air Temperature (OAT)

Manual entry of actual takeoff OAT is displayed in large–sized characters and is used by the FMC to calculate the takeoff N1 limits.

Entry can be made in degrees C or degrees F.

3 Takeoff Thrust Limit (TO XXK)

Push – selects full rated takeoff thrust limit.

Selection of TO automatically selects CLB thrust.

Data line title displays full rated thrust. For example, typical line titles display as “24K” or “22K.”

Selection of a new rating after V speeds are selected on the TAKEOFF REF page causes the V speeds to display in small font, and the NO VSPD flag to show on the airspeed indication.

4 Takeoff Derates (TO–1 and TO–2)

Push – selects the associated takeoff thrust limit.

[Option – With company data link]
Takeoff data uplink may automatically select a thrust derate.

Data line title displays the associated reduced thrust rating. For example, typical line titles display as “22K DERATE” or “20K DERATE”

Normally, selecting TO–1 automatically arms CLB–1 and selecting TO–2 automatically arms CLB–2.

Note: If a reduced thrust takeoff has been specified, then either CLB–1 or CLB–2 may be automatically specified if required to avoid a climb N1 value greater than the specified reduced thrust takeoff N1.

Selection of a new rating after V speeds are selected on the TAKEOFF REF page causes the V speeds to display in small font, and the NO VSPD flag to show on the airspeed indication.

5 PERF INIT

Push – displays the PERF INIT page.

6 Takeoff N1 (XXK N1)

Displays the FMC computed N1 for takeoff

Data line title displays full rated thrust or selected takeoff derate thrust. Typical line titles display as “24K N1” or “22K N1”

Data line title changes to RED XXK N1 when an assumed temperature (SEL TEMP) entry results in a reduced N1 value. If a SEL TEMP and a DERATE are both selected the data line title will change to “RED XXK N1,” and the effect on thrust will be additive.

[Option – Takeoff bump thrust]
Data line title changes to XXK BUMP N1 when takeoff bump thrust is selected.

Data line title changes to 26B2 BUMP N1 when takeoff bump thrust is selected.

7 Climb (CLB)

Push – selects full rated climb thrust limit.

[Option – Automatic takeoff thrust reduction]
Climb thrust is automatically selected at the thrust reduction point on the TAKEOFF REF page 2.

8 Reduced Climb (CLB–1 and CLB–2)

Push – selects the associated reduced thrust climb mode.

CLB–1 provides a climb limit reduced by 3% N1 (approximately 10% thrust).
CLB–2 provides a climb limit reduced by 6% N1 (approximately 20% thrust).

Deletion results in the selection of CLB thrust.

Manual selection of a climb thrust rating overrides the automatic selection.

[Option – With company data link]
Takeoff data uplink may automatically select a thrust derate.

9 TAKEOFF

Push – displays the TAKEOFF REF page.

[Option]
10 Takeoff Bump Thrust (TO–B)

Push – selects takeoff bump thrust limit

Selection of TO–B automatically selects CLB thrust.

Data line title displays takeoff bump thrust. Typical line titles display as “26K BUMP” or “24K BUMP.”

When takeoff bump thrust is selected, assumed temperature (SEL temperature) thrust reduction is not available.

[Option – With company data link]
Takeoff data uplink may automatically select takeoff bump thrust.

Selecting Takeoff Thrust

Selecting the maximum takeoff thrust or a derate (TO, TO-1, TO-2) displays <ACT> inboard of the option. The FMC automatically selects the highest climb thrust available (CLB, CLB-1, CLB-2) which would not result in a thrust lever push, when the aircraft transitions from takeoff to climb. <SEL> is displayed inboard of the selected climb N1 limit.

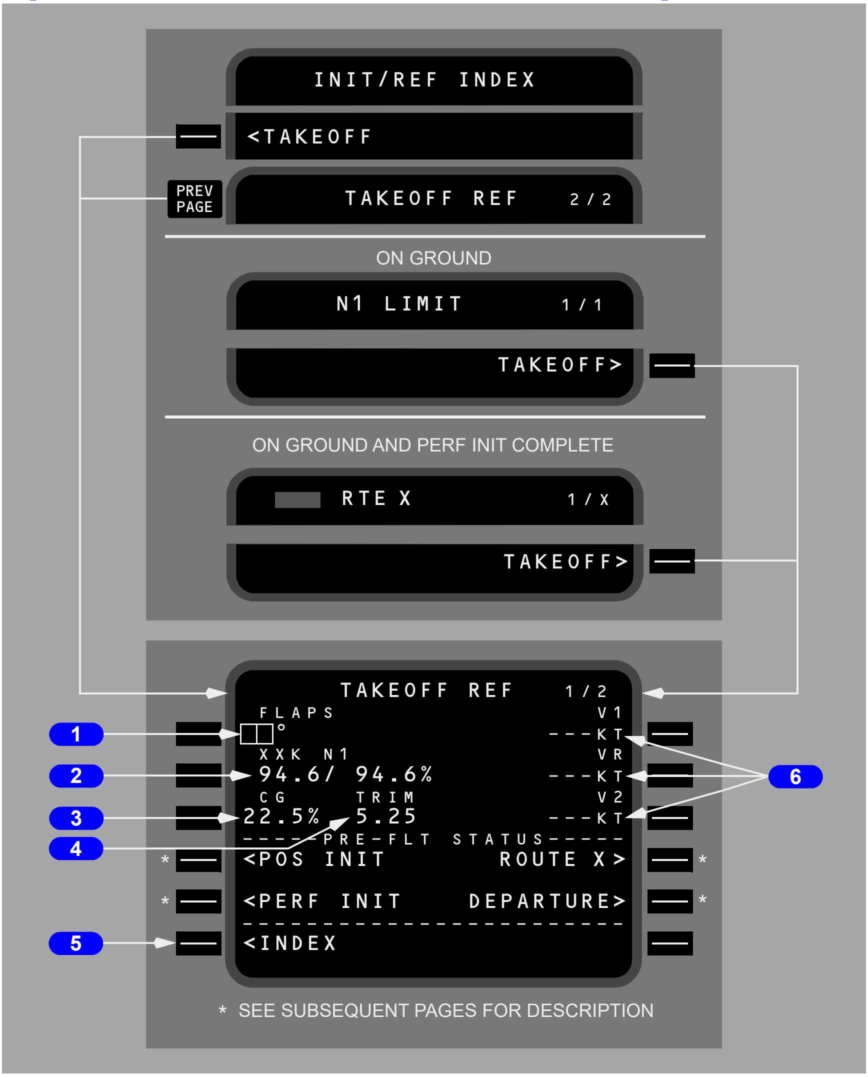
Takeoff Reference Page 1/2

The takeoff reference page allows the crew to manage takeoff performance.

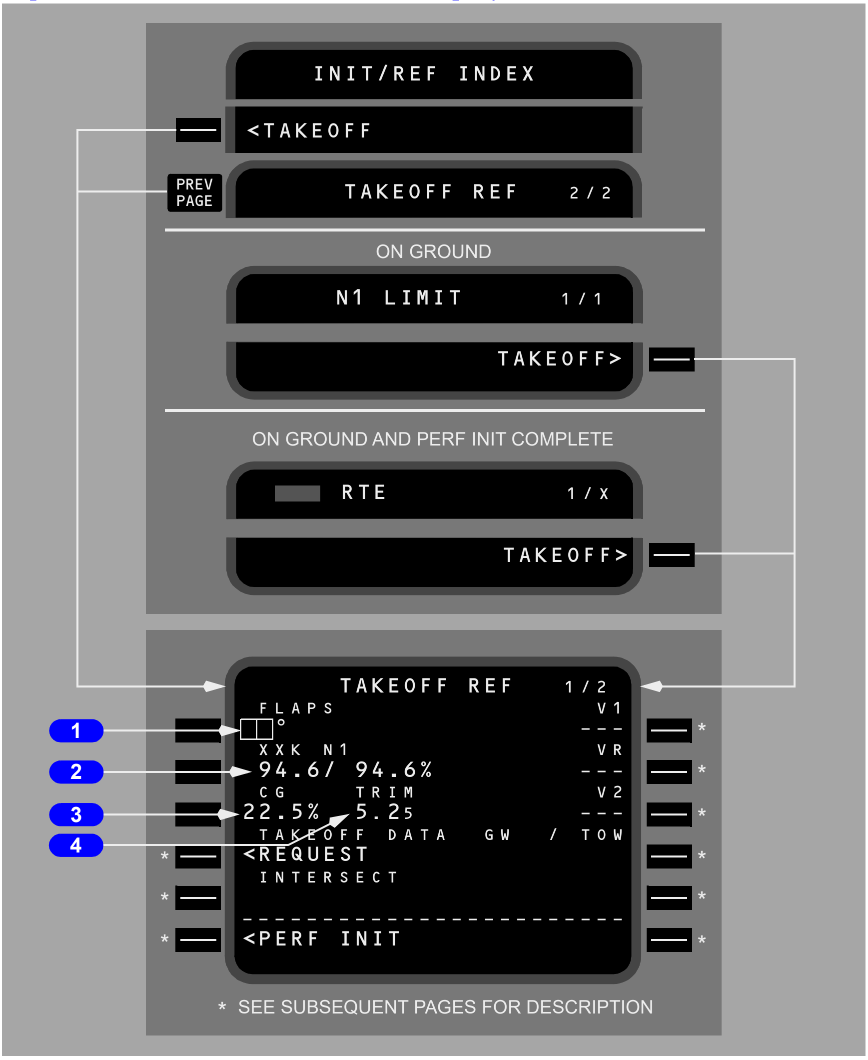
[Option – FMC U10.1 and later]
Takeoff flap setting and V speeds are entered and verified. Thrust limits, takeoff position, CG, and trim can be verified or changed.

Preflight pages are selectively displayed to indicate preflight status whenever required entries on those pages are incomplete. Takeoff reference page entries finish the normal preflight. V speeds should be set before completion. FMC position can be updated prior to takeoff.

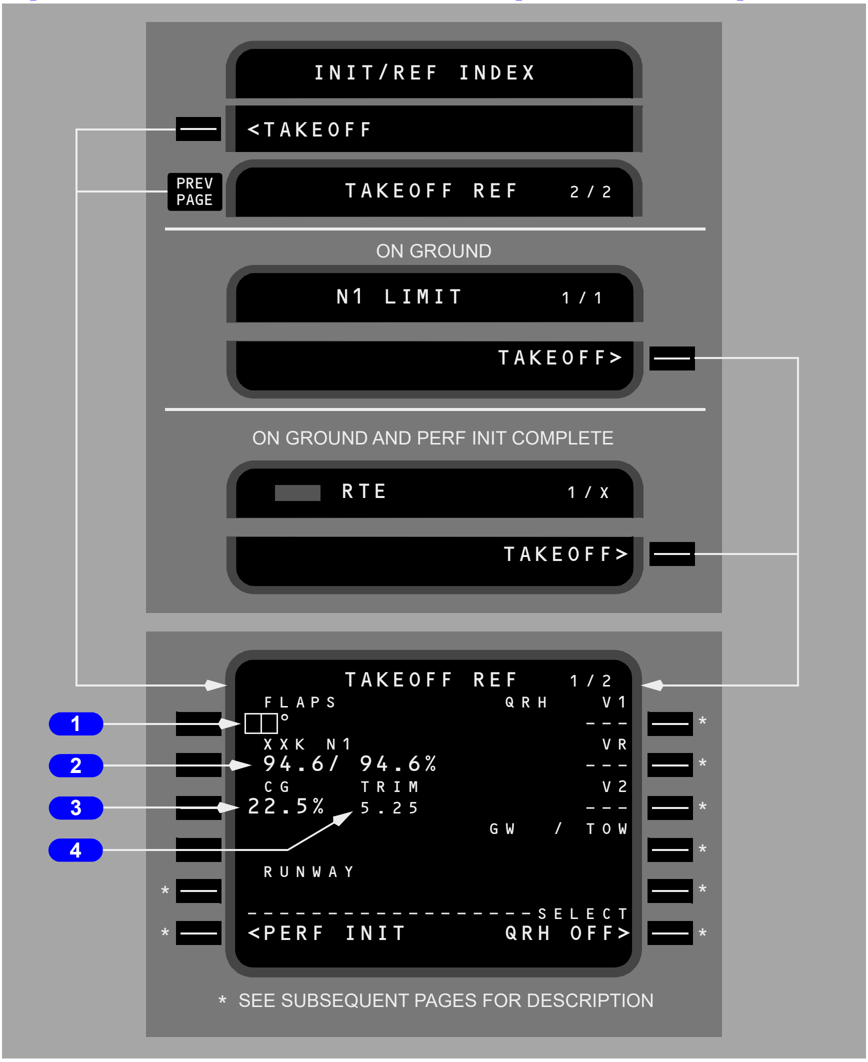
[Option – FMC U11.0 and later, without data link or takeoff speeds]



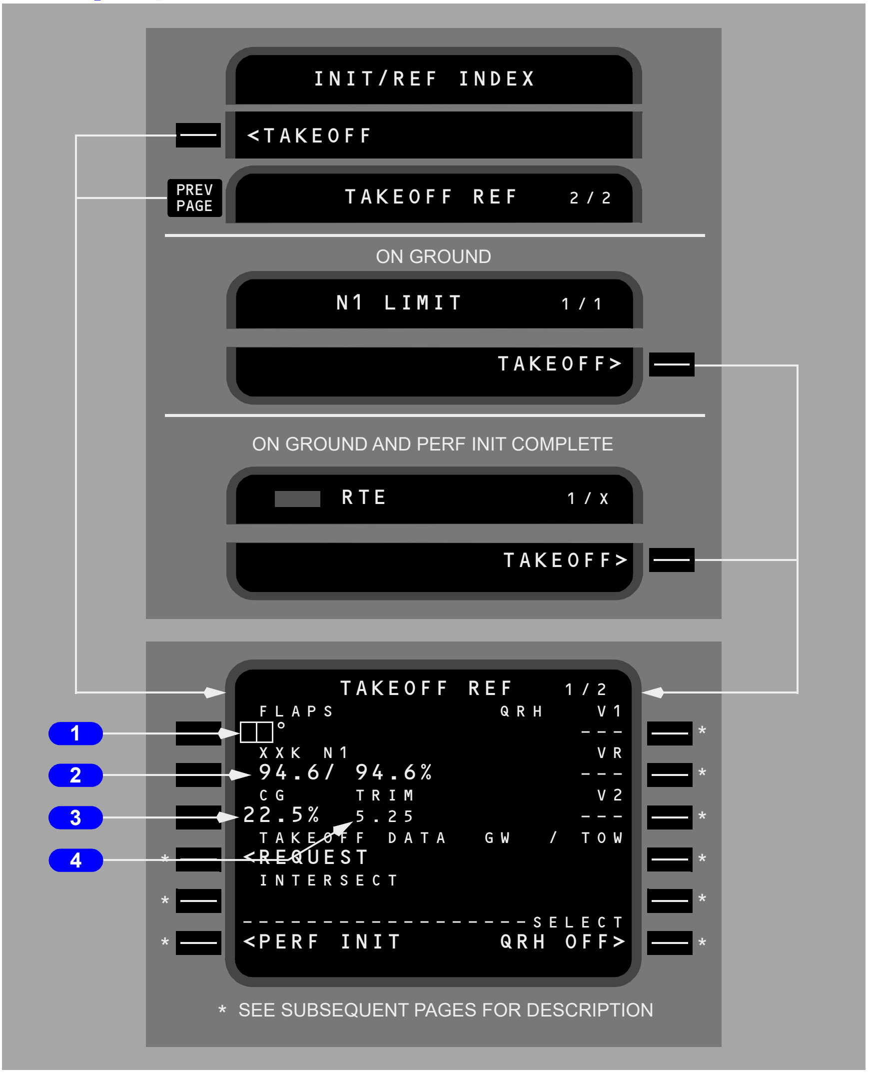
[Option – FMC U10.1 and later, with company data link]



[Option – FMC U10.1 and later, with FMC computed QRH takeoff speeds]



[Option – FMC U10.1 and later, with company data link and FMC computed QRH takeoff speeds]



1 **FLAPS**

Enter takeoff flaps setting. Manual entry of 1, 5, 10, 15, or 25 allowed.

2 **Takeoff N1 (XXK N1)**

Displays the FMC computed N1 for takeoff.

Data line title displays full rated thrust or selected takeoff derate thrust. Typical line titles display as “24K N1” or “22K N1.”

Data line title changes to RED XXK N1 when an assumed temperature (SEL TEMP) entry results in a reduced N1 value. If a SEL TEMP and a DERATE are both selected the data line title will change to "RED XXK N1," and the effect on thrust will be additive.

[Option – Takeoff bump thrust]
Data line title changes to XXK BUMP N1 when takeoff bump thrust is selected.

3 Center of Gravity (CG)

Initial display is dashes.

After CG is entered, the FMC calculates and displays stabilizer takeoff trim settings.

4 TRIM

Displays stabilizer takeoff trim setting.

Display is blank unless FLAPS and CG are entered.

[Option – FMC U10.1 and later without data link or takeoff speeds]
5 INDEX

Push – displays the INIT/REF INDEX page.

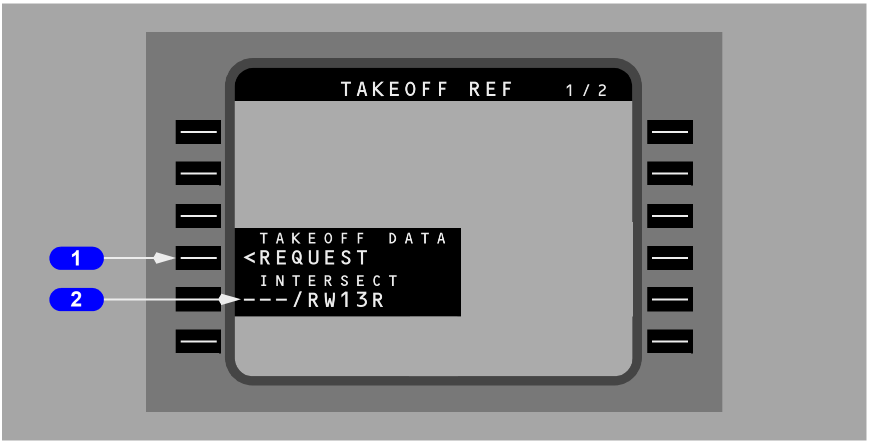
[Option – FMC U10.1 and later without data link or takeoff speeds]
6 V Speeds

Crew calculated V speeds may be entered and displayed for reference.

Entered V1 and VR will automatically display on the airspeed indication.

Company Data Link

[Option – With company data link]



1 TAKEOFF DATA REQUEST

Push – transmits a data link request for a takeoff data uplink. Resulting TAKEOFF REF uplink may contain takeoff data for up to 6 runways, which are stored in FMC uplink memory.

2 Intersection (INTERSECT)

Displays active runway.

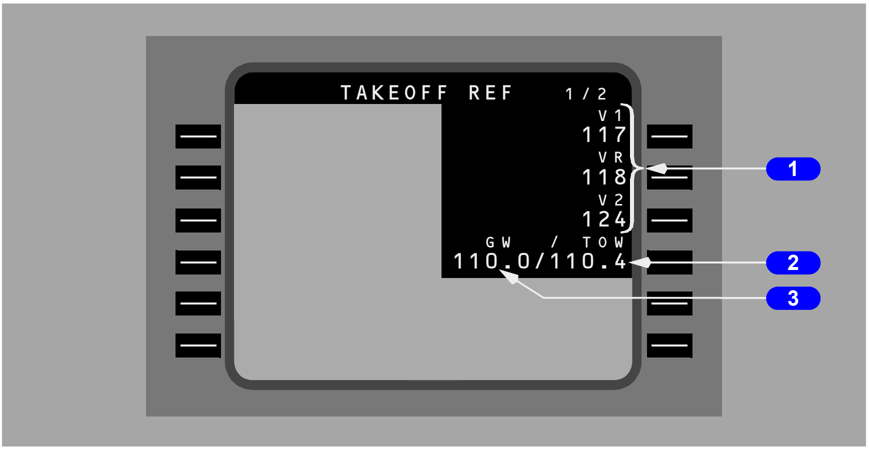
An intersection may be entered. Valid entries are 1 to 3 alphanumerics.

If an intersection is entered and TAKEOFF DATA REQUEST is made, the runway/intersection pair is included in the request downlink.

If the displayed runway or runway/intersection pair matches a runway or runway/intersection pair in FMC uplink memory, the associated TAKEOFF REF UPLINK is annunciated for flight crew ACCEPT/REJECT.

V Speed Data

[Option – With company data link, without FMC computed takeoff speeds]



1 V Speeds (V1, VR, and V2)

Crew calculated V speeds may be entered and displayed for reference.

V speeds may be uplinked.

Large font V speeds are displayed on the airspeed indication.

2 Takeoff Weight (TOW)

Displays gross weight the uplink V speeds are based on.

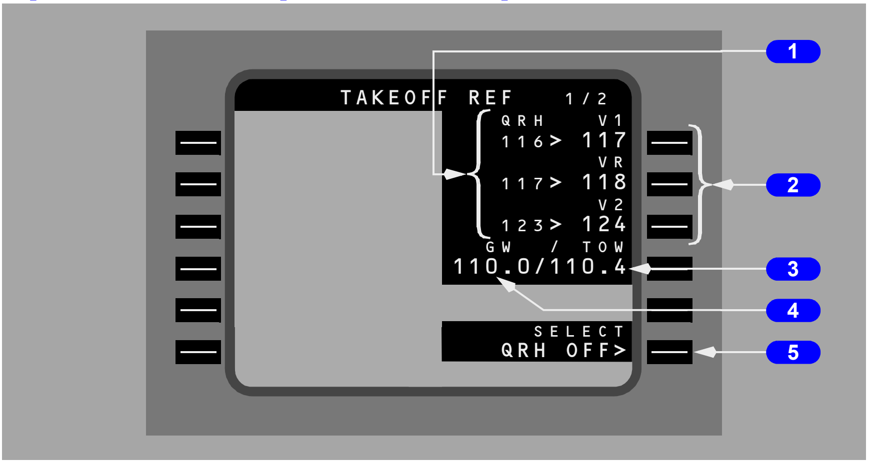
Blank if there are no uplinked V speeds in the column above.

3 Gross Weight (GW)

Displays current gross weight.

FMC Computed V Speed Data

[Option – With FMC computed QRH takeoff speeds]



[Option – With FMC computed QRH takeoff speeds]

1 QRH

Displays FMC computed V speeds, based on assumed temperature, current gross weight and flap setting.

2 V Speeds (V1, VR, and V2)

Push – selects associated FMC computed V speed from center column.

Manual entry may be made.

Large font V speeds are displayed on the airspeed indication.

3 Takeoff Weight (TOW)

Displays gross weight that the large font V speeds in the column above are based on.

Blank if there are no large font V speeds in the column above.

4 Gross Weight (GW)

Displays current gross weight.

FMC computed V speeds in the column above are based on this weight.

[Option – With FMC computed QRH takeoff speeds]

5 Select FMC Computed V Speeds On/Off (SELECT QRH ON/OFF)

When SELECT QRH OFF displayed

- Push – Removes FMC computed V speeds from display.

When SELECT QRH ON displayed

- Push – Displays FMC computed V speeds.

Default is FMC Computed V speeds displayed.

Change of Performance Data After V Speed Entry

V speeds should be entered on the TAKEOFF REF page as a final step of FMC preflight. If V speeds are entered and then performance data (for example, OAT or takeoff thrust) is subsequently changed, the FMC automatically removes the previously entered V speeds and the NO VSPD flag shows on the airspeed indication.

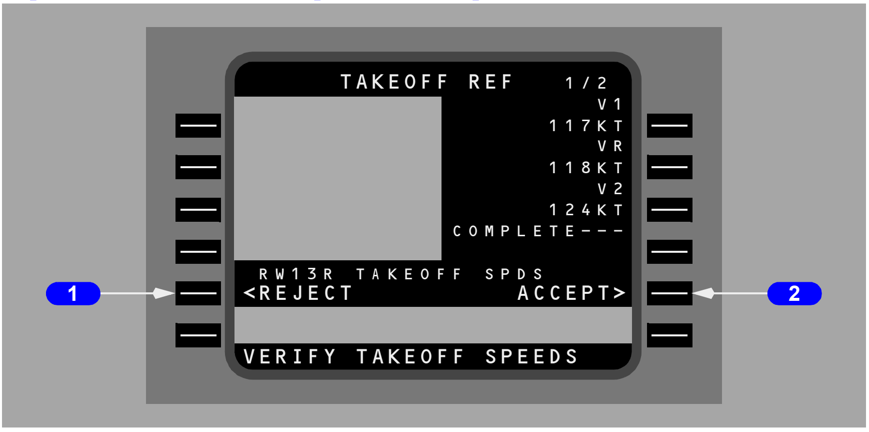
In addition, the scratchpad message VERIFY TAKEOFF SPEEDS displays if any of the following items are changed after V speeds have been entered:

- gross weight
- zero fuel weight
- plan fuel.

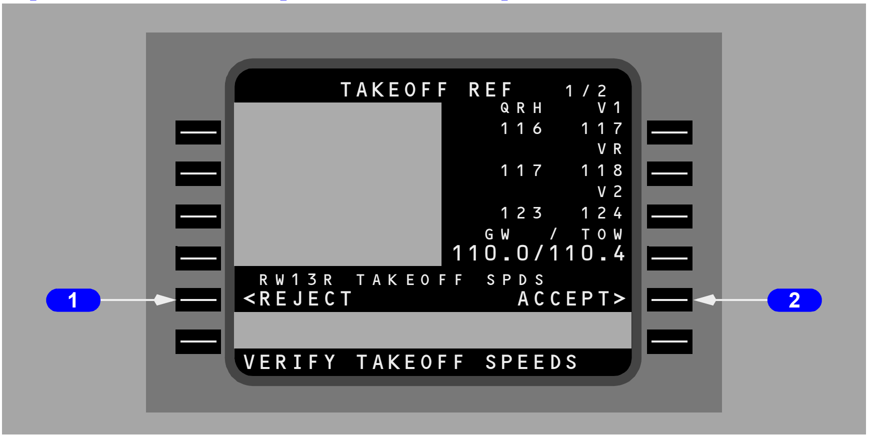
[Option – Without company data link or FMC computed takeoff speeds]
The FMC allows the flight crew to re-display the previously entered V speeds.

[Option – With company data link or FMC computed takeoff speeds]
The previously entered V speeds are displayed in small font on the TAKEOFF REF page.

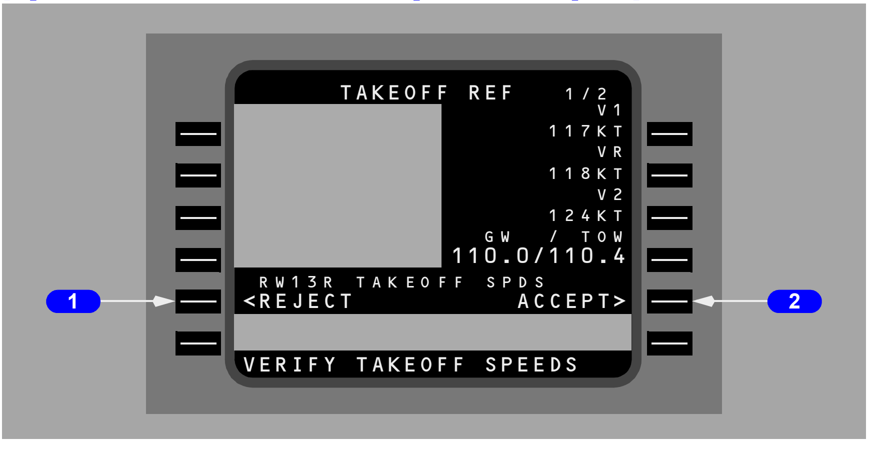
[Option – Without FMC computed takeoff speeds]



[Option – With FMC computed QRH takeoff speeds]



[Option – Data link without FMC computed takeoff speeds]



1 REJECT

[Option – With plan fuel]
Displayed if V speeds have been entered and airplane gross weight, ZFW, or plan fuel has been changed.

[Option – Without plan fuel]
Displayed if V speeds have been entered and airplane gross weight or ZFW has been changed.

Push – causes the now small font takeoff speeds to disappear.

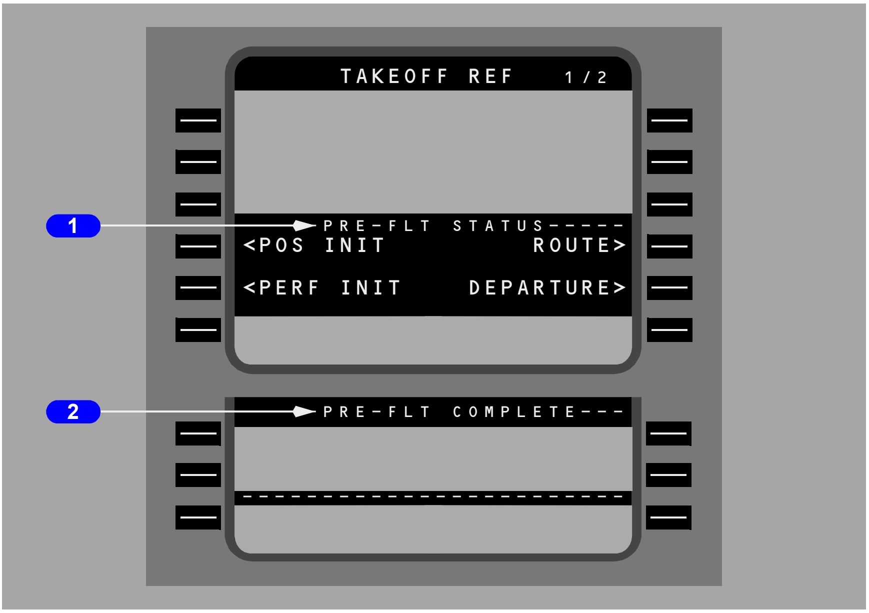
2 ACCEPT

[Option – With plan fuel]
Displayed if V speeds have been entered and airplane gross weight, ZFW, or plan fuel has been changed.

[Option – Without plan fuel]
Displayed if V speeds have been entered and airplane gross weight or ZFW has been changed.

Push – changes the small font takeoff speeds to large font.

Preflight Status



1 Preflight Status (PRE–FLT STATUS)

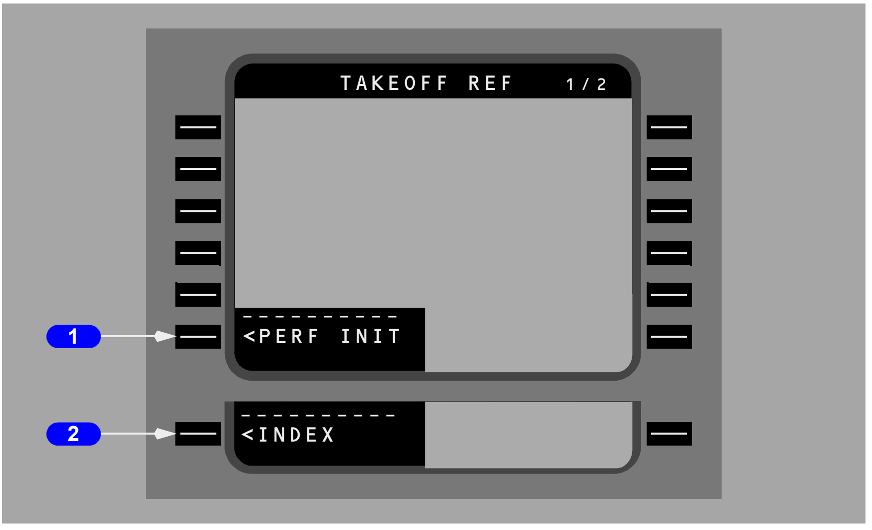
Displays when required preflight data is not complete. Lines below are selectively displayed to allow line selection of incomplete pages;

- POS INIT shows if a valid IRS position entry disagrees with the position determined by any IRS in the ALIGN mode; otherwise blank
- PERF INIT shows if any required PERF INIT entries not completed; otherwise blank
- ROUTE shows if a route is not active; otherwise blank
- DEPARTURE shows if RTE page displays prompts for RUNWAY and VIA lines; otherwise blank.

[Option – FMC U10.1 and later]
- N1 LIMIT shows if valid OAT has not been entered.

2 Preflight Complete (PRE–FLT COMPLETE)

Displayed following completion of required entries on the POS INIT, RTE, and PERF INIT pages.



1 Preflight Incomplete

When required preflight entries are not complete, the related page title displays
- POS INIT – IRS position not entered or invalid
- PERF INIT – required performance data not entered or executed
- ROUTE – required RTE page data not entered
- DEPARTURE – runway or route data not entered on the RTE page.

[Option – Non–aspirated TAT]
- N1 LIMIT – OAT not entered.

Push – Displays associated page.

2 Preflight Complete (INDEX)

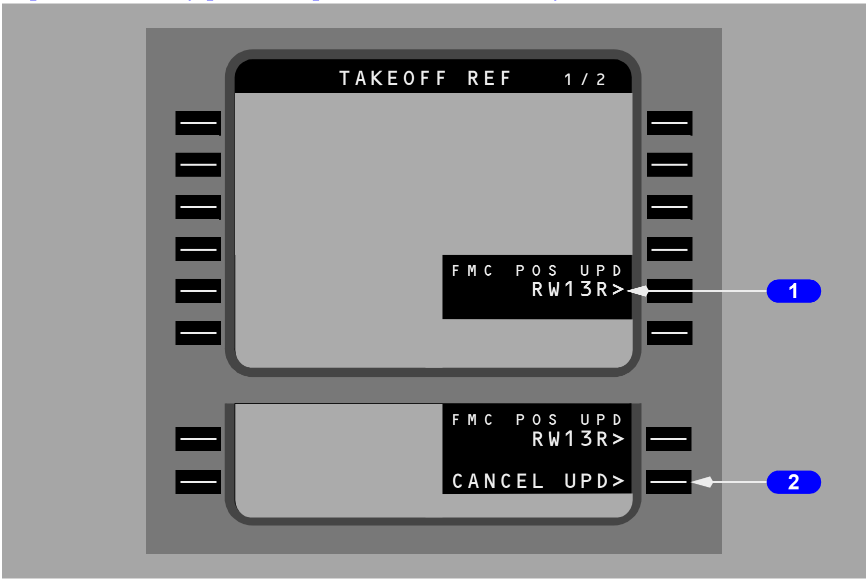
When the required preflight entries are complete, the index prompt is displayed below the takeoff reference page data. When required preflight entries are not complete, the related page title replaces the INDEX prompt.

Displayed following completion of required preflight entries on the POS INIT, RTE, and PERF INIT pages.

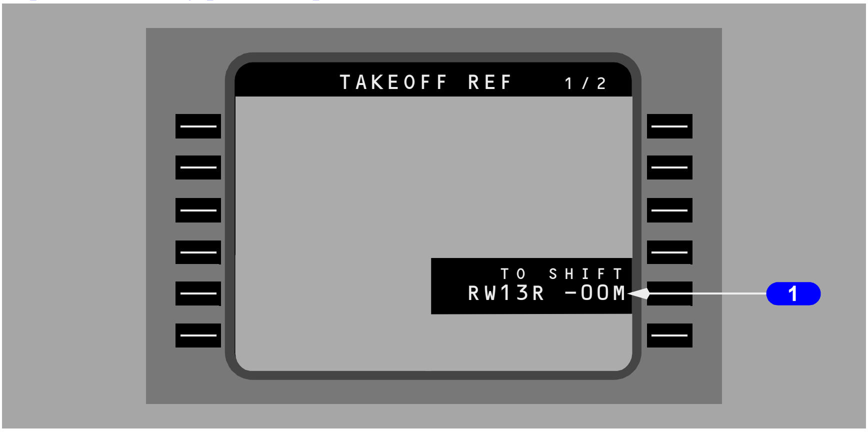
Push – Displays INIT REF INDEX page.

FMC Takeoff Position Update

[Option – Runway position update via the CDU only]



[Option – Runway position update with TO/GA activation, meters]



[Option – Runway remaining update with TO/GA activation, feet]

[Option – Runway position update via the CDU only]

1 FMC Position Update (FMC POS UPD)

Displayed automatically on the ground when preflight complete and a departure runway is entered into the active route.

Selection illuminates the execute key and displays the CANCEL UPDATE prompt on line 6R.

Execution updates the computed FMC position to the threshold of the departure runway.

[Option – Runway position update with TO/GA activation, FMC U10.2 and later]

1 Takeoff Shift (TO SHIFT)

Automatically displays the departure runway from the route page.

If a takeoff shift distance is not entered and GPS UPDATE is OFF, the FMC updates to the runway threshold when TO/GA is pushed.

If a takeoff shift distance is entered and GPS UPDATE is OFF, the FMC updates to the threshold of the departure runway plus the entered distance when the TO/GA switch is pushed.

TO/GA position update inhibited if GPS UPDATE is ON.

Following TO/GA update, the runway identifier and any entered shift value are highlighted in reverse video characters.

To remove a TO SHIFT entry, reselect RWY on the RTE page.

[Option – Runway remaining update with TO/GA activation, FMC U10.2 and later]

1 Runway Remaining (RWY REMAIN)

Automatically displays the departure runway from the RTE page.

If a runway remaining distance is not entered and GPS UPDATE is OFF, the FMC updates to the runway threshold when TO/GA is pushed.

If a runway remaining distance is entered and GPS UPDATE is OFF, the FMC updates to the runway length remaining when the TO/GA switch is pushed.

With valid GPS reception,TO/GA position update inhibited if GPS UPDATE is ON.

Following TO/GA update, the runway identifier and any entered shift value are highlighted in reverse video characters.

To remove a RWY REMAIN entry, reselect RWY on RTE page.

[Option – Runway position update via the CDU only]

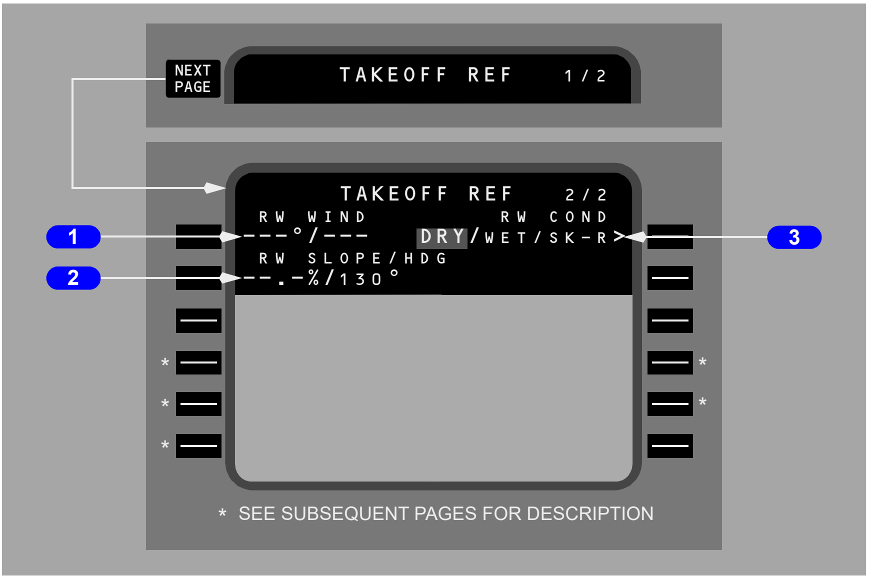
2 Cancel Update (CANCEL UPD)

Displayed after line selection of the FMC POS UPD prompt.

Push – clears the prompt, cancels the position update armed condition, and extinguishes the execute key light.

Takeoff Reference Page 2/2

[Option – FMC U10.1 and later, with company data link or FMC computed takeoff speeds]



1 Runway Wind (RW WIND)

Enter surface wind direction and speed.

Entry is optional for preflight completion.

2 Runway Slope/Heading (RW SLOPE/HDG)

Enter runway slope.

Entry is optional for preflight completion.

Valid runway slope is U or + for up or D or – for down followed by slope in percent gradient.

HDG displays runway heading for origin airport.

3 Runway Condition (RWY COND)

Active runway condition is highlighted:

- DRY – Dry runway computations
- WET – Wet runway computations
- SK–R – Skid resistant runway computations

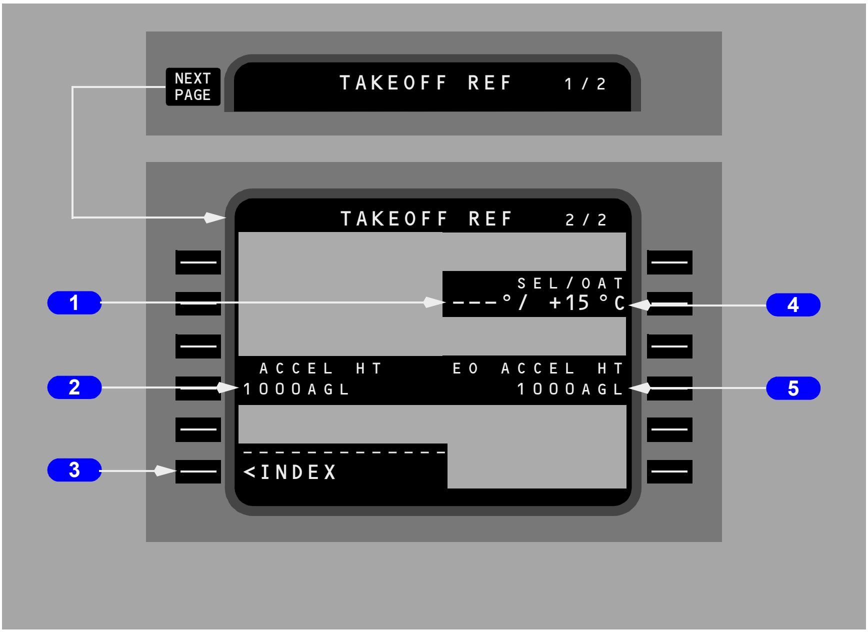
Default condition is DRY.

[Option – With company data link and FMC computed takeoff speeds]
Runway condition can be selected by the flight crew or uplinked.

[Option – With company data link]
The runway condition can be viewed by flight crew and shows under what conditions the uplinked V Speeds have been computed for. The runway condition is displayed for reference only and cannot be changed by the flight crew.

[Option – With FMC computed takeoff speeds]
Runway condition can be selected by the flight crew.

Takeoff Thrust



1 **Selected Temperature (SEL)**

Entry of an assumed temperature calculates a reduced thrust takeoff N1.

Entry can be made in degrees C or degrees F.

Maximum allowable entry is 70 degrees C (158 degrees F). The FMC, however, will limit the N1 to 25% takeoff reduction.

Repeats data shown on the preflight version of the N1 LIMIT page.

2 **Acceleration Height (ACCEL HT)**

Displays acceleration height altitude above origin airport elevation for flap retraction.

Default value is from the airline.

Entry is optional. Value is a height from 400 to 9999 feet.

3 INDEX

Push – displays the INIT/REF INDEX page.

4 Outside Air Temperature (OAT)

Aspirated TAT displays the sensed OAT in small–size characters. Manual entry of actual takeoff OAT is displayed in large–sized characters.

Sensed or manually entered OAT is used by the FMC to calculate the takeoff N1 limits.

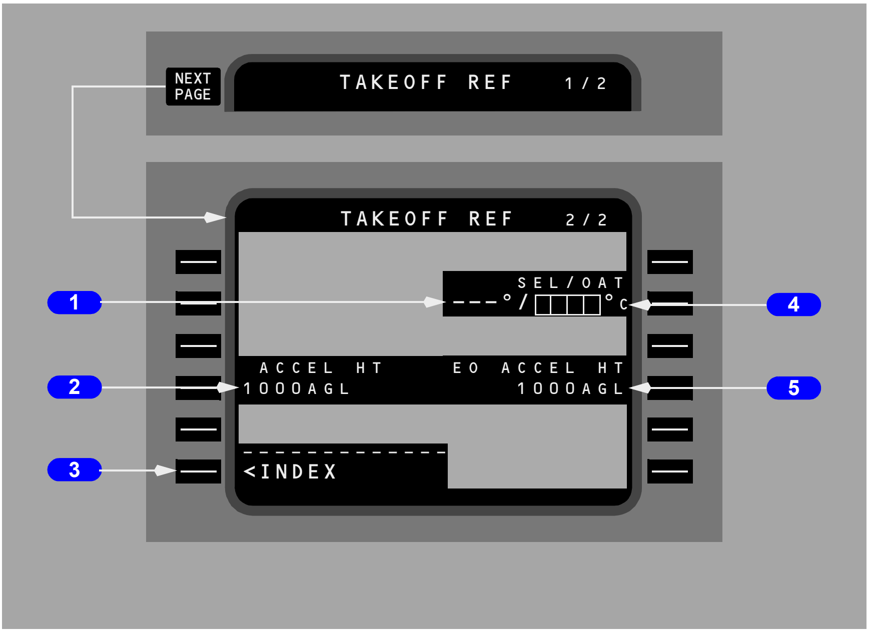
Entry can be made in degrees C or degrees F.

5 Engine Out Acceleration Height (EO ACCEL HT)

Displays acceleration height altitude above origin airport elevation for flap retraction with an engine out.

Default value is from the airline.

Entry is optional. Value is a height from 400 to 9999 feet.



1 Selected Temperature (SEL)

Entry of an assumed temperature calculates a reduced thrust takeoff N1.

Entry can be made in degrees C or degrees F.

Maximum allowable entry is 70 degrees C (158 degrees F). The FMC, however, will limit the N1 to 25% takeoff reduction.

Repeats data shown on the preflight version of the N1 LIMIT page.

2 Acceleration Height (ACCEL HT)

Displays acceleration height altitude above origin airport elevation for flap retraction.

Default value is from the airline.

Entry is optional. Value is a height from 400 to 9999 feet.

3 INDEX

Push – displays the INIT/REF INDEX page.

4 Outside Air Temperature (OAT)

Manual entry of actual takeoff OAT is used by the FMC to calculate the takeoff N1 limits.

Entry can be made in degrees C or degrees F.

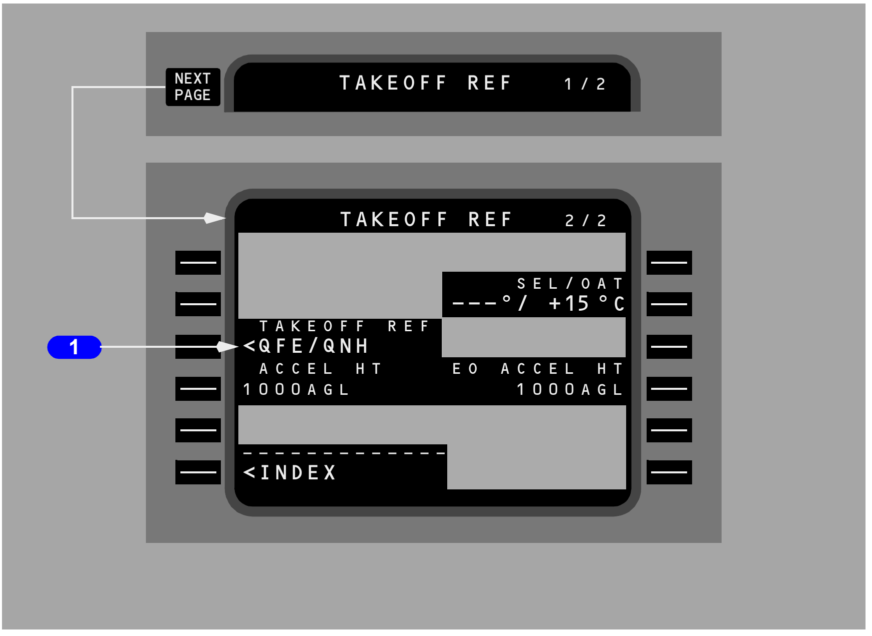
5 Engine Out Acceleration Height (EO ACCEL HT)

Displays acceleration height altitude above origin airport elevation for flap retraction with an engine out.

Default value is from the airline.

Entry is optional. Value is a height from 400 to 9999 feet.

Takeoff Reference



1 Takeoff Reference (TAKEOFF REF)

Push – Toggles altimeter reference between QFE and QNH.

Default is QNH.

Resets to QNH at flight complete.

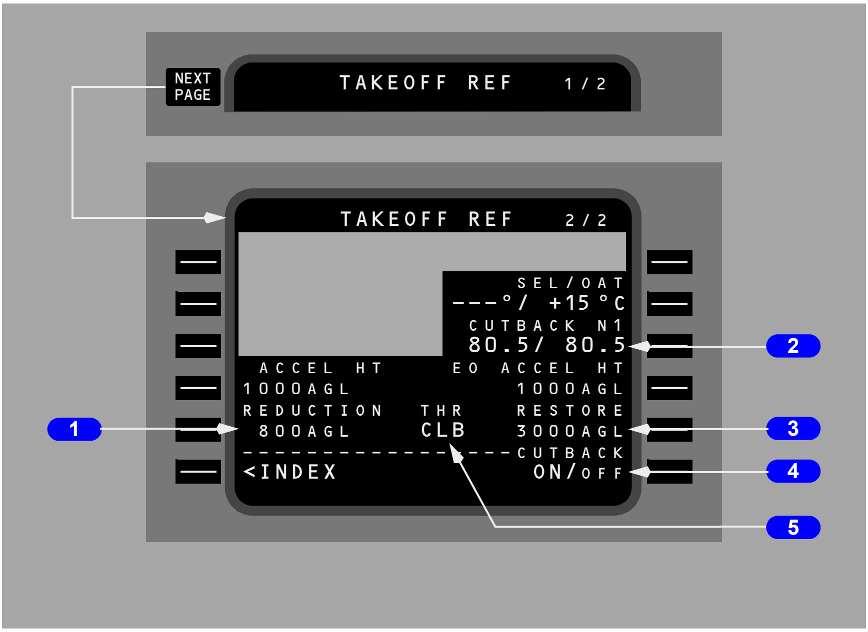
Reflects LANDING REF selection on APPROACH REF page.

Active altimeter reference is highlighted.

During preflight with QFE selected, the PFD altitude indications show zero feet at the departure runway threshold. The PFD altitude indication background colors change to green.

If QFE is the current altimeter reference, and the EFIS control panel STD switch is pushed, the takeoff reference automatically changes to QNH.

Cutback Mode



1 REDUCTION

With cutback mode OFF, altitude above origin airport elevation at which the autothrottle reduces from takeoff N1 to climb N1.

With cutback mode ON, altitude above origin airport elevation at which the transition from takeoff thrust to cutback thrust occurs.

Manual entries allowed on the ground.

The default value is determined by the airline and is stored in the model/engine database. The default is displayed in small font.

2 CUTBACK N1

FMC calculated cutback N1.

Prior to takeoff, if the FMC is unable to calculate the cutback N1 using the entered data, CUTBACK UNAVAILABLE displays.

3 RESTORE

The altitude at which the selected climb thrust is restored.

4 CUTBACK ON/OFF

Push – selects cutback mode ON/OFF.

Currently selected cutback mode is displayed in large font.

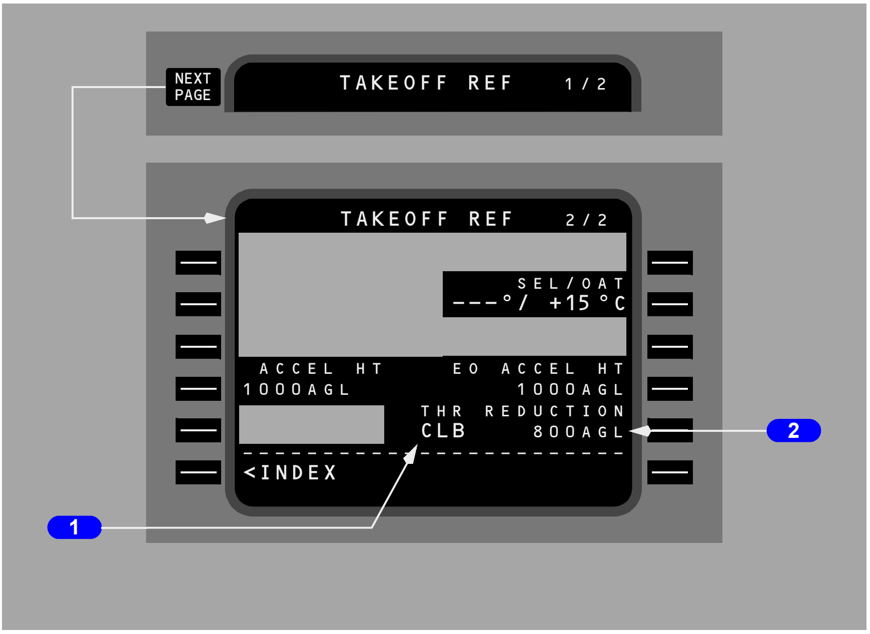
Default is cutback mode OFF.

5 Selected Climb Rating

Displays the climb rating that will be set at the THR REDUCTION altitude, as selected on the preflight version of the N1 LIMIT page.

Automatic Thrust Reduction

[Option – U10.7 and above with automatic takeoff thrust reduction]



1 Selected Climb Rating

Displays the climb rating that will be set at the THR REDUCTION altitude, as selected on the preflight version of the N1 LIMIT page.

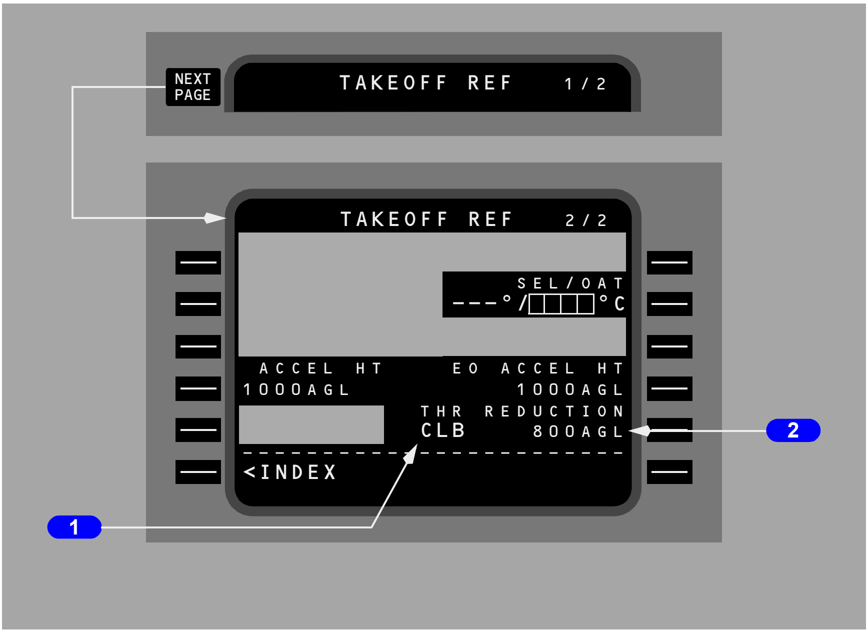
2 Thrust Reduction (THR REDUCTION)

Altitude above origin airport elevation at which the autothrottle reduces from takeoff N1 to climb N1.

The default value is determined by the airline and is stored in the model/engine database. The default is displayed in small font.

Manual entries allowed on the ground. Entries must be between 800 to 9,999 feet and are displayed in large font.

Deletion of a manual entry returns the display to the default value.



1 Selected Climb Rating

Displays the climb rating that will be set at the THR REDUCTION altitude, as selected on the preflight version of the N1 LIMIT page.

2 Thrust Reduction (THR REDUCTION)

Altitude above origin airport elevation at which the autothrottle reduces from takeoff N1 to climb N1.

The default value is determined by the airline and is stored in the model/engine database. The default is displayed in small font.

Manual entries allowed on the ground. Entries must be between 800 to 9,999 feet and are displayed in large font.

Deletion of a manual entry returns the display to the default value.

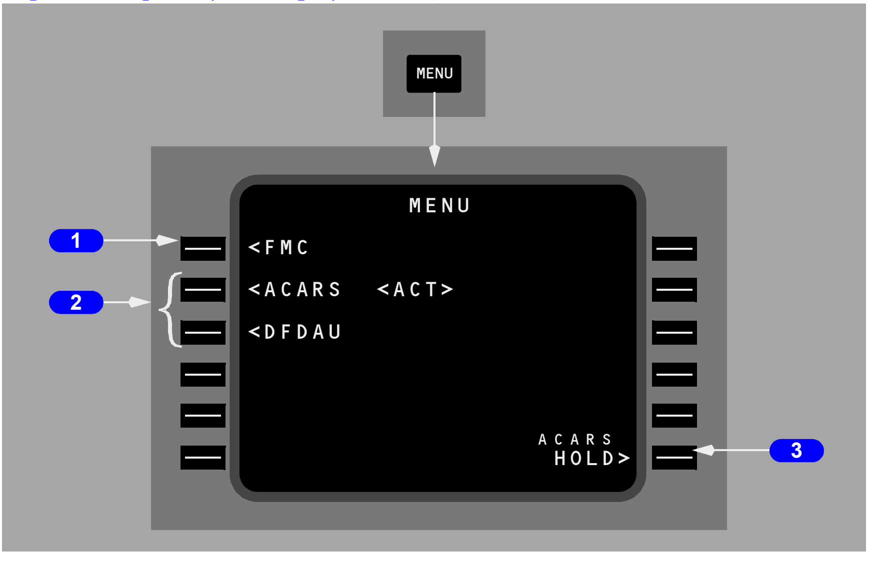
Menu Page

[Option – MCDU]

The menu page is selected with the MENU key or is automatically displayed when the currently active subsystem fails or on initial power up if the FMC system is not detected.

The menu page displays subsystems (ACARS, DFDAU, etc.) that require control/display functions through the MCDU and provides a means to temporarily access to these subsystems. The active system is indicated by <ACT> displayed next to the system title. A subsystem that requires use of the CDU displays a request message <REQ> next to the subsystem title. The FMC system or a requesting subsystem is accessed by using the line select key next to the title. The FMC can be reselected by selecting the FMC prompt on the MENU page or selecting any mode key (INIT/REF, RTE, etc.). A subsystem can be temporarily placed on hold <HLD> by selecting the subsystem XXXXXX HOLD> line select key returning the CDU display to the currently active FMC page (XXXXXX represents the system name). While the subsystem is on hold the MCDU CALL light is illuminated. To reselect the subsystem on hold, push the subsystem line select key again. When a subsystem is placed on hold a XXXXXX LOGOFF prompt appears to allow for release of the subsystem being held. No more than one subsystem can be selected at a time. If an attempt is made to select more than one subsystem, a FIRST LOGOFF XXXXXX prompt is displayed as a reminder to logoff the currently active subsystem.

[Option – Liquid crystal display MCDU]



1 FMC

Push – selects FMC as the system for which the MCDU will be active in providing control/display function.

2 Other Aircraft Subsystems (typical)

Push – selects the subsystem for which the MCDU will be active in providing control/display function.

3 XXXXXX HOLD/LOGOFF

Push - places active subsystem on hold or logs off subsystem and returns control to the FMC.

Intentionally
Blank

Flight Management, Navigation — Chapter 11
FMC Takeoff and Climb — Section 41

Introduction

The FMC takeoff phase begins with the selection of takeoff/go–around (TO/GA). Preparation for this phase begins in the preflight phase and includes entry of the TAKEOFF REF page data.

The takeoff phase automatically changes to the climb phase when climb thrust is selected. The climb phase continues to the top of climb point, where the cruise phase begins.

During these phases, the following pages are normally used:

- TAKEOFF REF page – to make last minute changes to the departure runway
- DEPARTURES page – to make last minute changes to the SID
- CLIMB page – to modify climb parameters and monitor airplane climb performance
- RTE LEGS page – to modify the route and monitor route progress
- PROGRESS page – to monitor the overall progress of the flight
- N1 LIMIT page – to select alternate climb thrust limits
- DEP/ARR INDEX page – to select an approach during a turn–back.

Takeoff Phase

When last minute changes are made to the departure runway and SID, the TAKEOFF REF and DEPARTURES pages must be modified to agree. The modifications are performed the same as during preflight.

With correct takeoff parameters, the FMC commands the selected takeoff thrust when the TO/GA switch is pushed. During the takeoff roll, the autothrottle commands the thrust and the FMC commands acceleration to between V2+15 and V2+25 knots.

LNAV can be armed prior to takeoff. Prior to 50 feet radio altitude, roll command is wings level. At 50 feet radio altitude, if within engagement criteria, LNAV engages and provides roll commands to fly the route leg. VNAV may be engaged to control the climb profile.

Note: For LNAV to be armed on the ground, the departure runway must be selected and the course, to the first waypoint, must be within 5 degrees of the runway heading.

VNAV Armed for Takeoff

[Option – FMC U10.7 and later]
VNAV may be armed on the MCP prior to takeoff provided the following requirements have been met:

- a valid flight plan has been entered
- performance data has been entered and executed
- both flight director switches have been switched on
- NG aircraft equipped with Collins P4 FCC or later; or Honeywell -710 FCC or later; and CDS BP06 software.

Note: If an older version of FCC or CDS software is installed, VNAV will not engage nor arm on the ground.

Target Speeds will follow the profile listed in the Climb Phase.

[Option – FMC U10.8 and later]
The CDS will annunciate VNAV armed on the FMA when VNAV is selected prior to takeoff and it is capable of being armed. On takeoff and after reaching 400 feet above the runway, the FCC will automatically engage VNAV if armed.

VNAV Takeoff -One Engine Out

During the all engine takeoff flight phase, VNAV will be enabled to automatically adjust the target airspeed profile upon engine out detection.

If a single engine failure is detected while in the VNAV takeoff flight phase (for all engines) and below the engine out takeoff acceleration height, the FMC will calculate and issue a target speed equal to the greater of current airspeed or V2 limited to be less than or equal to V2 + 20 KCAS.

This speed will continue to be updated until an engine failure is detected, at which point the target speed will be frozen at the present value.

VNAV will continue to generate this target speed until reaching the engine out acceleration height or when VNAV guidance initiates a level-off prior to reaching the engine out acceleration height, at which point the VNAV target speed will be changed to VREF + 70 KCAS (flaps up maneuver speed) subject to the applicable speed limits for the current airplane configuration.

VNAV will continue to issue the VREF + 70 KCAS target speed through flap retraction and thrust reduction, and retains this target for obstacle clearance until the pilot selects and executes the ALL ENG prompt on the CDU or VNAV transitions to the cruise flight phase to complete the engine-out takeoff flight phase.

[Option – FMC U10.8 and later]
The FMC engine-out mode will not be set when the groundspeed is less than 60 knots. If the engine-out mode is set while on the ground, the FMC will exit the mode when the speed drops below 60 knots. Engine-out speeds will be available if an engine fails on takeoff after 60 knots.

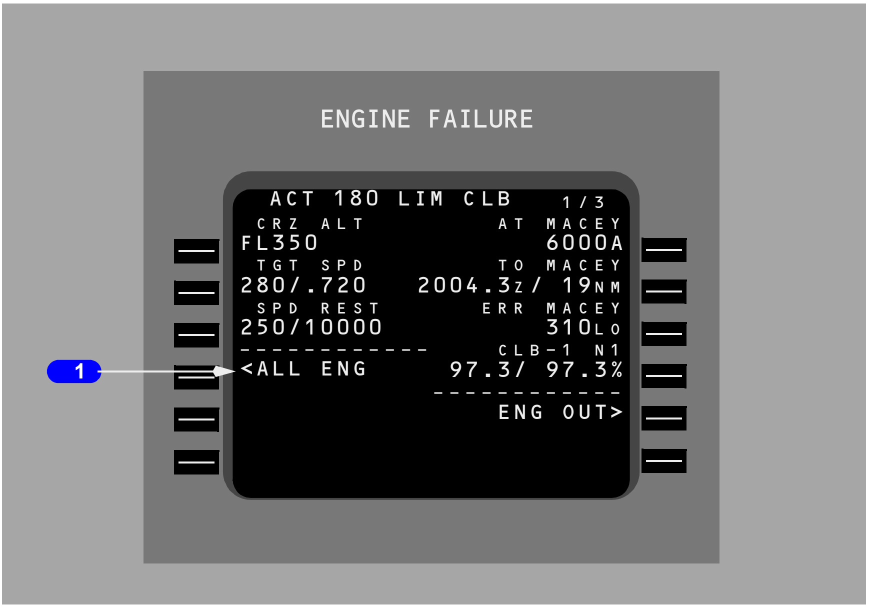
[Option – FMC U10.8 and later]
Prediction displays will be blanked on the MCDU pages when engine failure is detected and airspeed is over 60 knots of ground speed. Route (RTE) data, estimated time of arrival (ETA) data and top of climb (TOC) data displayed on the CDS Navigation Display will be blanked when an engine-out condition has been detected by the FMC. Engine-out will be cleared and the target speed and predictions will return to normal two engine values when the crew selects and EXECutes the ALL ENGINE prompt on the CLB page, or the CRZ or DES phase is entered, or a Flight Complete occurs, regardless of how many engines are running.

[Option – FMC U10.8 and later]
A new FMC CDU message (ENTER EO CRZ SPD AND ALT) will be displayed when the engine-out operation is terminated due to reaching cruise altitude or the pilot depresses the ALL ENGINE prompt button on the climb page.

When an engine failure has been detected, the thrust reduction height and the all engine acceleration height specified on TAKEOFF REF page two will be ignored. All waypoint fuel, ETA, Progress page and LEGS page performance predictions will be blanked. Upon exiting the engine out takeoff flight phase, the performance predictions will be displayed.

If an engine failure is detected after the all engine takeoff flight phase is complete, there will be no automatic engine out VNAV function as well as no modification of the Climb page.

Note: Prior to the all engine flight phase completion, with an engine failure detected, the Climb page is modified as depicted in the following illustration.



1 **All Engines**

Line select key 4L terminates the engine out takeoff mode and activates the normal climb mode.

Climb Phase

During the takeoff flight phase prior to the flap acceleration height the FMC calculates and issues a speed target equal to V2 + 20 KCAS. V2 will be obtained from the MCP speed window. The V2 speed set in the MCP speed window cannot be changed after reaching 60 knots. VNAV continues to generate this speed target until reaching the all engine acceleration height indicated on the TAKEOFF REF page. The speed target then changes to the pre-planned climb speed profile subject to applicable speed limits for the current configuration.

Climb Profile Speed Targets

With VNAV armed for the climb phase, VNAV commands acceleration to:

- last MCP speed (V2) + 20 kts until acceleration height
- the flap placard speed minus 5 kts
- 230 kts or less when leading edge flaps are not fully retracted
- 250 knots with flaps retracted
- the active target speed

- waypoint speed constraints, or
- the speed restriction associated with the origin airport, whichever is more restrictive.

Climb Profile Speed Target Exceptions

An exception to the standard climb speed profile is flown:

- if VNAV initiates a level off prior to reaching the acceleration height for either of the following reasons, then the speed target changes at the level off initiation as though the airplane had reached the planned acceleration height.
  - profile altitude constraint or MCP altitude capture.
  - cruise altitude capture.
- if an engine failure is detected, target speed will be last MCP speed (V2) + 20 kts if the airplane is at that speed or greater, or the existing speed if the airplane is between V2 and V2 + 20 kts
- if an engine failure is detected and the engine out acceleration height is reached or VNAV guidance initiates a level-off prior to engine out acceleration height the VNAV target speed will change to VREF + 70 KCAS (flaps up maneuver speed)

At the climb thrust reduction point, climb thrust can be selected. Passing 10,000 feet, VNAV commands an acceleration to the economy climb speed, which is maintained until entering the cruise phase. Waypoint speed constraints take priority if slower than target speed.

[Option – With automatic thrust reduction after takeoff]
At the climb thrust reduction point, the FMC commands a reduction to the selected climb thrust. Passing 10,000 feet, VNAV commands an acceleration to the economy climb speed, which is maintained until entering the cruise phase. Waypoint speed constraints take priority if slower than target speed.

[Option – With quiet climb]
When cutback mode is selected ON, the FMC calculates and commands a cutback thrust rating at the required cutback altitude. A new N1 is calculated during climb and normal climb thrust is restored at the RESTORE altitude. Passing 10,000 feet, VNAV commands an acceleration to the economy climb speed, which is maintained until entering the cruise phase. Waypoint speed constraints take priority if slower than target speed.

During the climb, VNAV complies with the LEGS page waypoint altitude and speed constraints. A temporary level–off for a crossing altitude restriction is accomplished at the current commanded speed.

When the climb speed profile causes an anticipated violation of a waypoint altitude constraint, the FMC displays the CDU scratchpad message UNABLE NEXT ALTITUDE. A different speed profile that provides a steeper climb angle must be manually selected.

When the speed profile causes an anticipated violation of a waypoint speed constraint, the FMC displays the CDU scratchpad message UNABLE YYY KNOTS AT XXXXX, where speed is YYY and waypoint is XXXXX.

If a CLB 1 or CLB 2 derate is selected, the derate is maintained for the initial part of the climb. Thrust eventually increases to maximum climb thrust by 15,000 feet.

Climb Page

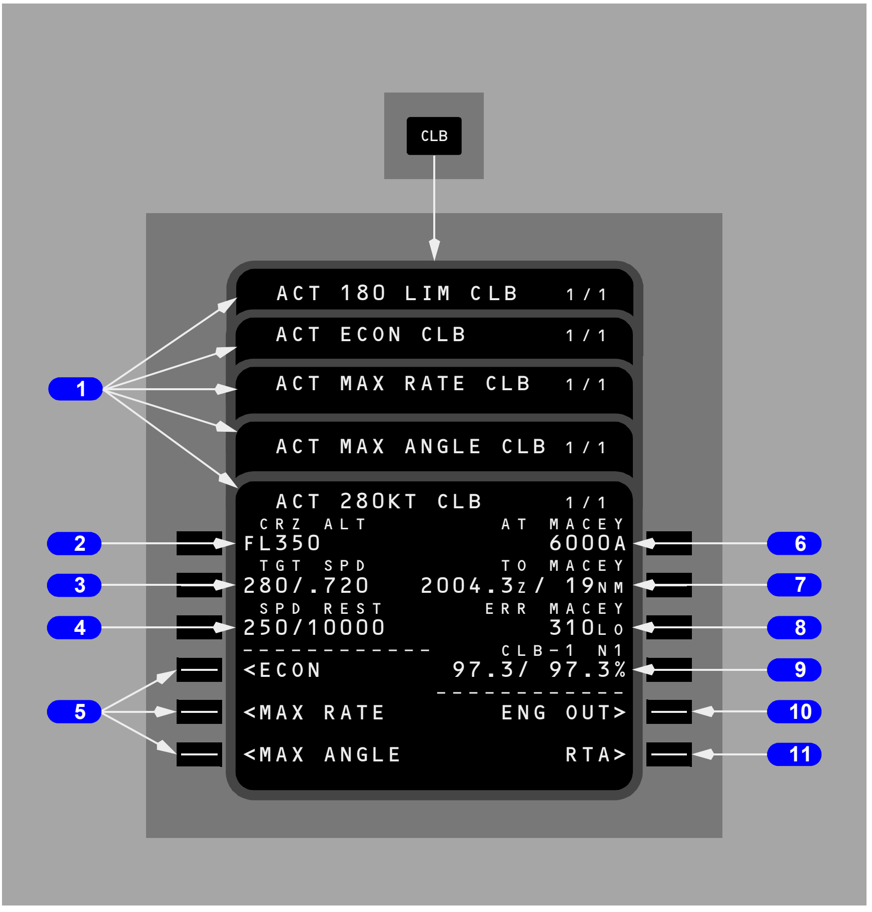
The climb page is used to evaluate, monitor, and modify the climb path. The data on the climb page comes from preflight entries made on the route and performance pages.

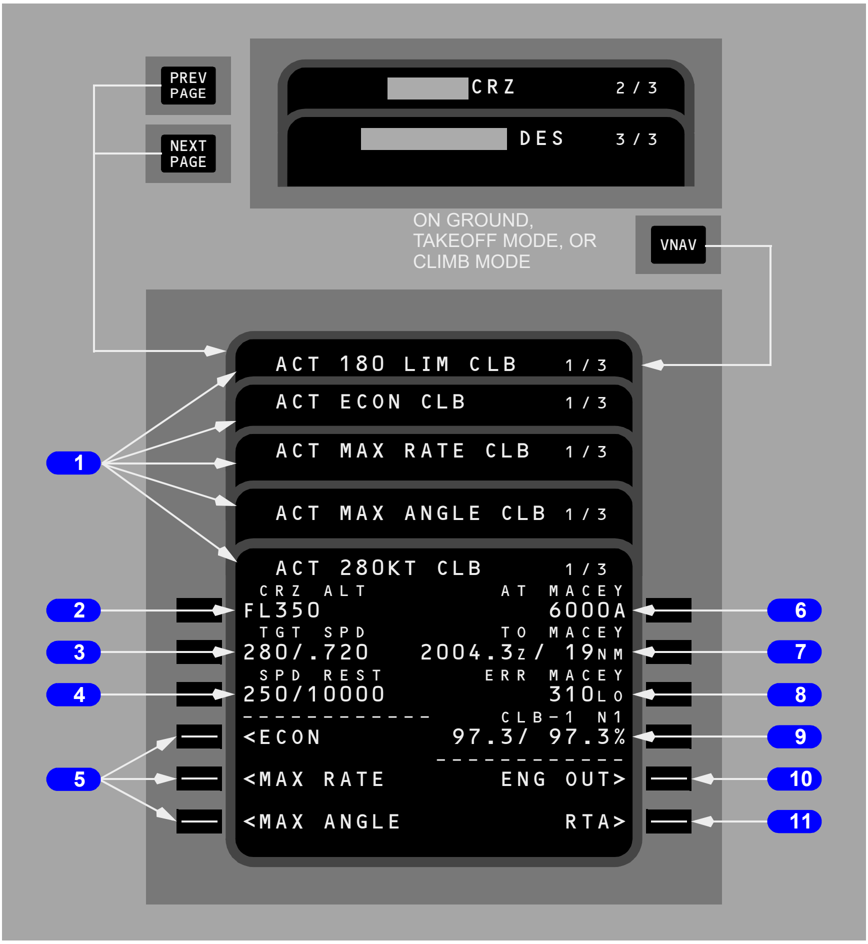
[Option – FMC U10.3 and later]
The climb page is automatically selected by pushing the CLB function key on the ground and during takeoff and climb. The TAKEOFF REF page automatically transitions to the climb page after takeoff.

[Option – FMC U10.3 and later with FANS MCDU]

The climb page is automatically selected by pushing the VNAV function key on the ground and during takeoff and climb. The climb page is the first of the three pages selected with the VNAV function key. Access from other performance pages is via the NEXT/PREV PAGE key. The TAKEOFF REF page automatically transitions to the climb page after takeoff.

The FMC climb mode can be economy or fixed speed. In either mode, similar data is displayed on the page.





1 **Page Title**

The page title displays the type of climb. Normally, the title displays ECON for the economy climb mode. Fixed speed climbs modify the title.

XXX LIM CLB indicates the limit speed, XXX, is based on leading or trailing edge flaps:

- target speed is 5 knots below trailing edge flap placard speed
- speed is limited to 230 kts if leading edge devices are not completely retracted

ECON indicates the speed is based on a cost index.

MAX RATE indicates the speed is based on the maximum altitude over the shortest period of time.

MAX ANGLE indicates the speed is based on the maximum altitude over the shortest horizontal distance.

Fixed climb speeds display XXXKT for a fixed CAS climb speed or M.XXX for a fixed Mach climb speed profile. Reasons for fixed speeds are:

- takeoff/climb acceleration segment constraints
- waypoint speed constraints
- an altitude constraint associated with a speed constraint
- a speed restriction
- a crew entered speed.

Displays ACT when the climb phase is active.

2 Cruise Altitude (CRZ ALT)

The cruise altitude from the PERF INIT page is displayed. A new altitude can be manually entered.

[Option – With speed and altitude intervention]
The cruise altitude from the PERF INIT page is displayed. The altitude can be changed by two methods:

- a new altitude can be manually entered from the CDU at any time. Changing the altitude in this manner creates a modification.
- setting the MCP altitude above the current FMC CRZ altitude, provided no intermediate altitude constraints exist between the current airplane altitude and the MCP target altitude. Selecting the new altitude on the MCP and pushing the altitude intervention button places the new altitude in the CRZ ALT data line. Entering a new cruise altitude in this manner does not create a modification.

3 Target Speed (TGT SPD)

Displays computed values or manually entered values for the selected mode.

Displays XXX/MCP when speed intervention is active and plan is active.

Airspeed and/or Mach may be entered using the keyboard. Title will display manually entered value.

The active controlling speed is highlighted in reverse video.

4 Speed Restriction (SPD REST)

The speed restriction line displays the speed restriction/altitude from one of the following sources:

- the navigation database value for the origin airport (dashes displayed when no speed restriction exists for the listed airport)
- waypoint related restriction from the RTE LEGS page if restriction limits climb speed
- a default speed of 250 knots and 10,000 feet for airports not listed in the navigation database (example 250/10000)
- displays XXX/FLAPS if the active speed restriction is lower than the minimum speed for the selected flap setting
- displays XXX/HOLD when decelerating to hold speed prior to hold entry fix.

Dashes displayed if no active speed restriction exists.

Manual crew entries or deletions may be made. HOLD or FLAPS speed may not be deleted or modified.

Note: If the FMC default speed restriction is overwritten, it will be deleted and not return after the overwrite condition passes (e.g. the default of 250/10000 is overwritten to 230/3000, after 3000 feet is passed there will be no speed restriction and VNAV will accelerate to the unrestricted climb speed).

The active controlling speed is highlighted in reverse video.

[Option – With quiet climb]
When cutback mode is selected ON, the cutback airspeed and RESTORE altitude is the active speed/altitude restriction. Deletion or modification of the cutback speed/altitude restriction is not allowed.

5 Climb Page Prompts

Push – selects various CLB pages.

Following line selection, the prompt for that page blanks.

6 AT XXXXX

The waypoint constraint line displays the next waypoint having an altitude constraint. Constraints are entered on the RTE LEGS page or by departure procedure selection. The constraints can be deleted on this page or the RTE LEGS page. The waypoint may be a HOLD AT point.

Display is blank if no restriction exists.

[Option – FMC U11.0 and later]

6 AT XXXXX

The waypoint constraint line displays the waypoint and constraining altitude of the current VNAV altitude target. Constraints are entered on the RTE LEGS page or by departure procedure selection. The constraints can be deleted on this page or the RTE LEGS page. The waypoint may be a HOLD AT point.

Display is blank if no restriction exists.

7 TO XXXXXX

Displays ETA and distance to go to waypoint on AT XXXXXX line.

If no waypoint constraint exists, values are for CRZ ALT.

8 Error (ERR XXXXX)

Displays predicted altitude undershoot for the waypoint on AT XXXXXX line.

During VNAV operation, the FMC commands a level off if an overshoot is predicted.

Display is blank, including the label, if no error exists.

[Option – FMC U10.3 and later]

9 Climb N1 (CLB N1, CLB – X N1)

Displays the computed climb N1 value.

[Option – FMC U10.3 and later with quiet climb]

9 Climb N1 (CUTBACK N1, CLB N1, CLB – X N1)

Displays the computed climb N1 value.

10 Engine Out (ENG OUT)

Push – displays RT ENG OUT and LT ENG OUT prompts. See ENG OUT CLB page description.

[Option – With engine out SIDS]

Selection will also load the engine–out SID if the following conditions are true:

- an engine–out SID exists for the ACTIVE departure runway
- an engine–out SID is not already selected for the active route
- the flaps are not up and have not been up since the takeoff was started
- the EO SID disarm waypoint has not been reached if designated in the active route, regardless of flap position
- if no disarm waypoint exists for the SID, and flaps are not up and have not been up since takeoff was started
- flight phase is takeoff or climb
- the airspeed is greater than 80 kts (airborne).

[Option – FMC U10.4 and later]
When the above conditions are met and there is a loss of thrust or split between the thrust levers, the FMC will automatically load the engine-out SID upon detection of the engine-out condition.

An EO SID disarm waypoint may be coded into the EO SID. When a flight plan is executed, it will be searched to see if the disarm waypoint exists in the active plan. The EO SID will remain armed until that waypoint is sequenced regardless of flap position. If no disarm waypoint exists in the flight plan the EO SID auto-loading will revert to a flap based loading.

11 Required Time of Arrival (RTA)

Push – displays the RTA PROGRESS page.

ERASE prompt replaces RTA during a page modification.

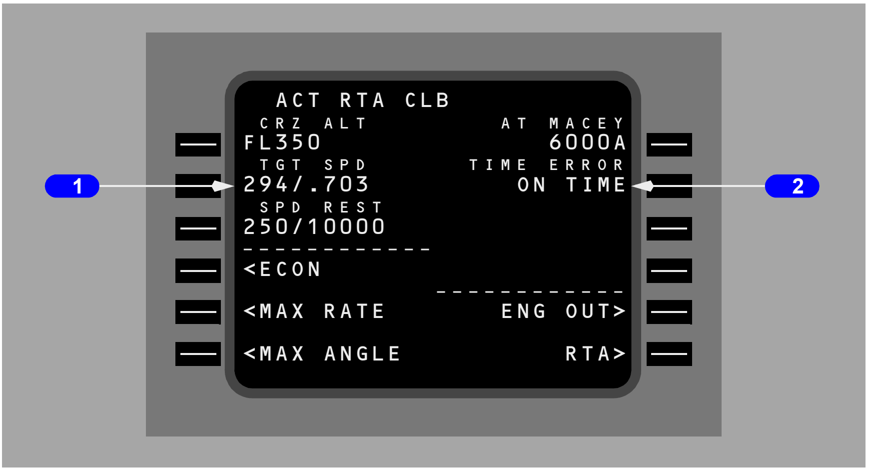
RTA Climb Page

The RTA climb page is displayed when a required time of arrival is active.

The RTA climb page is automatically selected by pushing the CLB function key when RTA is active.

[Option – With FANS MCDU]
During climb, the RTA climb page is automatically selected by pushing the VNAV function key when RTA is active.

Displays on this page are the same as other climb pages except as noted.



1 Target Speed (TGT SPD)

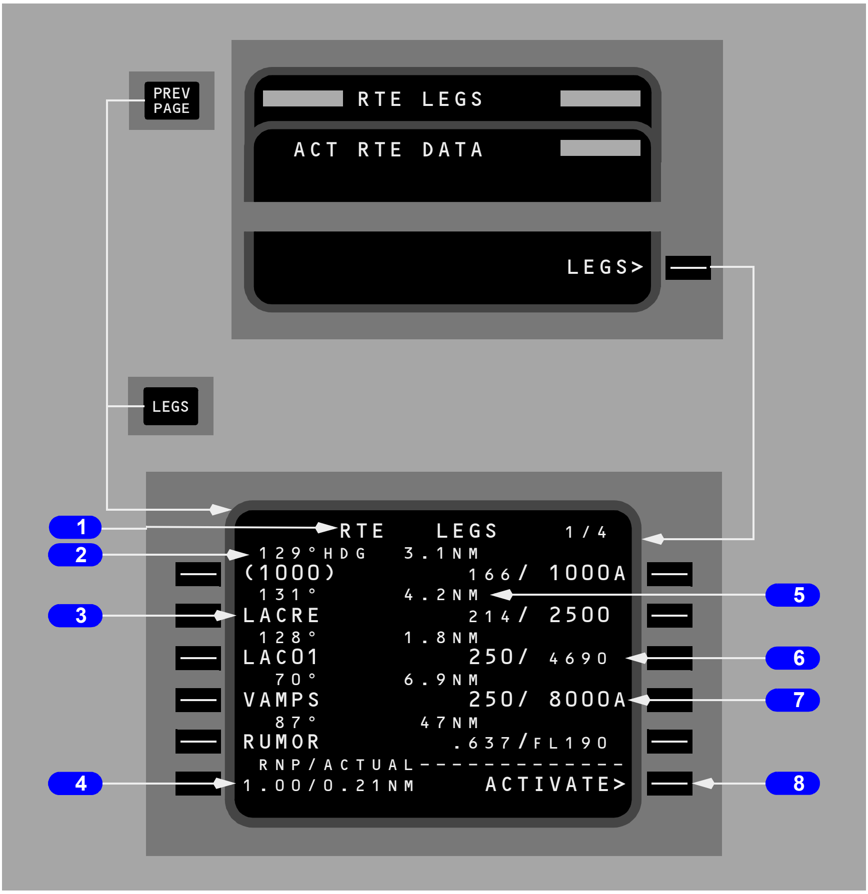
Displays computed speed required to meet entered RTA.

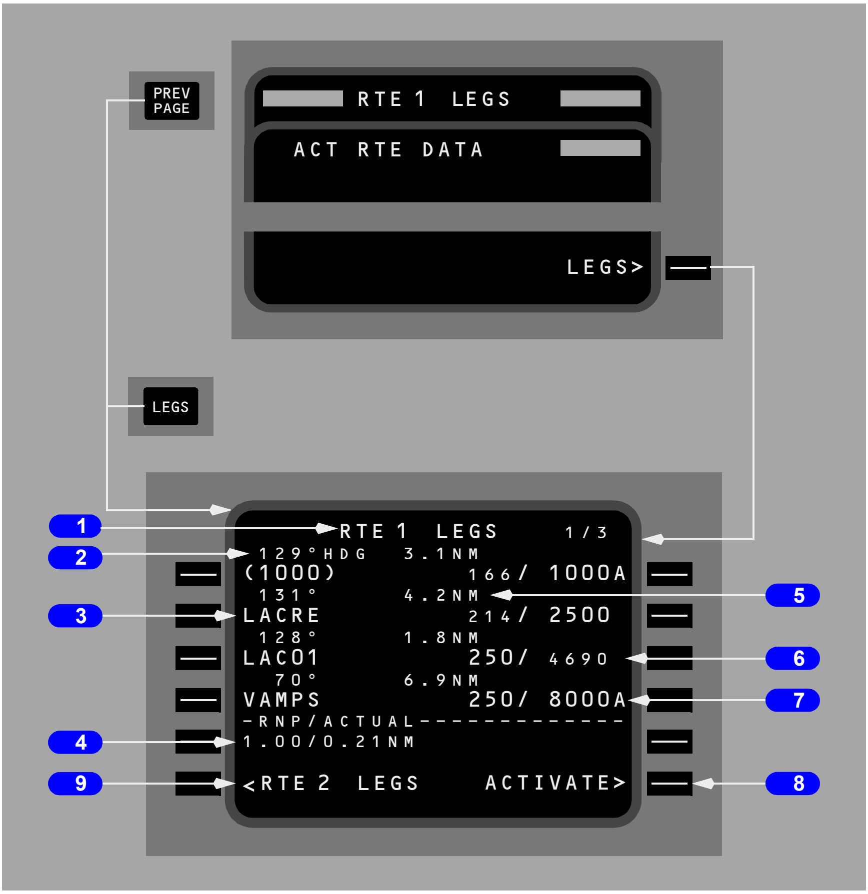
When RTA is exited by waypoint sequence or deletion, this speed changes to FMC target speed.

2 TIME ERROR

Displays computed time error at RTA waypoint. Same as RTA PROGRESS page.

RTE LEGS Page





1 **Page Title**

An active route legs page title is displayed with ACT as part of the title. A modified page title displays a reverse video MOD.

An active route legs page title is displayed with ACT as part of the title it can be either RTE 1 LEGS or RTE 2 LEGS that is ACT. When an inactive RTE 1 LEGS or RTE 2 LEGS is selected for display, the title (RTE 1 LEGS or RTE 2 LEGS) will be in cyan color.

2 Leg Direction

The leg segment direction is displayed as the title of the waypoint line. Courses are displayed in magnetic (xxx°) or true (xxx° T). Directions to maintain an arc display the arc distance, the word ARC followed by the direction, and left or right (24 ARC L). The computed great circle route leg directions may be different than chart values. Heading leg segments to conditional waypoints are displayed as (xxx° HDG) and track leg segments are displayed as (xxx° TRK). Directions may be displayed as special procedural instructions, such as HOLD AT or PROC TURN.

Display is blank for an undefined course.

3 Waypoint Identifier

The current active leg is always displayed at the top of the first active RTE LEGS page.

All route waypoints are displayed. Waypoints on an airway are included on the route legs page. Waypoints appear in flight sequence.

Waypoints can be entered and moved. This includes:

- adding new waypoints
- removing existing waypoints
- resequencing existing waypoints
- linking route discontinuities.

Displays the waypoint by name or condition.

Box prompts are displayed for route discontinuities.

Dashes are displayed for the next line beyond the end of the route.

4 Required Navigational Position/Actual (RNP/ACTUAL)

Displays the required navigation accuracy compared to actual navigation accuracy.

Manual entry is allowed.

5 Distance to Waypoint

Displays the distance from the airplane or the waypoint to the next waypoint.

6 Calculated Waypoint Speed/Altitude

Displays the calculated speed or altitude at the waypoint in small font.

7 Specified Waypoint Speed/Altitude

Displays any waypoint speed or altitude constraint in large font.

Manual entry is allowed.

8 ACTIVATE, RTE DATA

The activate prompt is displayed on the legs page when the route is not active.

Push –

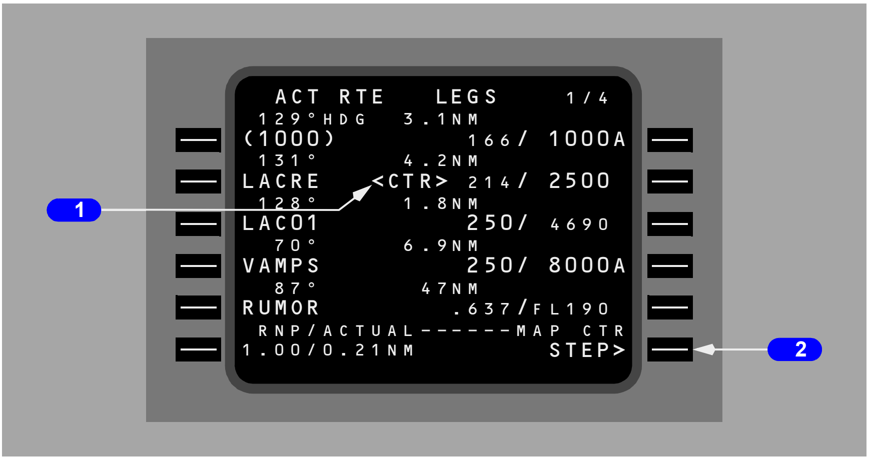
- ACTIVATE arms the execute function. Pushing the EXEC key activates the route and changes the ACTIVATE prompt to RTE DATA
- RTE DATA displays the route data page. The RTE DATA prompt is used to review or modify additional information about the route.

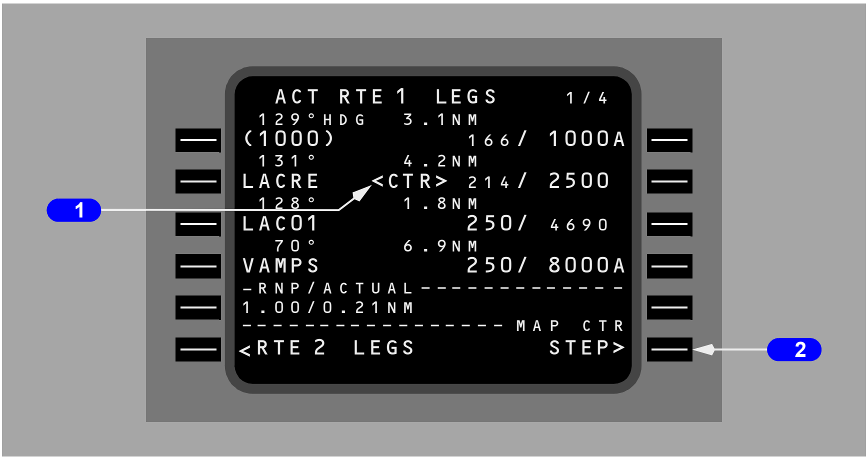
9 RTE (1 or 2) LEGS

Push – Displays RTE LEGS page that is at LSK 6L, either RTE 1 LEGS or RTE 2 LEGS.

Map Center Step Display

The map center step prompt replaces ACTIVATE or RTE DATA when the EFIS control panel mode selector is placed in the PLAN position. Pushing the prompt key advances the waypoint that is displayed in the center of the navigation display. The label <CTR> is displayed to the right of the corresponding waypoint on the RTE LEGS page.





1 Map Center Label (<CTR>)

Identifies the waypoint around which the map display is centered.

Whenever the EFIS Mode selector is positioned to PLAN, the label is automatically displayed for the first geographically fixed waypoint on the displayed page.

2 STEP

Displayed on a CDU when PLAN is selected on the associated EFIS control panel. Replaces the RTE DATA or ACTIVATE prompt.

Push – moves the map center label to the next geographically fixed waypoint in the route.

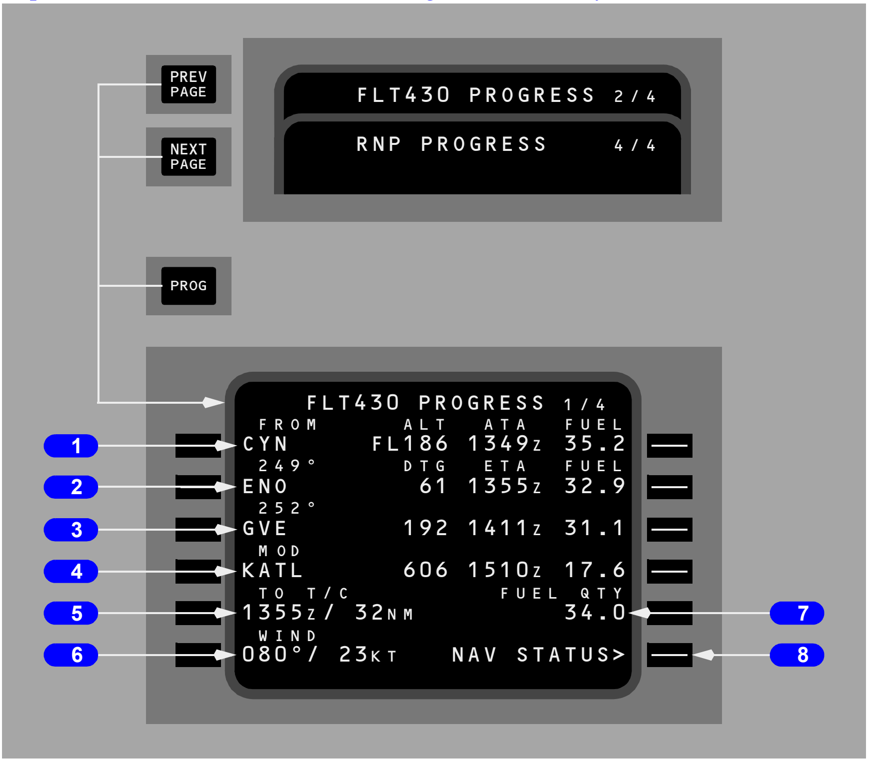
Progress Page 1/X

The progress page provides general flight progress information along the route of flight such as:

- waypoints (last, active and next)
- waypoint ETA
- waypoint ATA
- distance to go information
- destination information
- altitude change points
- current wind
- fuel quantity

[Option – With flight number entry]
The page title displays the company flight number from the RTE page.

[Option – FMC U10.5 and later with flight number entry]



1 FROM

Displays the identifier of the last (FROM) waypoint, the altitude (ALT), the actual time of arrival (ATA), and the fuel at that waypoint.

2 Active Waypoint

Displays the identifier of the active waypoint, the flight plan course to the active waypoint, and distance–to–go (DTG) from present position to the active waypoint. Also displays the estimated time of arrival (ETA) and predicted fuel remaining at the active waypoint. The active waypoint is highlighted by reverse video.

3 Next Waypoint

Displays the identifier of the next waypoint which follows the active waypoint, the flight plan course for that leg, and flight plan distance–to–go (DTG) from present position to the next waypoint. Also displays the estimated time of arrival (ETA) and predicted fuel remaining at the next waypoint.

4 Destination

Displays the identifier of the destination airport (DEST) and flight plan distance–to–go (DTG) from present position to the destination. Also displays estimated time of arrival (ETA) and predicted fuel remaining at the destination.

When a route modification is in progress, the destination line label displays MOD. Performance predictions include the modification.

Highlighting is used to identify the MOD or INACT destination field.

5 Altitude Change Point (TO XXXXX)

Displays ETA and distance to go to the following altitude change points as appropriate to phase of flight:

- TO T/C: to top of climb for the active climb
- TO STEP POINT: to the step point if a STEP TO entry is made on CRZ page
- TO T/D: to top of descent, if no STEP TO entry is made on CRZ page
- TO E/D: to the end of descent waypoint for an active path descent; blank if a path descent is not available.

6 WIND

Displays current true wind direction and speed.

7 Fuel Quantity (FUEL QTY)

Displays the present total fuel quantity remaining as obtained from the airplane fuel quantity indication system.

8 NAV STATUS

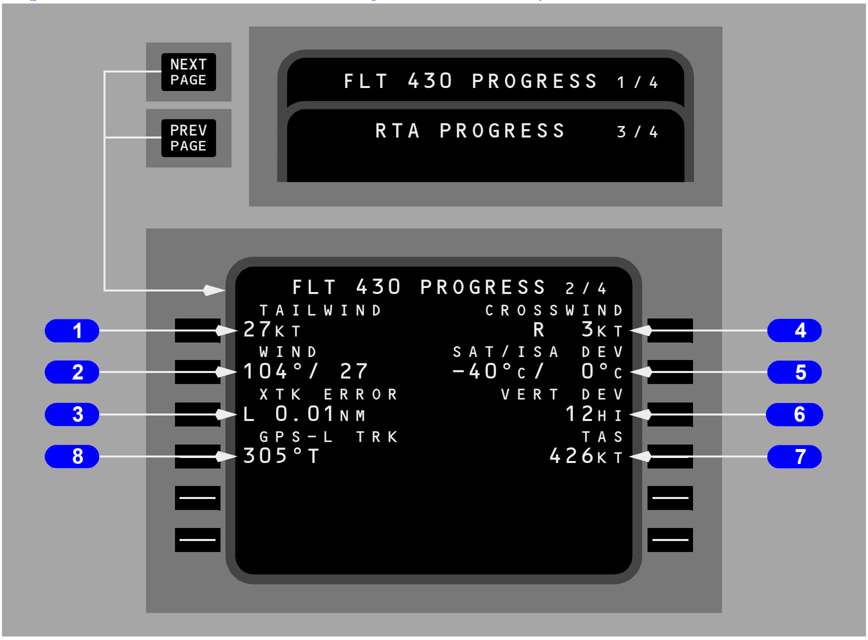
Push – displays the navigation status page.

Progress Page 2/4

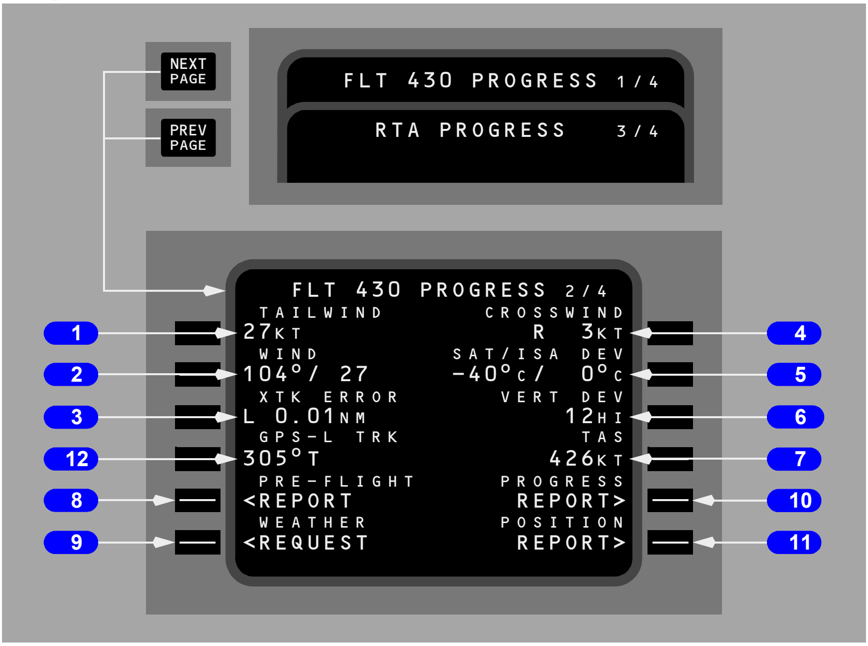
[Option – FMC U10.5 and later]

The progress page 2/4 displays wind, track, path, temperature, and speed data.

[Option – U10.5 and later, with flight number entry and GPS]



[Option – FMC U10.5 and later, with flight number entry, company data link and GPS]



1 **HEADWIND or TAILWIND**

Displays the present headwind or tailwind component.

2 **WIND**

Displays the present true wind direction/speed.

3 **Crosstrack Error (XTK ERROR)**

Displays present cross–track error from the desired LNAV course.

Blank if error is greater than 99.9 nm.

4 **CROSSWIND**

Displays present crosswind component (left or right).

5 **Static Air Temperature/ISA Deviation (SAT/ISA DEV)**

Displays present SAT and the equivalent ISA deviation.

6 **Vertical Descent Path Deviation (VERT DEV)**

Displays present computed deviation (HI or LO) from the FMC vertical path.

Blank if descent not active or path not available.

7 TAS

Displays present TAS.

[Option – With company data link]
8 PRE–FLIGHT REPORT

Push – transmits downlink report of preflight data.

[Option – With GPS]
8 GPS–L TRK

Displays GPS track.

[Option – With company data link]
9 WEATHER REQUEST

Push – transmits a data link request for a weather uplink.

[Option – With company data link]
10 PROGRESS REPORT

Push – transmits a downlink report of progress data.

[Option – With company data link]
11 POSITION REPORT

Push – transmits a downlink report of position data.

[Option – With GPS]
12 GPS–L TRK

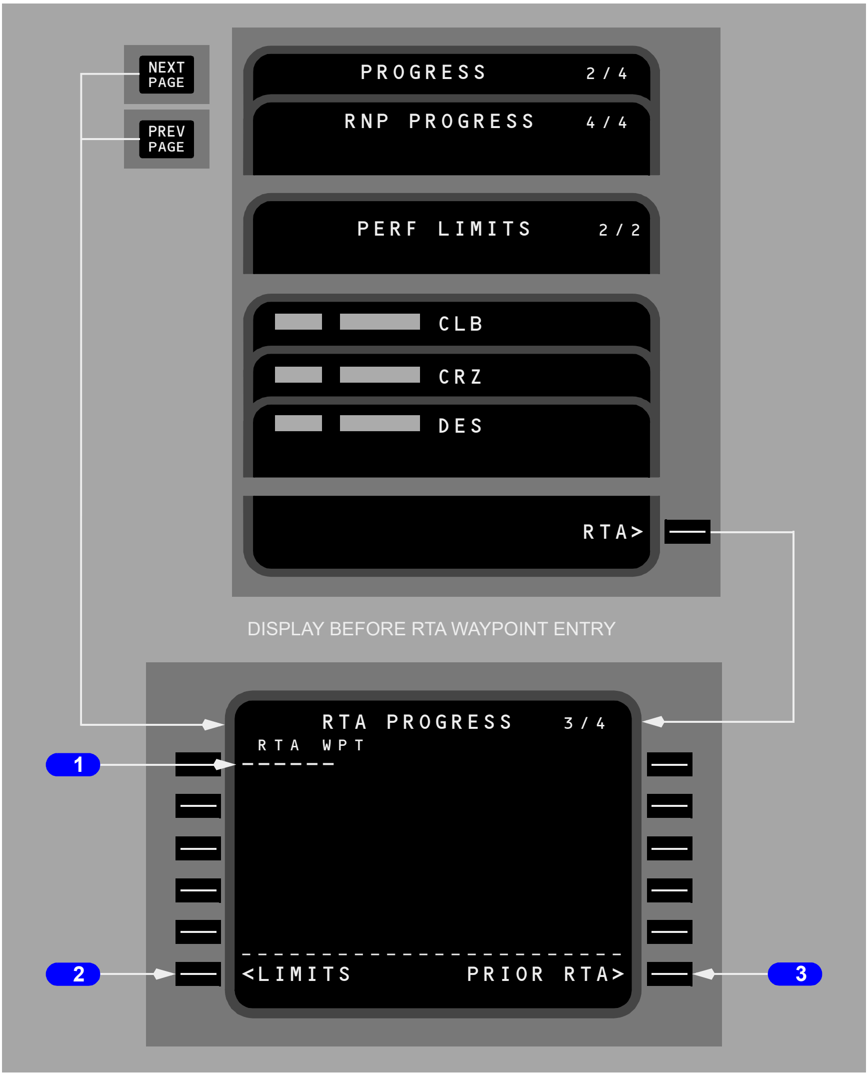
Displays GPS track.

RTA Progress Page 3/4

[Option – FMC U10.5 and later]

RTA Progress page is used to initiate the required time of arrival (RTA) mode.

The RTA page provides advisory data on flight progress in the RTA mode and advises of control times such as recommended takeoff time to meet RTA.



1 Required Time of Arrival Waypoint (RTA WPT)

Displays dashes when entry allowed.

2 LIMITS

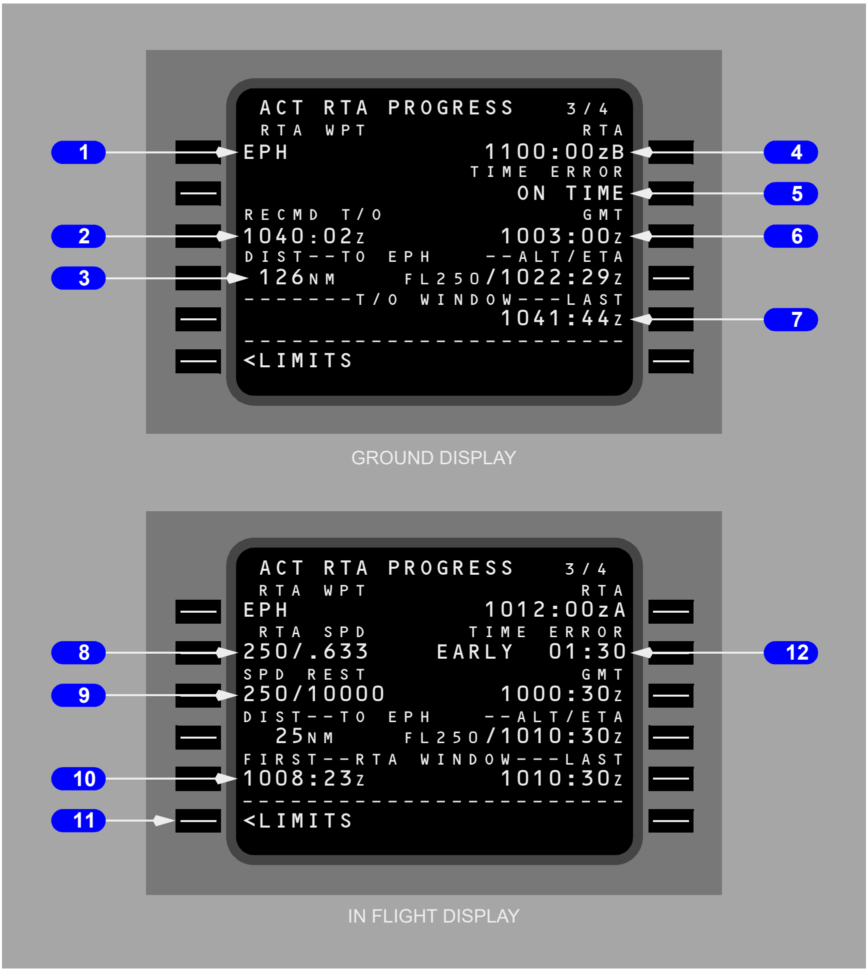
Push – displays the PERF LIMITS page.

3 Prior RTA Waypoint (PRIOR RTA)

Prompt displayed when the RTA waypoint field contains dashes and a previous RTA waypoint is still in the flight plan; otherwise blank.

Push – displays last active RTA waypoint data.

RTA Progress on Ground and in Flight



1 Required Time of Arrival Waypoint (RTA WPT)

Waypoint entry must be in flight plan or the CDU message NOT IN FLIGHT PLAN will be displayed.

Entering a valid waypoint will generate a MOD RTA PROGRESS page and illuminate the EXEC light.

Deletion of the RTA waypoint will create a MOD RTA PROGRESS page with all data blanked and EXEC light illuminated. Execution will exit the RTA mode.

Deletion of the RTA waypoint does not remove the waypoint from the flight plan.

Automatically clears the RTA waypoint and exits the RTA waypoint after sequencing the RTA waypoint out of the flight plan.

2 Recommended Takeoff Time (RECMD T/O)

Displays the recommended takeoff time (brake release time) to meet the planned RTA.

Time is based on entered Cost Index as well as the earliest and latest times to achieve RTA.

3 Distance To, Altitude, and ETA at the RTA Waypoint (DIST – – TO XXX – – ALT/ETA)

Displays the distance to the RTA waypoint.

Displays the predicted altitude at the RTA waypoint.

Displays ETA to the RTA waypoint based on:

- immediate takeoff
- MIN/MAX speeds on PERF LIMITS page
- entered forecast winds.

4 Required Time of Arrival (RTA)

After RTA waypoint entry, initially displays current ETA based on the active flight plan and performance parameters at time of waypoint entry.

Desired RTA may be entered by overwriting displayed data.

Entry must be in one of the following forms:

- XXXXXX (hr/min/sec)
- XXXX (hr/min)
- XXXX.X (hr/min/tenths of min).

Entry of “A” after RTA specifies arrival time of at or after.

Entry of “B” after RTA specifies arrival time of at or before.

5 TIME ERROR

Displays the most recent time error in minutes and seconds up to a maximum of 59:59 minutes.

Displays ON TIME if GMT is within current T/O WINDOW.

Displays EARLY or LATE as appropriate if GMT is not within current T/O WINDOW.

6 GMT

Displays the actual GMT.

7 Takeoff Window (– – – – – – – – T/O WINDOW – – – LAST) or (FIRST – – T/O WINDOW – – – – – – – –)

Displays latest takeoff time to meet the planned RTA.

If the entered RTA time is “At or After” time, only the FIRST field will be displayed.

If the entered RTA time is “At or Before” time, only the LAST field will be displayed.

Time is based on minimum and maximum speeds on the PERF LIMITS page.

8 Required Time of Arrival Speed (RTA SPD)

Displays the target speed required to meet the planned RTA.

Same as speed displayed on RTA CLB, CRZ, or DES page.

Limited by MIN/MAX speeds on the PERF LIMITS page and the SPD REST line.

During cruise, displays XXX/HOLD when decelerating to hold speed prior to hold entry fix.

9 Speed Restriction (SPD REST)

Displays the current speed restriction affecting RTA progress.

When not in cruise, displays XXX/HOLD when decelerating to hold speed prior to hold entry fix.

10 Arrival Time Window (FIRST – – RTA WINDOW – – – LAST)

Displays earliest and latest achievable arrival times at the RTA waypoint.

Times based on MIN/MAX speeds on PERF LIMITS page, existing winds, and entered forecast winds.

11 LIMITS

Push – displays PERF LIMITS page.

12 TIME ERROR

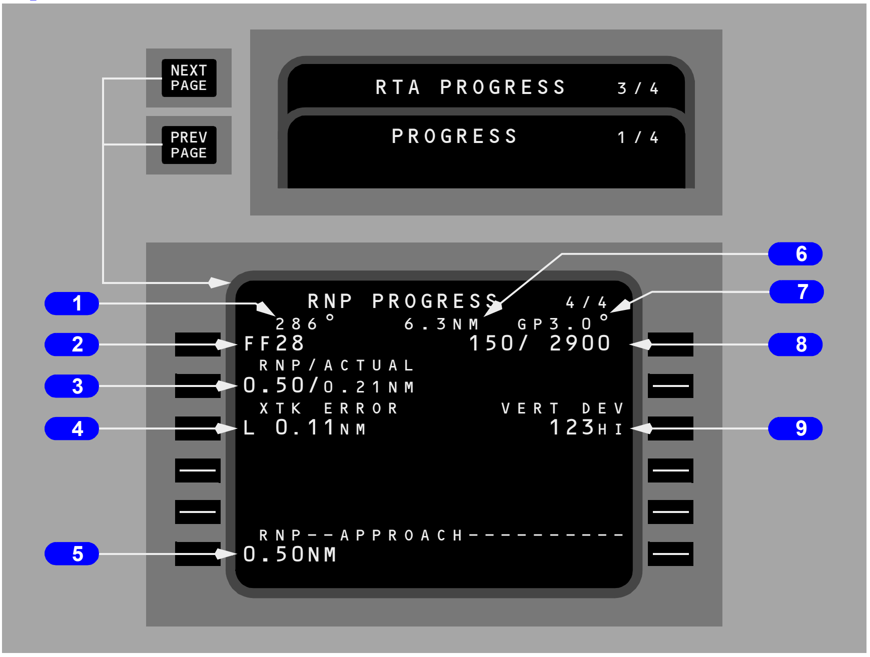
In flight, displays difference between the ETA and the RTA plus the TIME ERROR TOLERANCE on the PERF LIMITS page.

RNP Progress Page 4/4

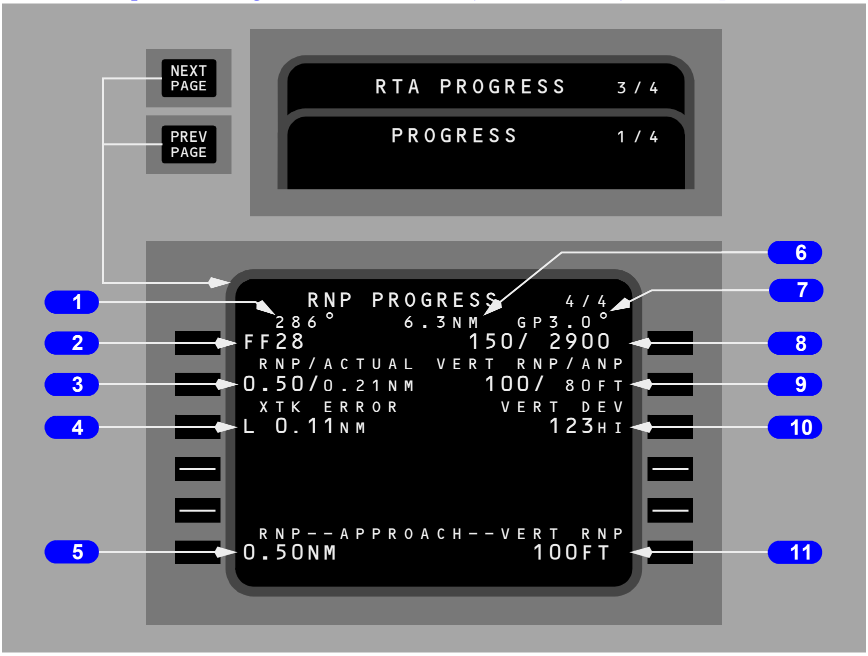
[Option – FMC U10.5 and later]

Progress page 4/4 displays essential Required Navigation Performance (RNP) information. The items displayed include waypoint identifier, RNP and ANP values, course, distance, glide path, cross track error, speeds, altitudes and vertical deviation.

[Option – FMC U10.5 and later]



[Option – FMC U10.5 and later with navigation performance scales enabled and Vertical Required Navigation Performance (Vertical RNP) enabled]



1 Leg Direction

The leg segment direction is displayed as the title of the waypoint line. Courses are displayed in magnetic (xxx°) or true (xxx° T). Directions to maintain an arc display the arc distance, the word ARC followed by the direction, and left or right (24 ARC L). The computed great circle route leg directions may be different than chart values. Heading leg segments to conditional waypoints are displayed as (xxx° HDG) and track leg segments are displayed as (xxx° TRK). Directions may be displayed as special procedural instructions, such as HOLD AT or PROC TURN.

Display is blank for an undefined course.

2 Waypoint Identifier

Displays the next waypoint.

Same as displayed on the RTE LEGS page.

3 RNP / ACTUAL

Displays the current FMC RNP / ANP values. The RNP may be overwritten (manual entries are displayed in large font) and affects the approach RNP 6L value. The RNP value displayed is selected from the performance defaults database if not specified in the navigation database.

Same as displayed on the POS SHIFT page.

4 Crosstrack Error (XTK ERROR)

Displays present cross–track error from the desired LNAV course.

L or R indicates left or right of course.

Blank if error is greater than 99.9 nm.

5 Lateral RNP (Approach)

Displays the lowest RNP (initial, intermediate or final segment) for the selected approach

Displays in large font for 3L manually entered RNP values.

Displays in small font for values provided by the navigation database.

6 Distance To Go

Displays the distance remaining to the next waypoint.

7 Glide Path

Displays the FMC computed glide path for the approach.

8 Waypoint Speed/Altitude

Displays waypoint speed or altitude constraints in large font.

Displays FMC predicted values in small font when no restrictions have been specified.

9 Vertical Deviation

Displays present vertical deviation from the FMC computed glide path.

[Option – With navigation performance scales enabled]

9 Vertical Navigation Performance

Displays both the vertical RNP (Required Navigation Performance) and the vertical ANP (Actual Navigation Performance) for the current leg.

Valid display range for vertical ANP is 0 to 999 feet.

Manual entries are allowed and are displayed in large font.

Valid entries are 10 to 999 feet and may be suffixed with an optional “/“

Entries are cleared at flight completion.

Values from the navigation database are displayed in small font.

[Option – With navigation performance scales enabled]

10 Vertical Deviation

Displays present vertical deviation from the FMC computed glide path.

[Option – With navigation performance scales enabled]

11 Vertical RNP (Approach)

Displays the lowest applicable vertical RNP for the approach.

Manual entries (entered in 2R) are displayed in large font.

Values from the navigation database are displayed in small font.

N1 Limit Page

[Option – FMC U10.1 and later]

This section describes the in–flight version of the N1 LIMIT page. See the FMC Preflight section for a description of the preflight version of the N1 LIMIT page.

Normally, N1 limits are automatically specified. Pilot selection of other limits is allowed.

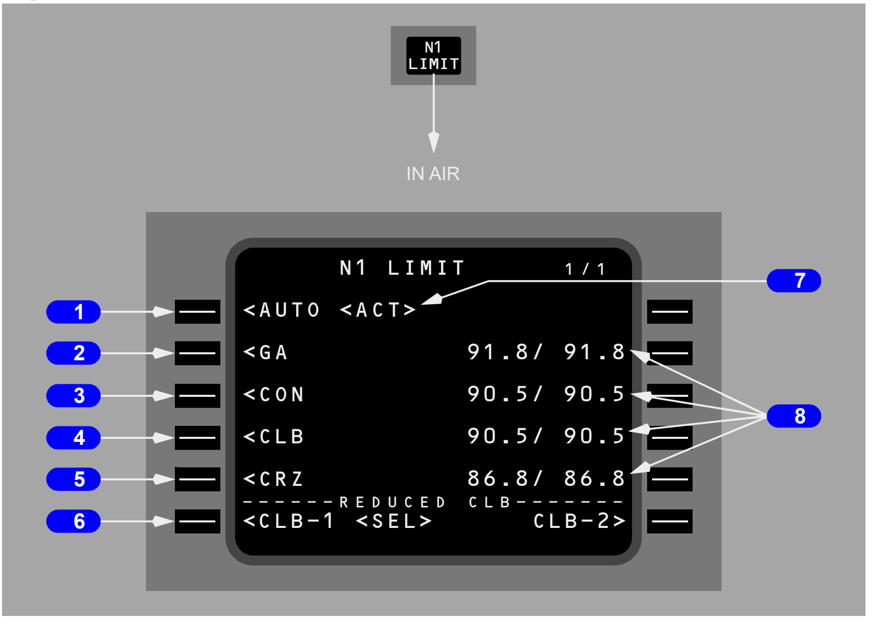
Pilot selection of a reduced climb mode does not change the automatic selection for other phases of flight.

Pilot selected mode is automatically replaced by AUTO selection when the autopilot next changes vertical mode.

The active thrust limit is used by the autopilot and is displayed on the thrust mode display.

An optional increase in available cruise thrust limits is available via a custom Loadable Defaults Database (LDDB). The default cruise N1 thrust rating is CRZ where cruise N1 limits are used as the default cruise thrust rating. The optional setting is CLB where climb N1 limits are used as the default cruise thrust rating.

[Option – FMC U10.1 and later]



1 AUTO

Push – selects automatic computation of N1 limits for all phases of flight.

2 Go Around (GA)

Push – selects the go–around thrust limit.

3 Continuous (CON)

Push – selects the maximum continuous thrust limit.

4 Climb (CLB)

Push – changes the thrust mode from AUTO to the active climb thrust, i.e. CLB, CLB–1, or CLB–2.

5 Cruise (CRZ)

Push – selects the cruise thrust limit.

6 Reduced Climb (REDUCED–CLB)

Push – selects either of two reduced climb thrust modes.

CLB–1 provides a climb limit reduced by 3% N1 (approximately 10% thrust).

CLB–2 provides a climb limit reduced by 6% N1 (approximately 20% thrust).

The reduced climb N1 value is displayed on the CLB pages.

If either mode is <SEL>, deletion allows return to full rated climb thrust.

Any reduced climb selection is automatically deleted above 15,000 feet.

Note: If a reduced thrust takeoff has been specified on the TAKEOFF REF page, then either CLB–1 or CLB–2 may be automatically specified if required to avoid a climb N1 value greater than the reduced thrust takeoff N1 value.

Note: When combining a high level of derate with a high assumed temperature, or if a climb thrust rating higher than the automatically selected climb thrust rating is selected, it is possible that the climb thrust may be higher than the takeoff thrust. In such a case, thrust levers will advance forward upon reaching thrust reduction altitude.

7 <ACT> STATUS LABEL

Identifies the active N1 thrust limit.

8 N1

Displays the N1 for individual thrust limits based on present conditions and bleed air configuration.

If CLB–1 or CLB–2 is selected, the N1% for CLB and the N1 cursors still display values for full rated climb.

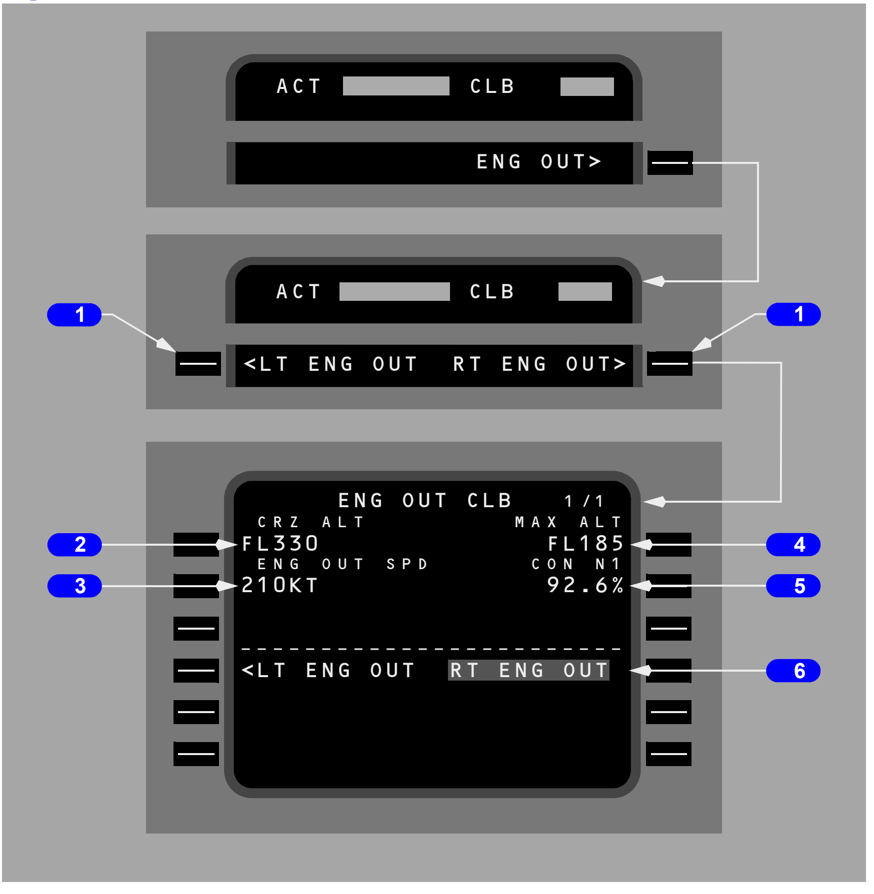
Engine Out Climb

Engine out climb advisory data is available on the CLB page. Engine out data is also available with both engines operating. The engine out climb phase automatically transitions to the engine out cruise phase when reaching the cruise altitude.

Engine Out Climb Page

Displays advisory information for an engine inoperative condition. Once the page is selected, it cannot be executed.

[Option – FMC U10.3 and later]



1 Left/Right Engine Out (LT ENG OUT/RT ENG OUT)

Displayed after selection of ENG OUT prompt.

2 Cruise Altitude (CRZ ALT)

[Option – FMC U10.3 and later]
Displays the current active cruise altitude. Value is forwarded from either the PERF INIT, CRZ, CRZ CLB, or CRZ DES pages. Manual entry not allowed.

[Option – FMC U10.3 and later]
3 Engine Out Speed (ENG OUT SPD)

Displays the minimum drag engine out climb speed.

4 Maximum Altitude (MAX ALT)

Displays the maximum altitude at which company specified rate of climb can be achieved using one engine at maximum continuous thrust.

After page selection, the FMC accounts for wing and engine anti–ice, air conditioning and engine bleed of the operating engine.

[Option – FMC U10.3 and later]
5 Continuous N1 (CON N1)

Displays the N1 for maximum continuous thrust.

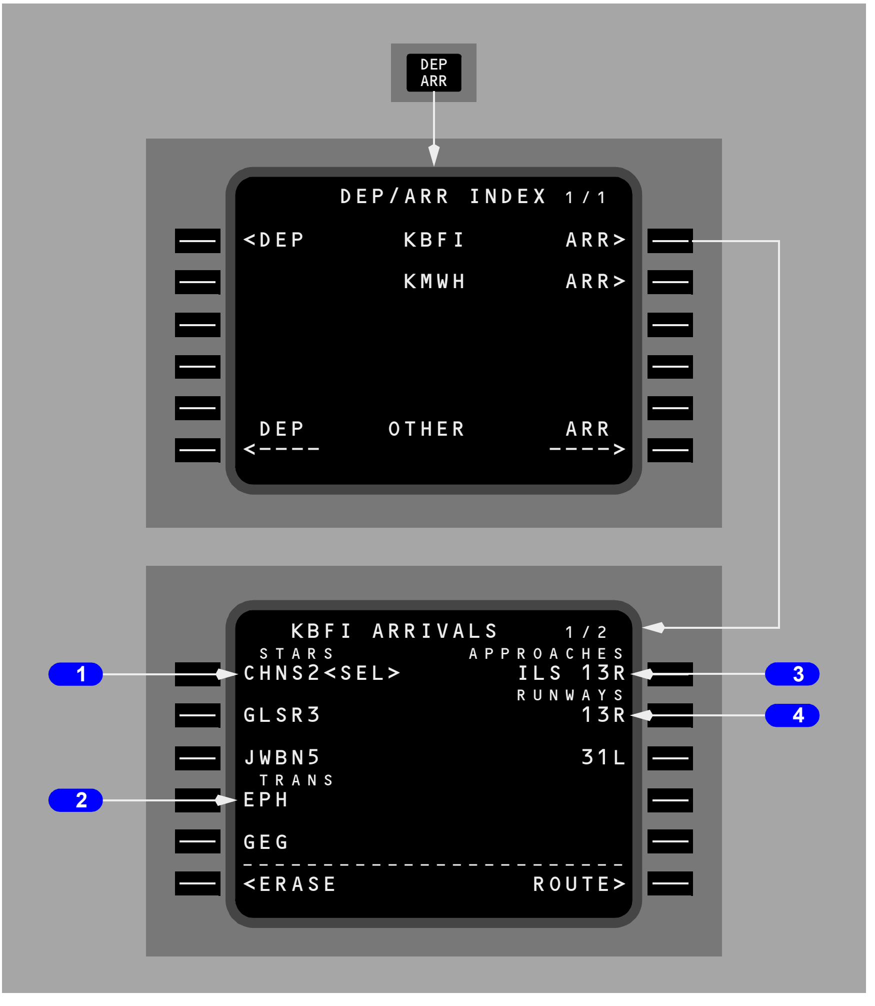
6 LT ENG OUT/RT ENG OUT

Selected engine is shown in reverse highlighting.

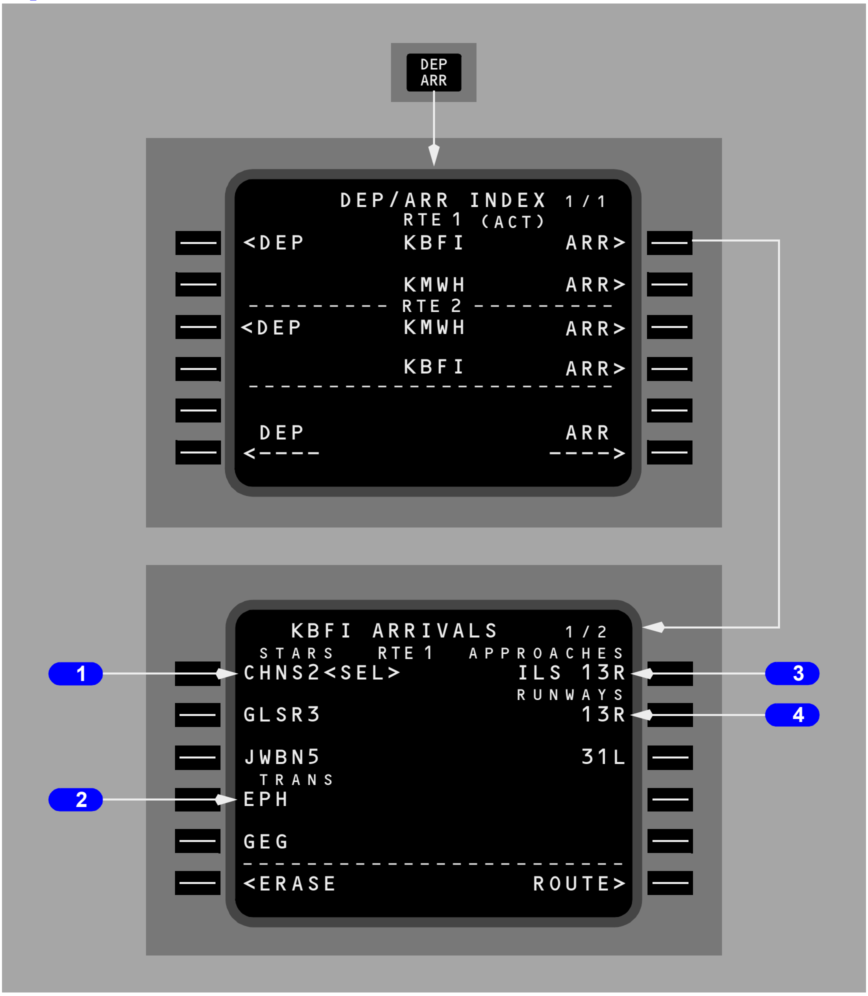
Air Turnback

Arrivals Page

During a turn–back situation, the crew requires quick access to the arrivals information for the origin airport. The departure/arrivals index and arrivals page provide access without changing the destination on the route page. See Chapter 11, Section 43 for additional information on the arrivals page.



[Option – FMC U11.0 and later]



1 Standard Terminal Arrival Routes (STARS)

Displays STARS for the origin airport.

2 Transitions (TRANS)

Displays transitions for the origin airport.

3 APPROACHES

Displays approaches for the origin airport.

4 **RUNWAYS**

Displays runways for the origin airport.

Introduction

The cruise phase automatically begins when the top of climb is reached.

During cruise, the primary FMC pages are:

- RTE LEGS
- PROGRESS
- CRZ.

The RTE LEGS pages are used to manage route restrictions and modify the route. The PROGRESS pages display flight progress information. RTA requirements are also specified on the PROGRESS pages. The CRZ pages display VNAV related information. Other pages include:

- POS REF page – verifies the FMC position (refer to Section 40 of this chapter)
- POS SHIFT page – permits selection of preferred position from list of references
- RTE DATA page – displays progress data for each waypoint on the RTE LEGS page. Displays wind data for cruise waypoints.
- REF NAV DATA page – displays information about waypoints, navaids, airports, or runways
- LATERAL OFFSET page – permits selection of a route offset
- FIX INFO page – displays information about waypoints, and can be used to create new waypoints and fixes
- SELECT DESIRED WAYPOINT page – permits selection of the desired waypoint from a list of duplicate named waypoints
- NAV STATUS page – displays information about available navigation aids.

The only cruise mode automatic page changes are the transition from climb to cruise at the top of climb point and from cruise to descent at the top of descent point.

LNAV Modifications

This section presents the normal techniques for modifying the route. The modifications include:

- adding and deleting waypoints
- resequencing waypoints
- linking discontinuities
- intercepting a course.

RTE LEGS Page Modifications

When modifications are made to the RTE LEGS page, several automatic prompt or identifying features assist in managing and executing the modifications, such as:

- ERASE
- INTC CRS.

Adding Waypoints

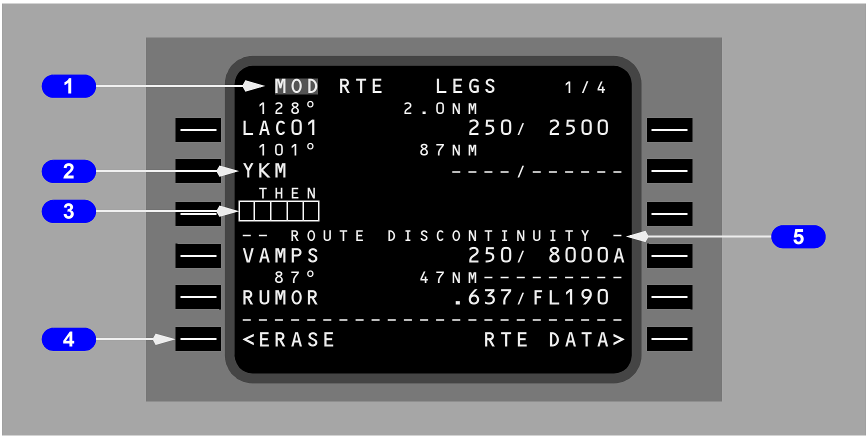
A waypoint can be added to the route whenever necessary.

The new waypoint must first be placed into the CDU scratchpad. Existing waypoints can be copied from a RTE LEGS page into the scratchpad by pushing the line select key adjacent to the desired waypoint.

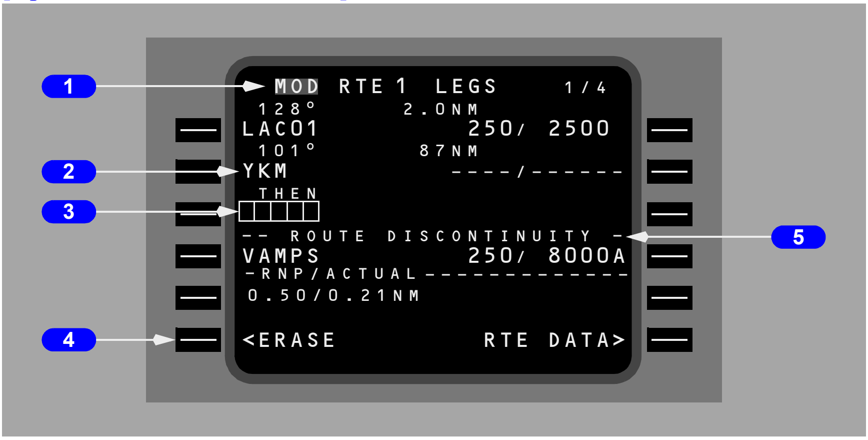
The new waypoint is then inserted into the route at the desired sequence point by pushing the line select key adjacent to the desired location for the new waypoint. Using the NEXT PAGE/PREV PAGE function keys to select the desired location does not alter the CDU scratchpad. The new entry automatically links to the preceding waypoint via a direct route. Placing the new waypoint into the active waypoint line is a special case and is discussed under Intercept Course in this section.

All new waypoints, except along track waypoints, cause a route discontinuity between the new waypoint and the following waypoint.

Note: If the FMC NAV database contains a HOLD pattern at the FAF, executing a database approach with a procedure turn and then executing a HOLD at the same FAF, using any inbound course, may cause a discontinuity between the FAF and the procedure turn. If the discontinuity is removed, LNAV guidance is available to fly the approach from the published holding pattern. LNAV guidance is not available to fly the published procedure turn.



[Option – FMC U11.0 and later]



1 Page Title

When the page is modified, MOD appears in front of the title in reverse highlighting. This means the route is now altered. The MOD title also shows that the modifications are not yet executed and can be removed using the ERASE prompt.

2 Modified Waypoint

YKM waypoint is entered into the route between LAC01 and VAMPS. This modification creates a route discontinuity.

3 Discontinuity Waypoint

Box prompts indicate the requirement to link the route by entering a route waypoint into the discontinuity waypoint position.

4 ERASE

The ERASE prompt is displayed when the first modification is entered. The prompt remains on the page until the modifications are erased or executed.

Push – removes all modifications and restores all active data.

5 Discontinuity Header

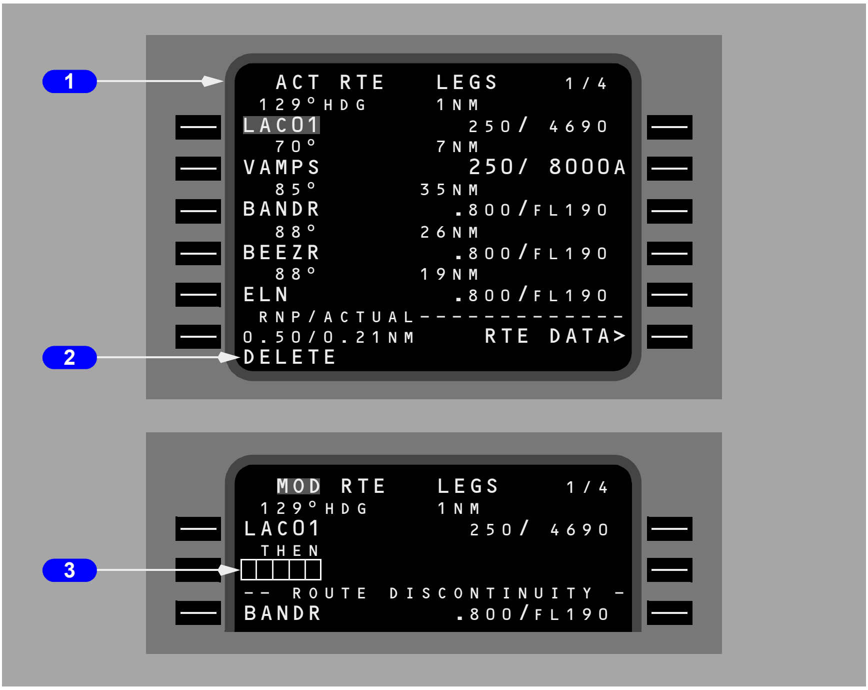
Indicates that the route is not continuous. Distance to destination on the PROGRESS page is not correct.

Deleting Waypoints

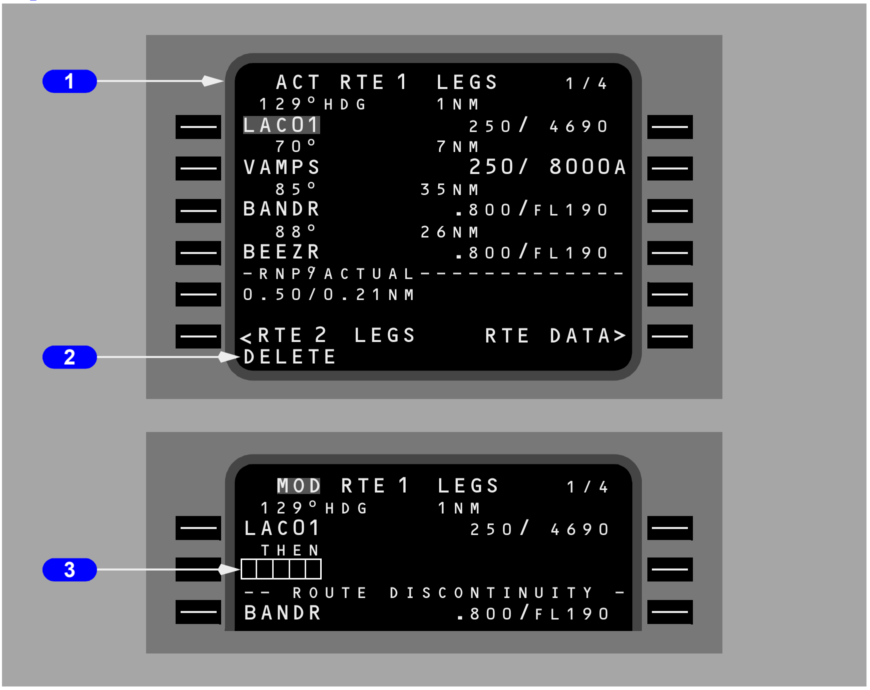
Waypoints can be removed from the RTE LEGS page. There are two normal methods to remove a waypoint:

- delete the waypoint using the DEL function key (not possible for the active waypoint and some conditional waypoints)
- resequence the route by moving a down–route waypoint up in the sequence and automatically removing all waypoints that are between.

During the deletion process, all of the route prior to the deletion point remains unchanged. Removing a waypoint using the DEL function key causes a route discontinuity to replace the deleted waypoint.



[Option – FMC U11.0 and later]



1 Active Route

The existing route shows VAMPS followed by BANDR, BEEZR, and ELN.

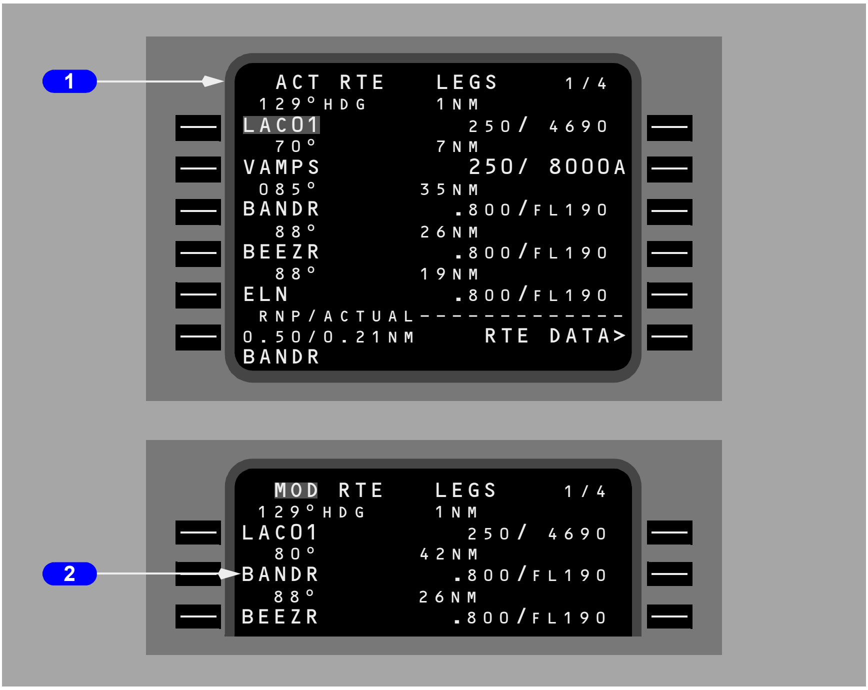
2 DELETE Entry

Push the DEL key to arm the delete function. DELETE is displayed in the scratchpad.

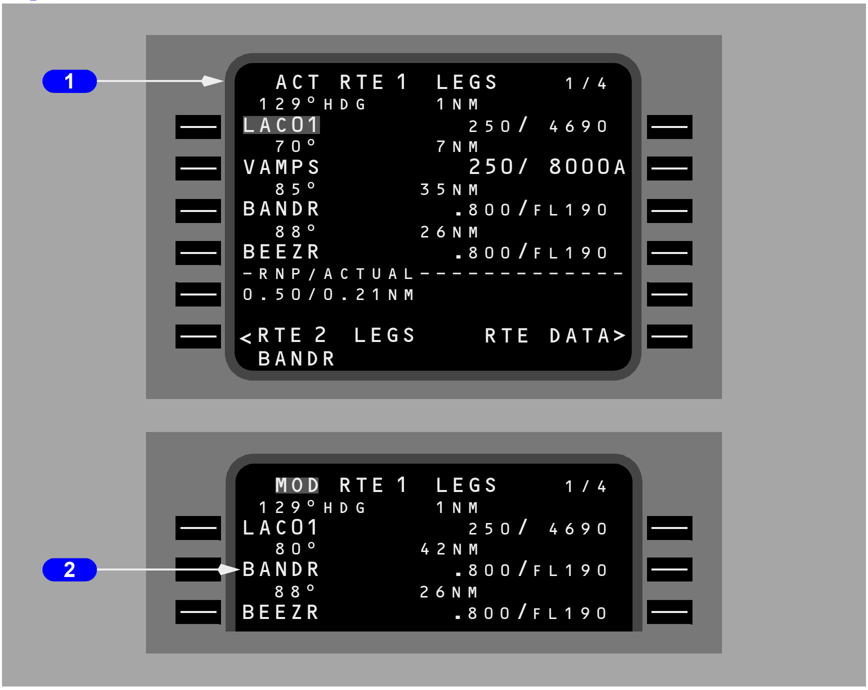
3 Delete VAMPS

With DELETE displayed in the scratchpad, push the line select key left of VAMPS to delete the waypoint. Box prompts replace VAMPS and a route discontinuity follows the box prompts.

Resequencing Waypoints



[Option – FMC U11.0 and later]



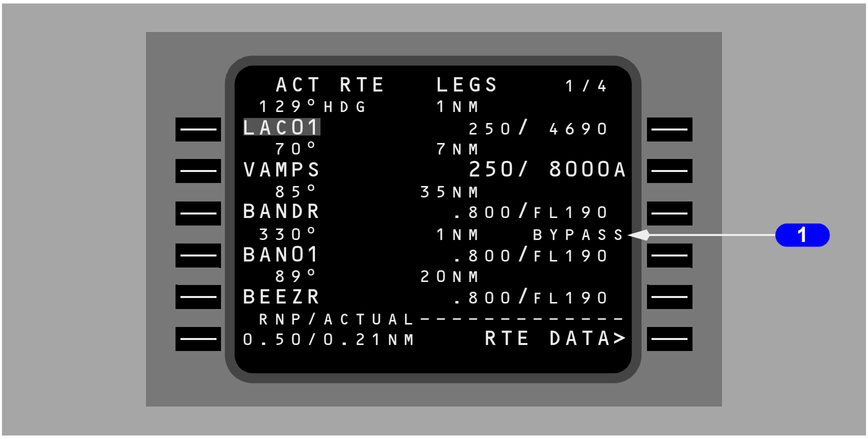
1 Active Route

The existing route shows VAMPS followed by BANDR, BEEZR, and ELN. The airplane must fly direct from LAC01 to BANDR. The BANDR waypoint is copied into the scratchpad.

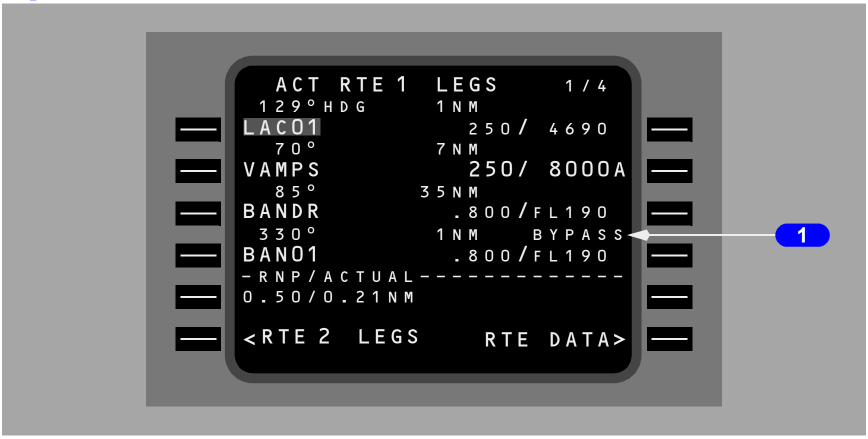
2 Resequence BANDR

BANDR is transferred to the waypoint following LAC01. VAMPS is removed, and the route remains continuous.

Leg Bypass



[Option – FMC U11.0 and later]



1 Bypass Notification

A waypoint (BAN01) has been entered into the route which is very close to another route waypoint (BANDR). It is impossible for the airplane to turn and capture the leg between BANDR and BAN01, so a bypass is noted.

Turn construction is based upon FMC criteria which assumes that LNAV is engaged. Normal turn construction may not be possible under certain combinations of airspeed, short leg length, and a significant change in leg direction. If normal turn construction cannot be provided to capture the leg into a waypoint, the FMC bypasses the affected waypoint and uses alternative turn construction to intercept that leg. When the bypass is for the active waypoint, the waypoint remains active until the airplane passes abeam.

Any mandatory altitude–crossing restriction for the bypass waypoint is still observed if VNAV is engaged, based on passing abeam the waypoint.

If a triple bypass condition occurs (bypass of three consecutive legs), a route discontinuity will be inserted.

Removing Discontinuities

A discontinuity exists when the FMC is unable to determine the route leg following a waypoint. Discontinuities are removed by linking the route segment following the discontinuity to the route segment preceding the discontinuity.

The next desired waypoint from the subsequent route is copied into the CDU scratchpad and entered into the discontinuity, just as when adding a waypoint.

[Option – FMC U11.0 and later]

1 ROUTE DISCONTINUITY

The active route shows a discontinuity. The airplane must fly direct from LAC01 to BANDR. The BANDR waypoint is copied into the scratchpad in preparation to remove the discontinuity. Any waypoint from the route can be copied into the scratchpad to remove the discontinuity.

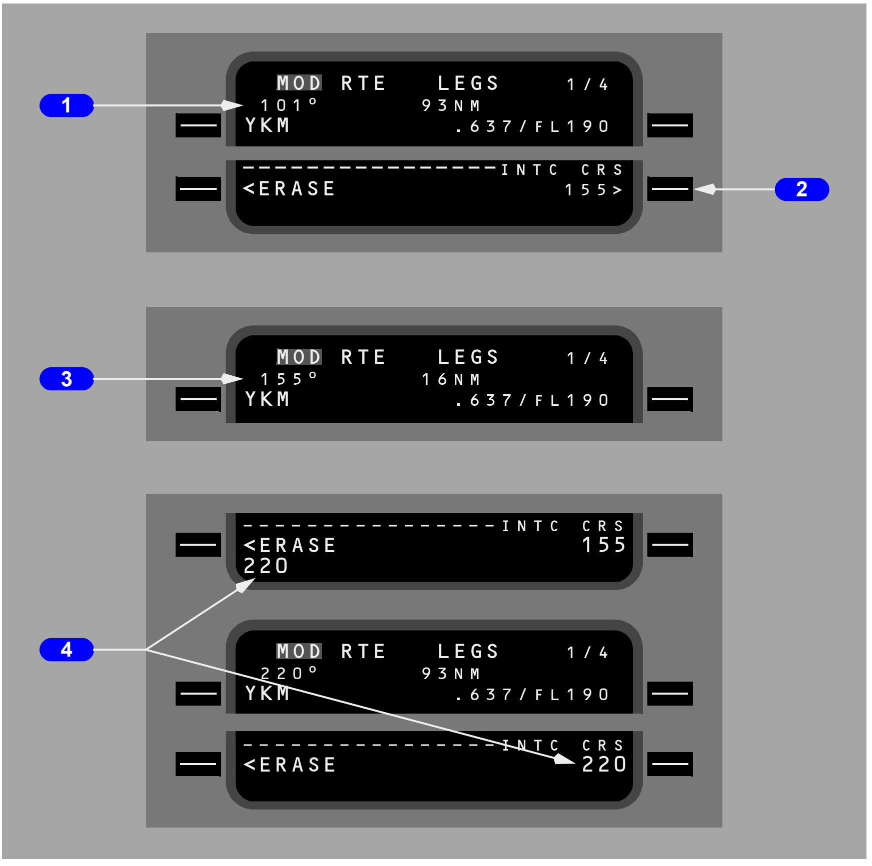
2 Continuous Route

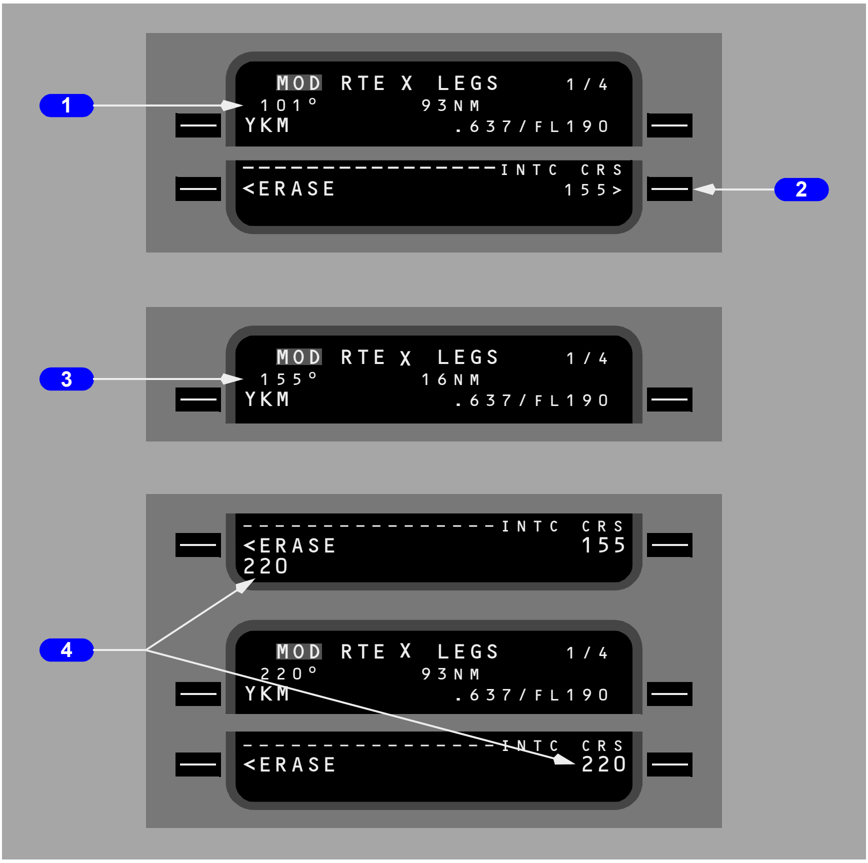
BANDR is copied into the box prompts to remove the discontinuity.

Entering a waypoint which does not already exist on the route moves the discontinuity one waypoint farther down the route.

Direct To and Intercept Course

To fly direct to a waypoint or intercept a course to a waypoint, enter the waypoint name on RTE LEGS page 1 active waypoint line. The INTC CRS prompt displays in line 6R. The example shows the result with YKM entered into the active waypoint line.





1 Direct Course

Direct course from airplane present position to entered waypoint.

Execute to proceed direct to active waypoint.

2 Intercept Course (INTC CRS)

Push – puts displayed course (155) into active waypoint leg direction. Enables intercept course function.

Displayed whenever the active waypoint name is modified.

Displays flight plan leg direction to entered waypoint in small font. Displays dashes if entered waypoint was not in the flight plan.

Valid input is any course from 000 through 360. May be changed until executed. Entered or selected value displays in large font.

3 **Leg Direction**

Displays the course inbound to the active waypoint after selecting the course displayed in the INTC CRS line.

4 **Intercept Course (INTC CRS) – Change**

Enter the inbound intercept course to the modified waypoint in the scratchpad.

Select the INTC CRS line to change the leg direction.

The example shows 220° intercept course to YKM entered in the INTC CRS line.

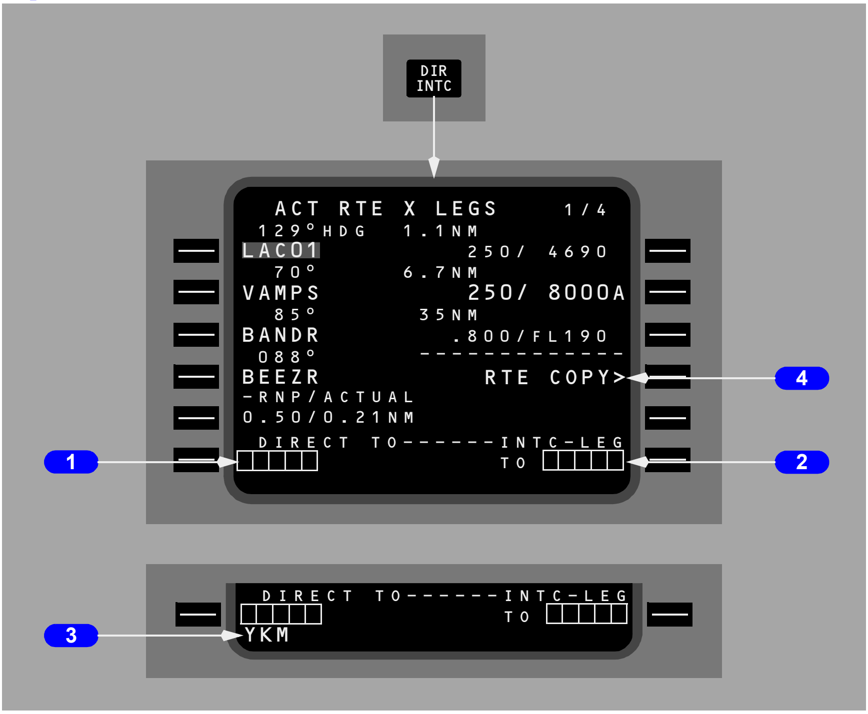
DIR INTC Key

[Option – CDU]

Proceeding direct to a waypoint or intercepting a course to a waypoint may also be accomplished by using the direct intercept (DIR INTC) mode select key. Pushing the DIR INTC key adds box prompt options to the bottom of the ACT RTE LEGS page.

Using line select or manual entry, the desired waypoint is entered into the scratchpad. The waypoint is then moved into the appropriate boxes. Subsequent operations are identical to those described in the Intercept Course section.

[Option – FMC U11.0 and later]



1 Direct To Boxes

Entering the desired waypoint in these boxes establishes a course direct to the waypoint and makes that waypoint the active waypoint.

2 Intercept Leg To Boxes

Entering the desired waypoint in these boxes allows a course to be specified to the waypoint and makes that waypoint the active waypoint.

3 Scratchpad Entry

The desired waypoint is entered into the appropriate boxes.

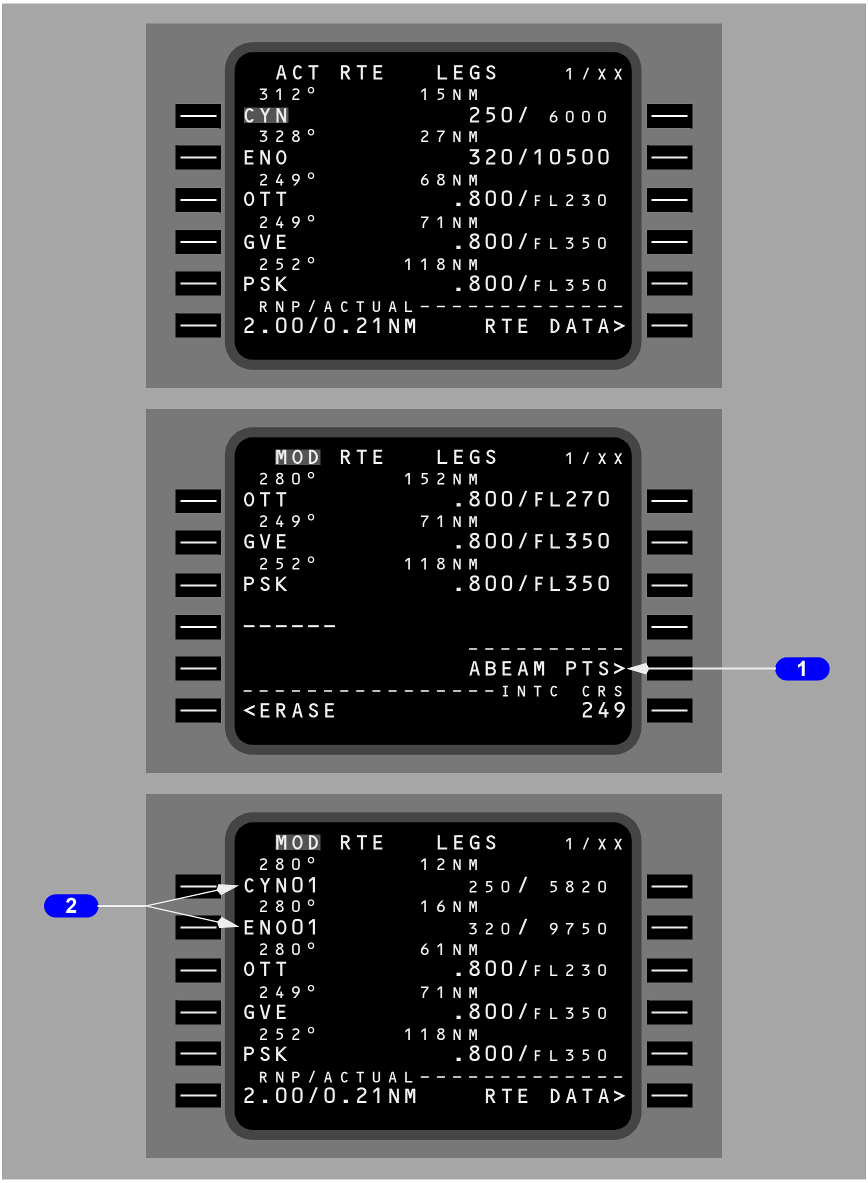
[Option – FMC U11.0 and later]

4 Route COPY (RTE COPY)

Selection of the prompt will result in duplication of the active route x into the inactive route and the display of RTE COPY in the header and Complete in the data field of 5R. Any flight plan previously existing in the inactive route will be erased by this action. When the "Route Copy" function has been selected all the winds associated with the route will be copied.

Abeam Points

[Option]
When a direct–to modification bypasses existing route waypoints in the active flight plan, these bypassed points can be projected onto the new route as abeam points. Abeam points are perpendicular to the bypassed waypoints.



[Option – FMC U11.0 and later]

1 Abeam Points (ABEAM PTS)

Selecting the prompt permits the retention of waypoints following a direct–to modification. The FMC creates and displays points on the new route which are abeam the waypoints bypassed by the route modification.

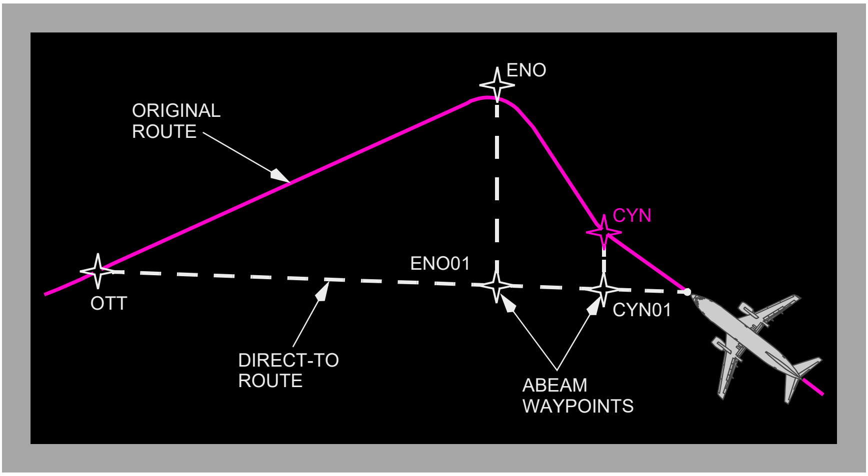
In the example, the route has been modified to proceed direct to OTT. This modification bypasses CYN and ENO.

2 Abeam Waypoints

CYN01 and ENO01 have been created. Any entered winds associated with the active flight plan waypoints will be transferred to the corresponding abeam waypoints only if the corresponding abeam distance is less than 100 nm. Winds entered on abeam waypoints will be transferred back to the parent waypoints.

This transfer of winds between parent and abeam waypoints is accomplished for winds entered manually as well as via ACARS uplink. A parent waypoint's status as a reporting point (ACARS) is also transferred to the ABEAM waypoint.

The following diagram depicts the situation.



[Option – FMC U10.3 and later]
The ABEAM PTS prompt will not appear if no abeam waypoints are possible or if selection would increase the total number of waypoints to more than 150.

Abeam waypoints will not be generated for floating (non–fixed) waypoints; if the abeam distance exceeds 700 nm; or if the abeam waypoint would fall within 10 nm of either the present position or the direct–to waypoint.

If two or more identical (within 1 nm of each other) abeam waypoints are generated, only one will be designated.

Abeam waypoints use the same naming conventions as used for place–bearing/distance waypoints. See chapter 11, section 31, "Manually Entered Place–Bearing/Distance or ..." for additional information.

Select Desired Waypoint Page

When a waypoint identifier is not unique (other database waypoints have the same name), a selection of which latitude/longitude to use must be made before that waypoint can be used in the route.

[FMC U10.6 and later]
The SELECT DESIRED XXX page is automatically displayed when the FMC encounters more than one identifier for the same waypoint name after a waypoint entry.

[FMC U10.6 and later]

1 **Identifier**

Displays the identifier for the duplicate named waypoints. Select the proper waypoint by pushing the appropriate left or right line select key. This page is automatically removed after a waypoint is selected.

2 **Type**

Shows type of navaid.

Available types include VOR, VORTAC, VORDME, NDB, LOC, ILS, DME, ILSDME, LOCDME, APT or WPT.

3 **Frequency**

Displays the frequency of the navaid.

Blank if the waypoint is not a navaid.

4 **Waypoint Name**

Displays the name of the waypoint.

Blank if the waypoint is not a navaid.

5 Latitude/Longitude

The latitude/longitude is displayed for each duplicate name.

Airway to Airway Intercept Feature

[Option U14]

There are two methods in which this feature can be used.

The first method in which the airway to airway feature can be used, involves picking two airways that share a common waypoint. The common waypoint acts as the terminal waypoint for the first airway and the entry waypoint for the second airway. The first airway to be used is entered in the first available VIA field, the common waypoint in the TO field, and the second airway in the next available VIA field.

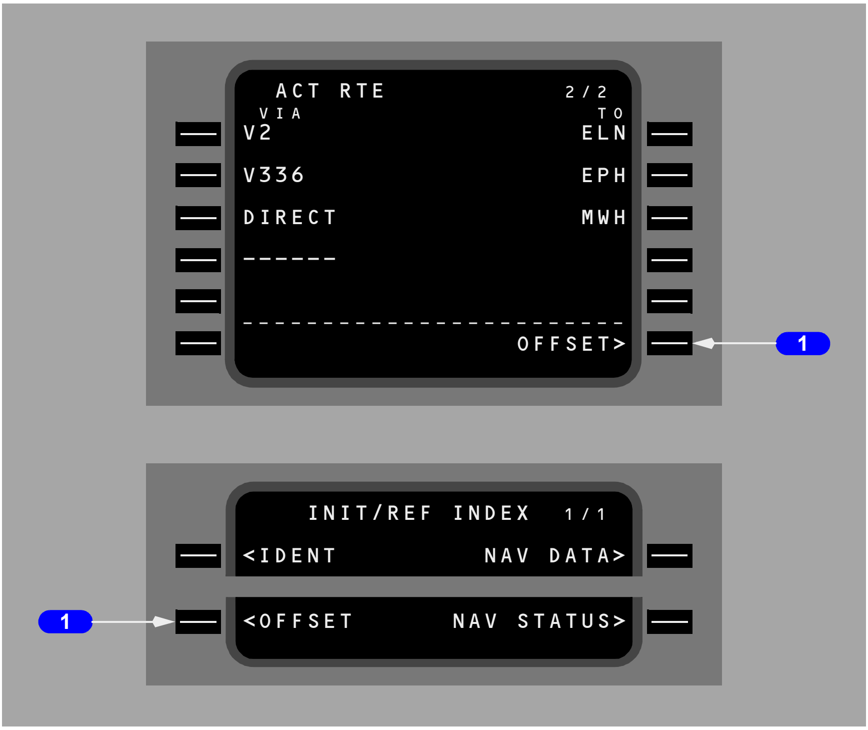
The second method in which this feature can be used to create an airway to airway intercept, involves entering two airways that intersect in the first and second available VIA fields, but do not have a common waypoint at the intersection. In this case, a temporary waypoint is created, starting with the letter "X", and used as the TO waypoint.

Lateral Offset

A lateral offset may be specified up to 99.9 nautical miles left or right of course. The OFFSET prompt is displayed on the INIT/REF INDEX page and in flight on the RTE page. Selection displays the LATERAL OFFSET (or ACT LATERAL OFFSET page if an offset already exists).

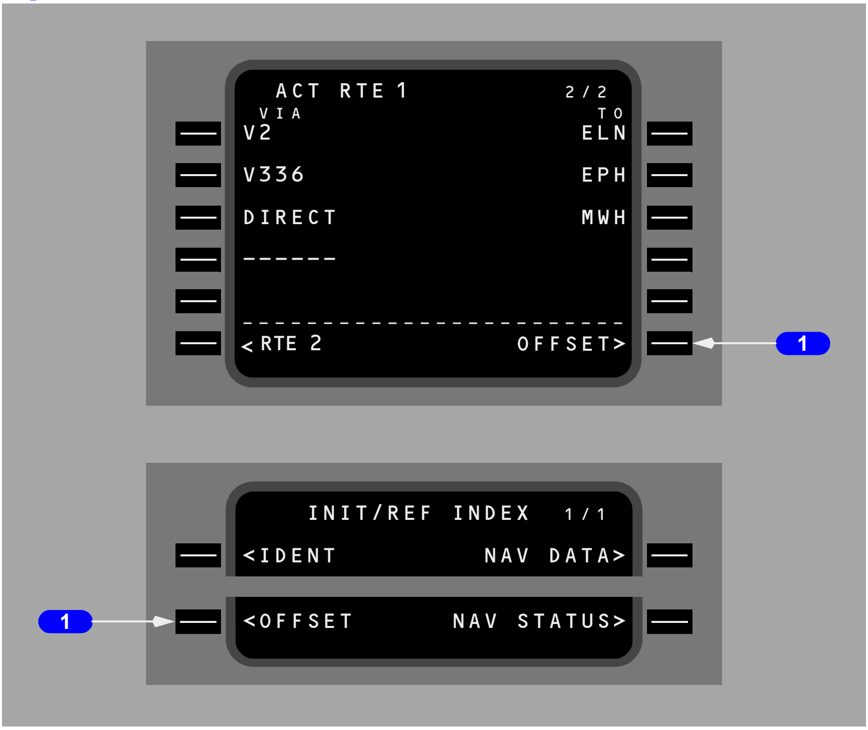
Some legs are invalid for offset. These include:

- End of flight plan waypoint
- Discontinuity
- Beginning of approach transition
- Approach procedure
- DME arc
- Heading leg
- Holding pattern (except PPOS)
- Certain legs containing flyover waypoints
- Course change greater than 135 degrees
- Preplanned termination waypoint.


ACT RTE
2/2
VIA
TO
V2
ELN
V336
EPH
DIRECT
MWH

OFFSET>
1
INIT/REF INDEX
1/1
<IDENT
NAV DATA>
<OFFSET
NAV STATUS>
1

[Option – FMC U11.0 and later]

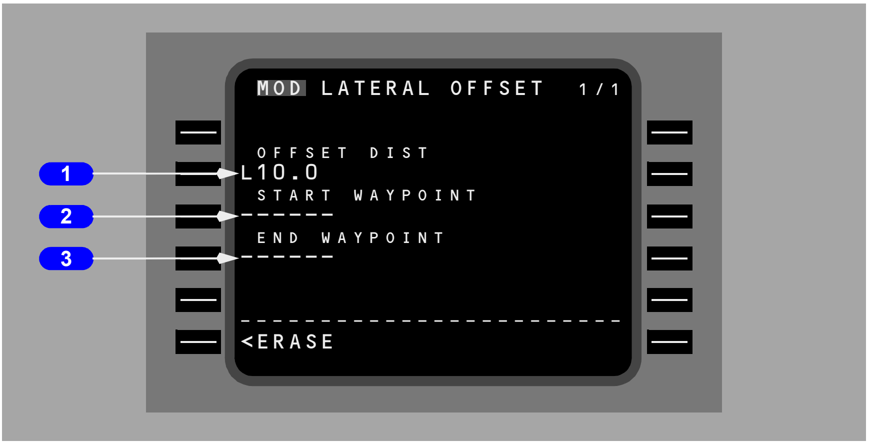


1 OFFSET

Push – displays the lateral offset page.

The offset prompt is only displayed when an ACTIVE or MODIFIED flight plan exists.

Lateral Offset Page



1 Offset Distance (OFFSET DIST)

The desired lateral offset distance is entered on line 2L In the example, the 10.0 nm offset left of course could be entered L10.0, L10, 10.0L, or 10L.

Entry results in display of start and end waypoint fields.

2 START WAYPOINT

The waypoint at which the offset is to begin may be entered (up to 6 characters).

Dashes are displayed if current leg is valid for offset. Box prompts are displayed if current leg is invalid for offset.

Offset will begin at first valid offset leg after the start waypoint.

Deletion of start waypoint (or no entry) will result in offset beginning at first valid offset leg in the flight plan.

3 END WAYPOINT

The waypoint at which the offset is to end may be entered (up to 6 characters).

Offset will propagate through flight plan until end waypoint is encountered.

Deletion of end waypoint (or no entry) will result in offset propagating until an invalid offset leg is encountered.

VNAV Modifications

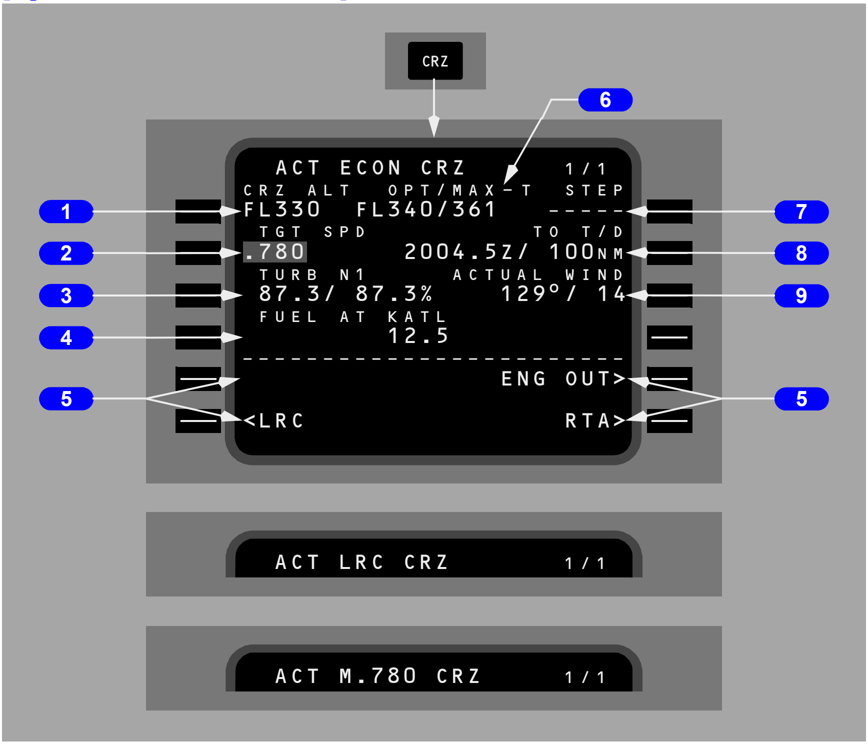
Three primary cruise modes are available – economy (ECON) cruise, long range cruise (LRC), and cruise with a manually selected speed.

Access to the various cruise pages is obtained by pushing the CRZ mode select key.

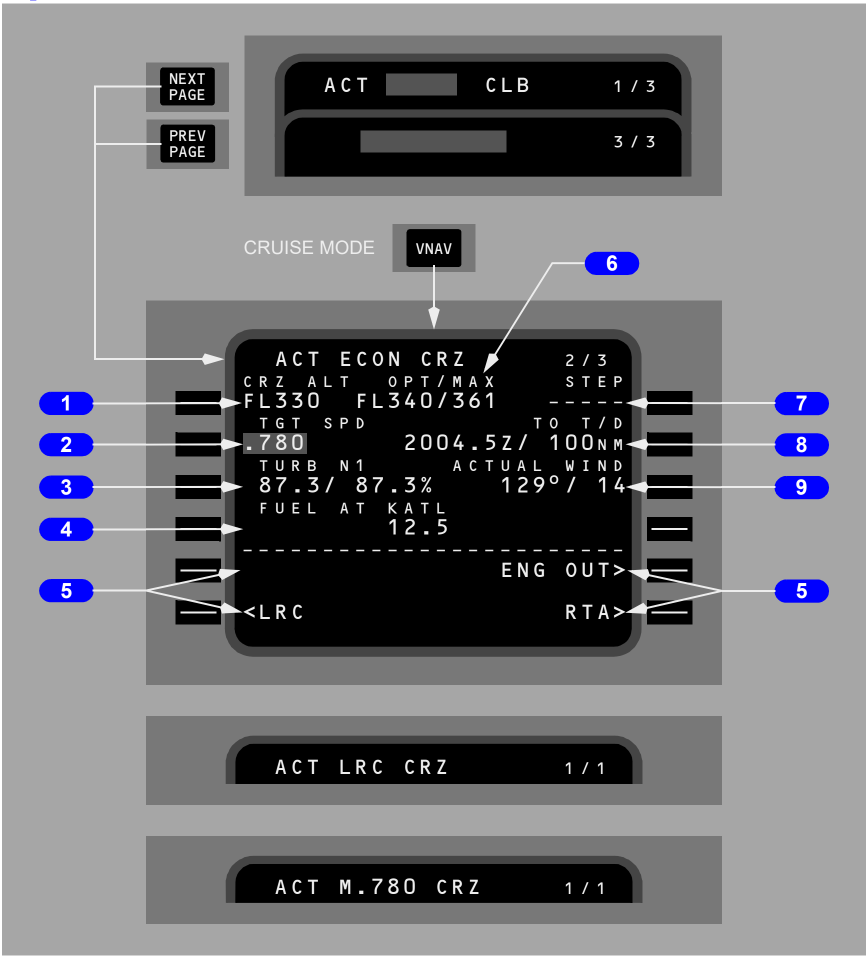
[Option – With FANS MCDU]
Access to the various cruise pages is obtained by pushing the VNAV function key while in cruise. Access from other performance pages is via the NEXT/PREV PAGE key.

Cruise Page

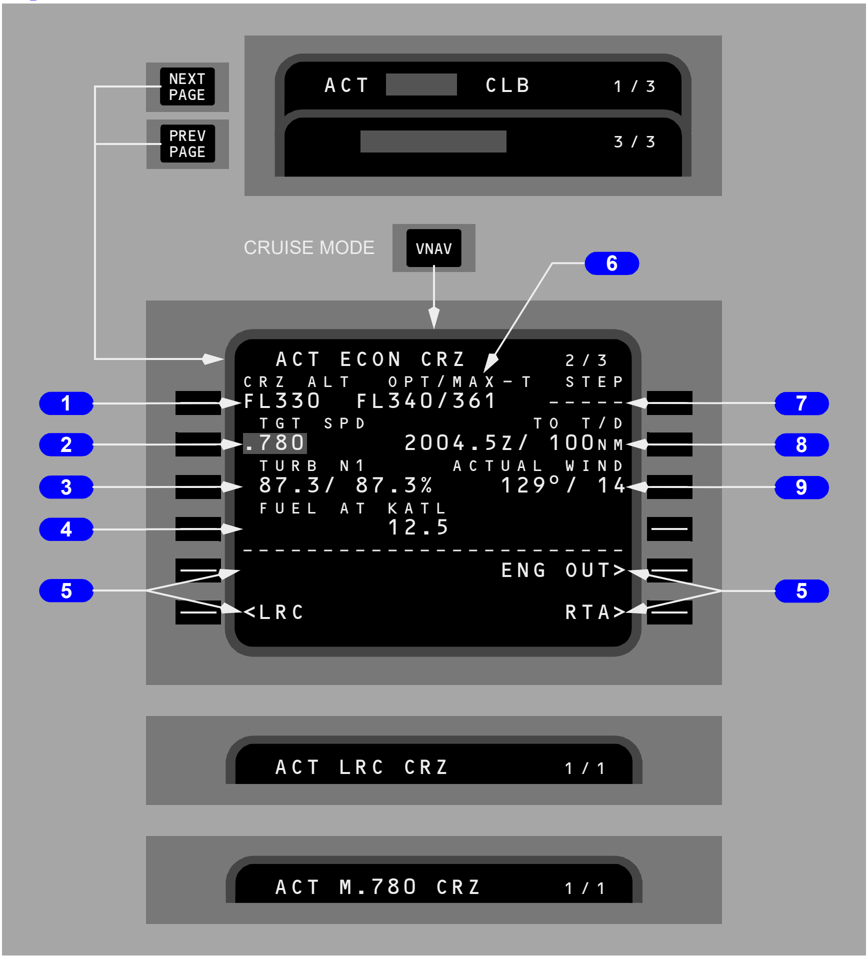
[Option – FMC U11.0 and later]



[Option – With FANS MCDU]



[Option – With FANS MCDU and FMC U11.0 and later]



1 Cruise Altitude (CRZ ALT)

Displays present cruise altitude in flight level or feet x 100. Value may be entered via the keyboard or propagated from the PERF INIT, CLB, CRZ CLB, or CRZ DES pages.

During active cruise, entry of a new value propagates to all other pages which display cruise altitude and causes the MOD CRZ CLB or MOD CRZ DES page to appear.

[Option – With speed and altitude intervention]
Value may be increased using altitude intervention.

[Option – FMC U11.0 and later]
Value may be increased or decreased using altitude intervention.

2 Target Speed (TGT SPD)

The computed target speed displays one of the following:

- computed or manually selected value for target airspeed or Mach
- XXX/MCP when speed intervention is active and the plan is active
  - deletion or modification of XXX/MCP is not allowed
- XXX/HOLD when decelerating to hold speed prior to the hold entry fix
  - deletion or modification of hold speed is not allowed.

The value is reverse highlighted on an active cruise page.

A manual airspeed or Mach entry will automatically propagate to the descent page TGT SPD field.

3 Turbulence N1 (TURB N1)

Displays proper N1 for turbulence penetration.

Value is for reference only. It is not commanded to the autothrottle.

4 Fuel at Destination (FUEL AT XXXX)

Displays the predicted fuel remaining at destination.

The value assumes continued flight per the displayed cruise and planned descent modes along the active route.

If a step to altitude is entered on line 1R, the computation assumes that the step will occur at the step point. After passing the step climb point, the predicted fuel weight is based on an immediate step climb from current position.

5 Cruise Page Prompts

Allow line selection of the various cruise pages.

The RTA prompt is replaced with ERASE when a MOD page is displayed.

6 Optimum/Maximum Altitude (OPT/MAX)

Displays the computed optimum altitude for the displayed cruise mode. The value is not constrained by minimum cruise time criteria (as is the TRIP ALT on the PERF INIT page).

Also displays the maximum possible altitude based on the selected target speed and the specified maneuver margin.

[Option – FMC U11.0 and later]
The limiting criterion for MAX altitude is labeled in the header.

- “- T” when available thrust is the limiting criterion for maximum altitude.
- “- B” when buffet margin is the limiting criterion for maximum altitude.

[Option – FMC U11.0 and later]
Maximum altitude reflects the altitude for the active or mod flight plan.

Values are advisory only. They are provided for crew reference.

7 Step to Altitude Line (STEP)

This line may be used to enter a possible step climb or descent altitude for crew evaluation.

The line will be blank when within 100 nm of top of descent or when RTA mode is active.

8 Top of Descent (TO T/D) Line

Displays time of arrival at and distance to top of descent point.

The data is always displayed when the distance is less than 100 nm. If the distance is more than 100 nm, the data will be displayed only if a step to altitude has not been entered.

9 ACTUAL WIND

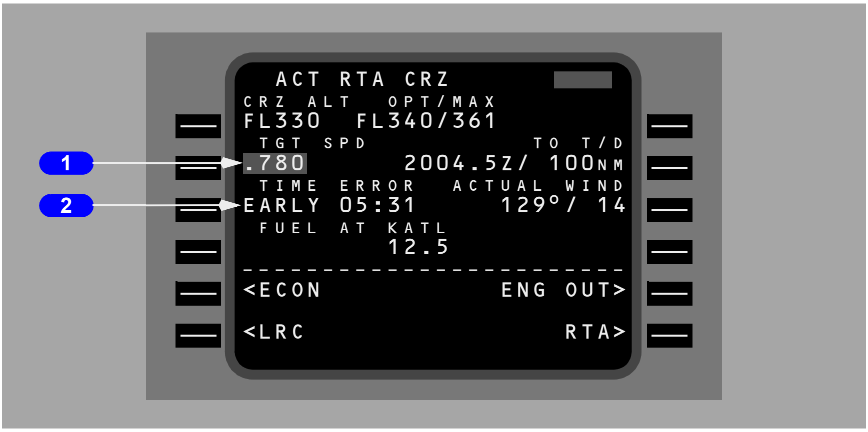
Displays computed or manually entered true wind for present altitude.

A manual entry has priority. The data line title then changes to EST WIND (estimated wind).

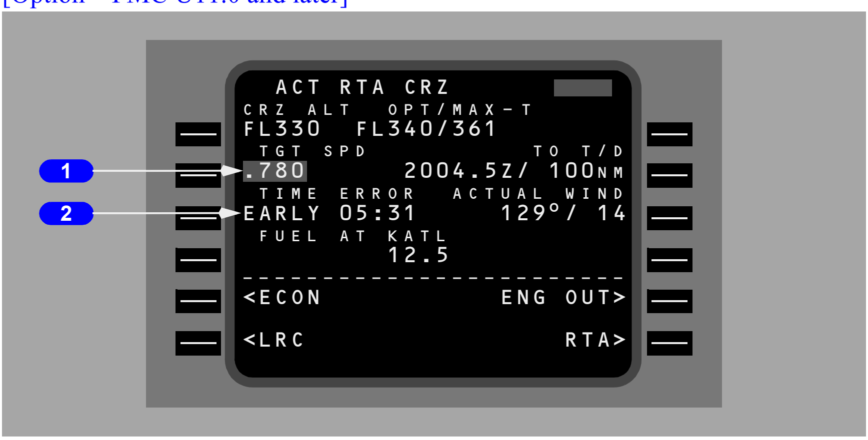
The displayed value is used as the assumed true wind at the step to altitude for making wind/altitude trade computations.

RTA Cruise

If an RTA waypoint has been specified, the cruise page will reflect the RTA data.



[Option – FMC U11.0 and later]



1 Target Speed (TGT SPD)

Displays the computed speed required to meet the RTA.

When RTA mode is exited by waypoint sequence or by deletion, this speed becomes the FMC target speed on a manual speed cruise page and the scratchpad message SELECT MODE AFTER RTA is displayed.

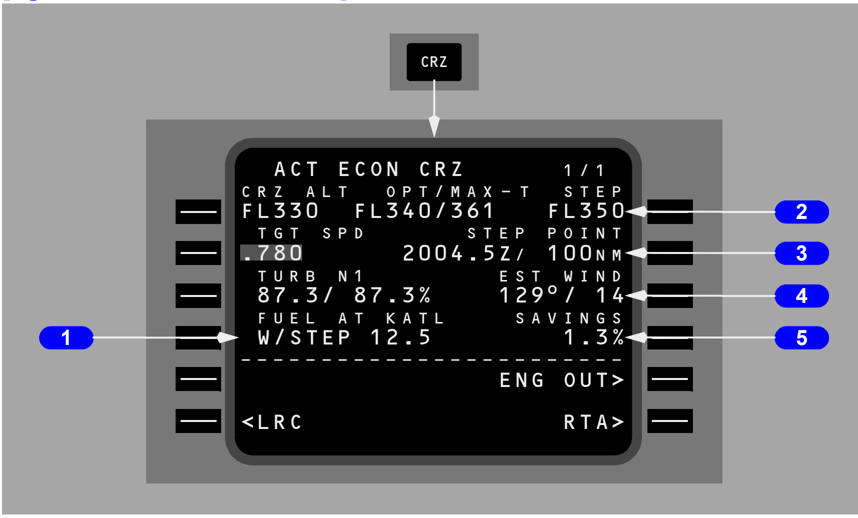
2 TIME ERROR

Displays the computed time error at the RTA waypoint.

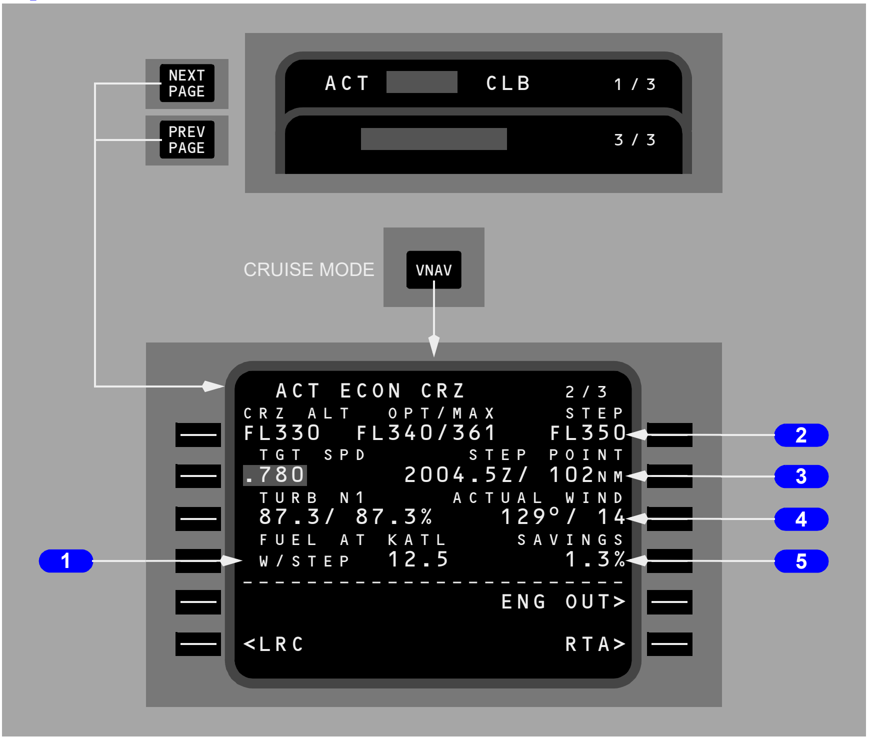
Same as time error on RTA PROGRESS page.

Cruise with Step Climb

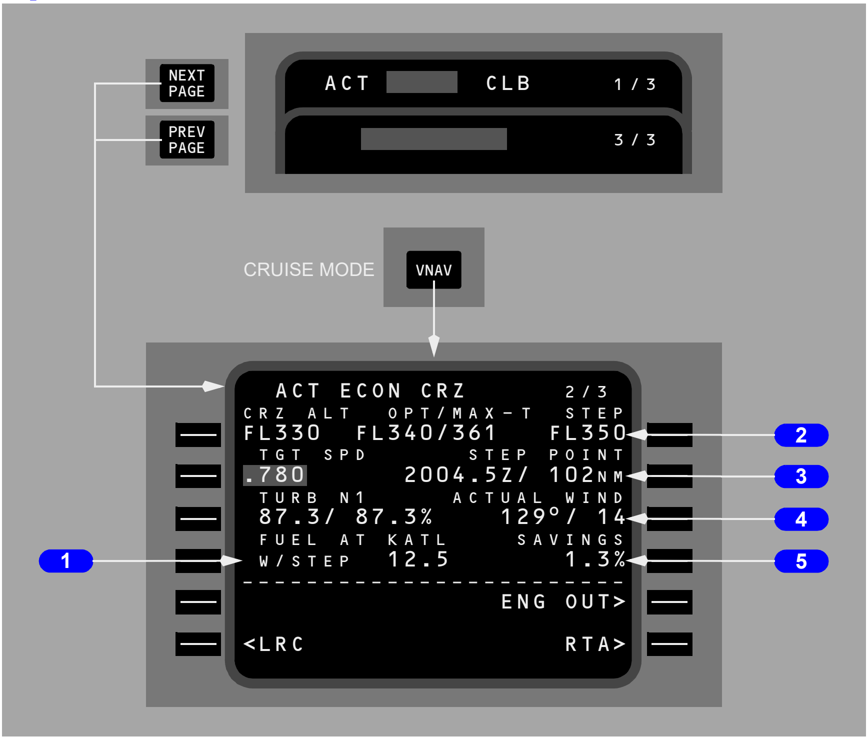
[Option – FMC U11.0 and later]



[Option – With FANS MCDU]



[Option – With FANS MCDU and FMC U11.0 and later]



1 **Fuel at Destination with Step Climb Altitude (FUEL AT XXXX)**

The computation assumes the step climb will occur at the STEP point, and the value is prefixed by W/STEP.

2 **Step To Altitude (STEP)**

Used to enter step climb or step descent altitudes for crew evaluation.

Blank when within 100 nm of top of descent or when RTA mode is active.

3 **STEP POINT**

Displays the computed ETA at, and distance to, the first possible step climb point based on gross weight.

Blank if no entry on STEP TO line.

4 **Wind (ACTUAL WIND or EST WIND)**

Used as the assumed true wind at the STEP TO altitude for making wind–altitude trade computations.

5 **Savings/Penalty (SAVINGS or PENALTY)**

Displays the predicted cost savings or penalty associated with flying the displayed speed/altitude step climb or descent profile, as compared to flying the current cruise speed schedule and maintaining present altitude to top of descent.

Blank if no step data entered.

Cruise Climb

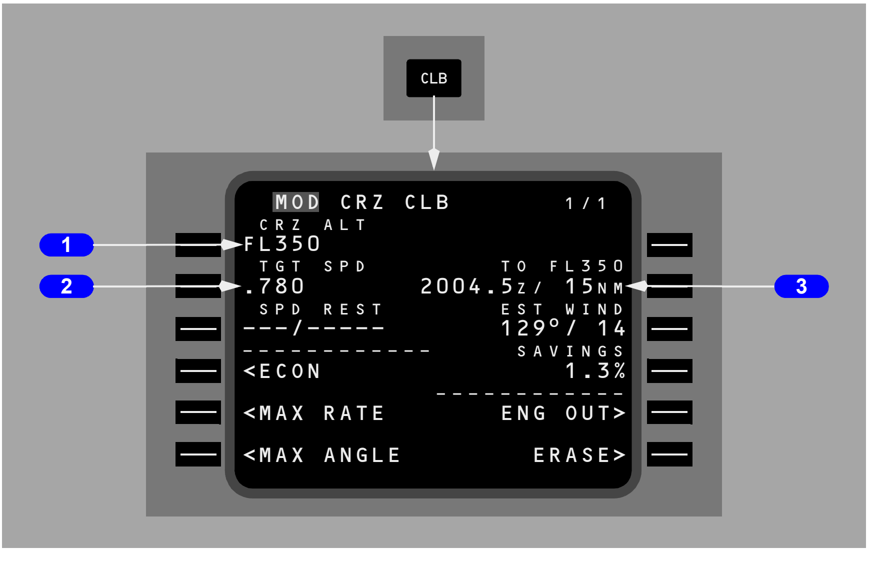
The cruise climb page displays data for a cruise climb to a new altitude.

MOD CRZ CLB is automatically displayed during cruise if a higher cruise altitude is entered on the CRZ page.

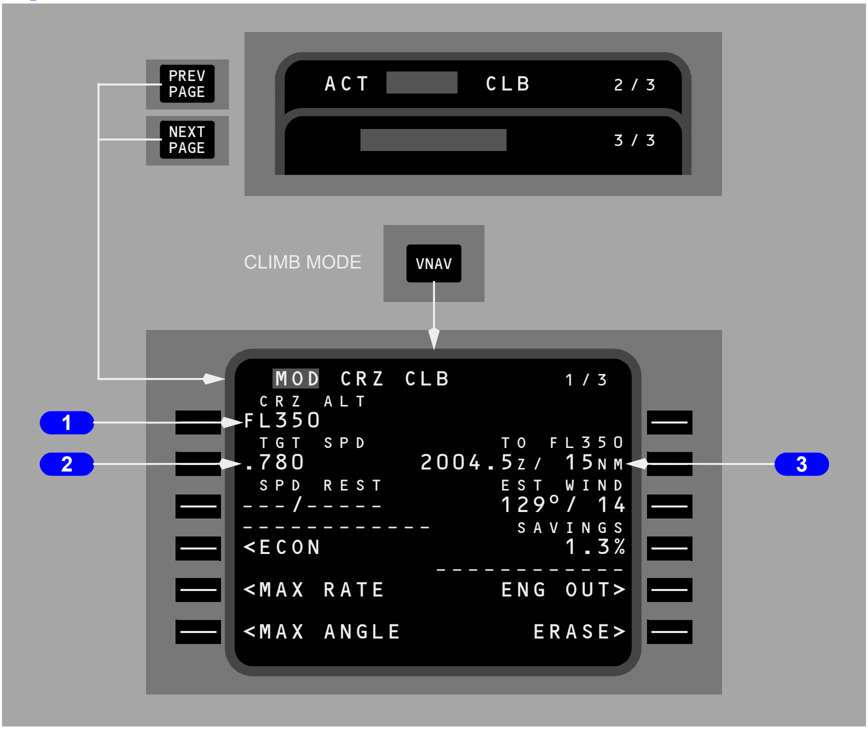
[Option - U13 and Below]
During VNAV operation, execution initiates a climb at climb thrust and cruise target speed to the new altitude.

[Option - U14]
During VNAV operation, execution initiates a climb at climb thrust. When the CRZ target speed is ECON/LRC, the target speed changes with a cruise climb speed schedule from the initial cruise altitude ECON/LRC speed to the new executed cruise altitude ECON/LRC speed.

The VNAV climb mode is active until reaching the selected altitude. The mode then automatically changes back to cruise.



[Option – With FANS MCDU]



1 **Cruise Altitude (CRZ ALT)**

Initially displays the CRZ ALT entered on the CRZ page.

Manual entry may be made.

2 **Target Speed (TGT SPD)**

Displays target cruise speed for the displayed cruise altitude.

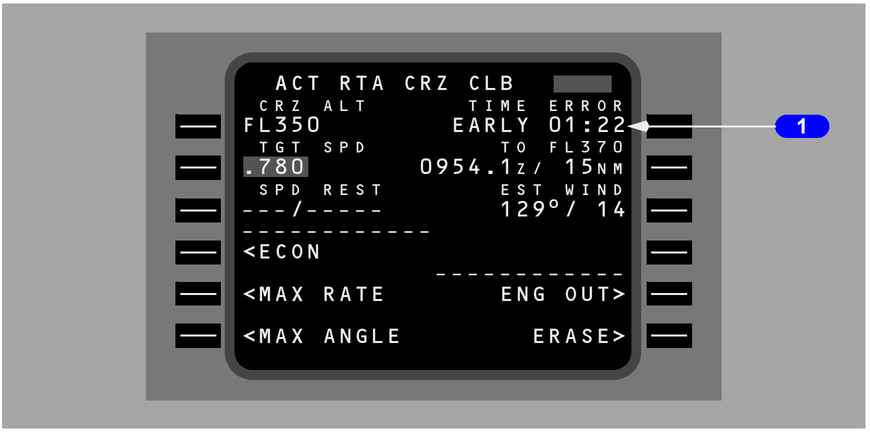
Manual entry may be made.

3 **TO FLXXX**

Displays ETA at, and distance to, the displayed cruise altitude.

RTA Cruise Climb

The RTA cruise climb page displays the same data as the cruise climb page except for the TIME ERROR line.



1 TIME ERROR

Displays the computed time error at the RTA waypoint.

Same as time error on RTA PROGRESS page.

Cruise Descent

The cruise descent page displays data for a cruise descent to a new altitude.

MOD CRZ DES is automatically displayed during cruise if a lower cruise altitude is entered on the CRZ page.

[Option – FMC U11.0 to U13]
CRZ DES provides the means of initiating step descents to a new cruise altitude during cruise.

[Option – FMC U14.0]
During VNAV operation, execution initiates a descent at 1,000 feet per minute. When the cruise target speed is ECON/LRC, the target speed changes with a cruise descent speed schedule from the initial cruise altitude ECON/LRC speed to the new executed cruise altitude ECON/LRC speed.

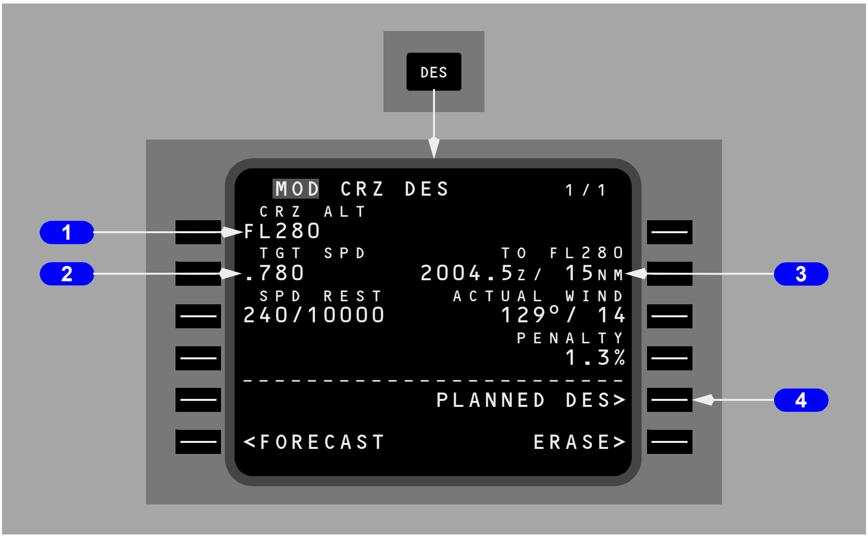
During VNAV operation, execution initiates a descent at 1,000 feet per minute and cruise target speed to the new altitude.

[Option – FMC U11.0 and later]
A CRZ DES will occur upon lowering the MCP ALT to a lower altitude, but at or above any descent constraint altitude and pressing ALT INTV if the airplane is further than 50 nm from the top of descent at the current cruise altitude, or by entering a new cruise altitude on the FMC CRZ page after setting the new level-off altitude in the MCP.

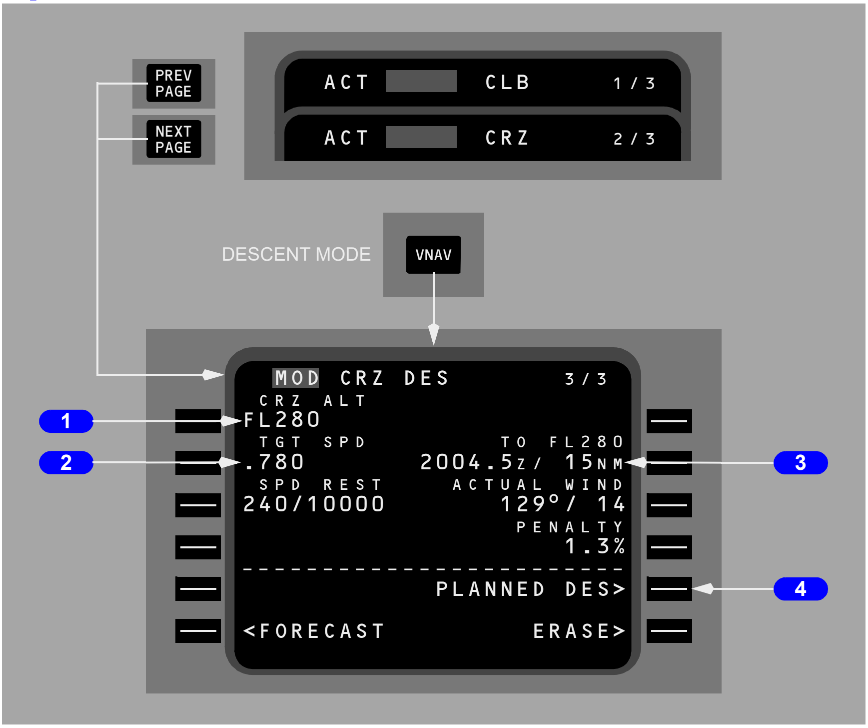
[Option – FMC U11.0 and later]
The FMC software allows a CRZ DES to the normal Descent Path capture if the normal path is encountered during the Cruise Descent and prior to reaching the new cruise altitude. The active VNAV descent phase will be entered from a Cruise Descent at the time the extended descent path is captured.

For U13 and below

Note: VNAV CRZ DES guidance at 1000fpm may not capture a new cruise altitude with sufficient distance to comply with any fix or waypoint altitude constraint if the fix or waypoint altitude constraint is the same as the new cruise altitude. Any fix or waypoint constraint that is the same as the cruise altitude may not be considered in the initial vertical trajectory. If initiating early descent, VNAV descent predictions will update the vertical path to include the fix or waypoint constraint.



[Option – With FANS MCDU]



1 Cruise Altitude (CRZ ALT)

Initially displays the CRZ ALT entered on the CRZ page.

Manual entry may be made.

[Option – FMC U11.0 and later]
With Speed/Altitude Intervention software, "CRZ ALT" can be decreased using altitude intervention.

2 Target Speed (TGT SPD)

Displays target cruise speed for the displayed cruise altitude.

Manual entry may be made.

Manual CAS or Mach entries are automatically copied to the descent page TGT SPD field.

3 TO FLXXX

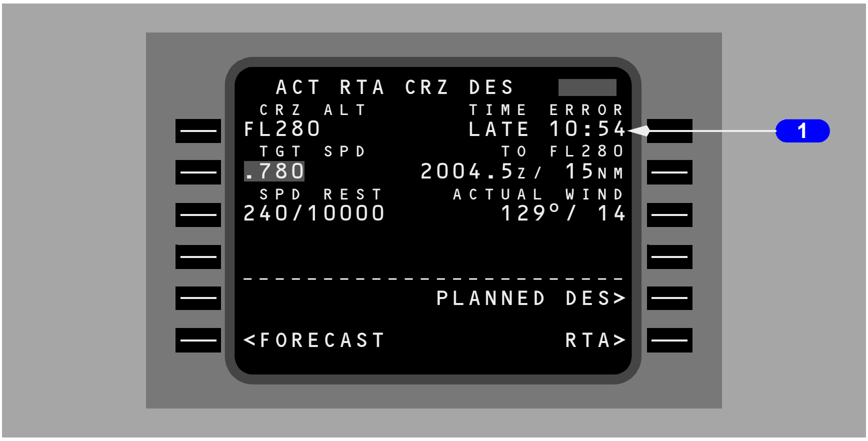
Displays ETA at, and distance to, the displayed cruise altitude.

4 **Planned Descent (PLANNED DES)**

Push – displays the planned DES page and allows access to the planned standard descent mode.

RTA Cruise Descent

The RTA cruise descent page displays the same data as the cruise descent page except for the TIME ERROR line.



1 **TIME ERROR**

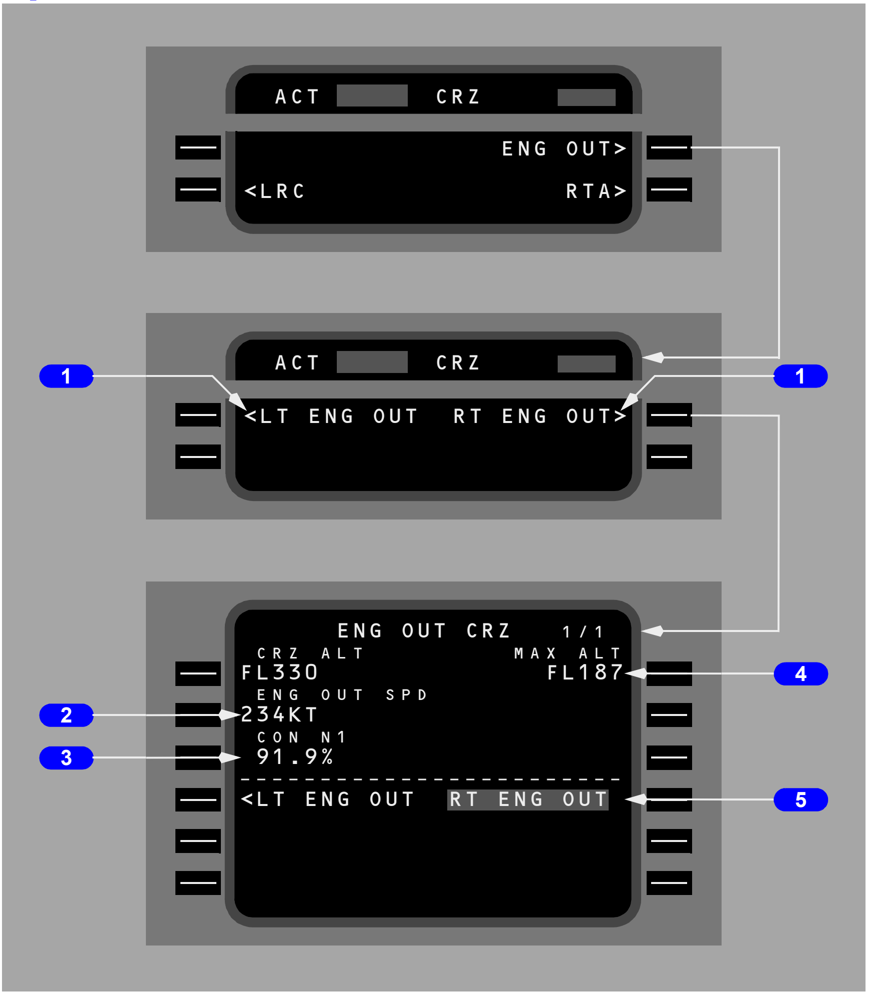
Displays the computed time error at the RTA waypoint.

Same as time error on RTA PROGRESS page.

Engine Out Cruise

The engine out cruise page may be accessed by selecting the ENG OUT prompt on the cruise page. The page displays advisory data for a one engine inoperative condition.

[Option – FMC U10.3 and later]



1 Left/Right Engine Out (LT ENG OUT/RT ENG OUT)

[Option – FMC U10.3 and later]
Selection changes display to ENG OUT CRZ page. The ENG OUT CRZ page is information only.

[Option – FMC U10.3 and later]

2 Engine Out Speed (ENG OUT SPD)

Displays the optimum speed based on minimum drag.

[Option – FMC U10.3 and later]

3 Continuous N1 (CON N1)

Displays N1 for maximum continuous thrust.

N1 is computed using actual bleed conditions.

4 Maximum Altitude (MAX ALT)

Displays the computed maximum altitude at which a company–specified rate of climb can be achieved, using one engine at maximum continuous thrust (default climb rate is 100 feet per minute).

After page selection, the FMC accounts for wing and engine anti–ice, air conditioning, and the engine bleed of the operating engine.

5 LT ENG OUT/RT ENG OUT

Selected engine is shown in reverse highlighting.

Early Descent

Early descents are initiated from the DES page. Once an early descent is executed, VNAV transitions to the descent mode and cruise features are no longer available.

For a path descent the DES NOW prompt will not be displayed until a descent path is established. Once executed, the autothrottle adjusts thrust to maintain 1000 feet per minute until intercepting the descent path.

For a speed descent, the autothrottle retards to idle and pitch maintains target speed.

1 **Descend Now (DES NOW)**

Selecting the PATH DES page before reaching the top of descent displays the normal descent page with the prompt DES NOW on the bottom right of the page. Selecting and executing the DES NOW prompt initiates a VNAV descent of 1000 feet per minute at ECON speed. Upon reaching the planned descent path, VNAV transitions to maintain the planned descent path.

[Option – FMC U10.6 or later and Common VNAV]
Selecting the DES page before reaching the top of descent displays the normal descent page with the prompt DES NOW on the bottom right of the page. Selecting and executing the DES NOW prompt initiates a VNAV descent of 1000 feet per minute at ECON speed. Upon reaching the planned descent path, VNAV transitions to maintain the planned descent path.

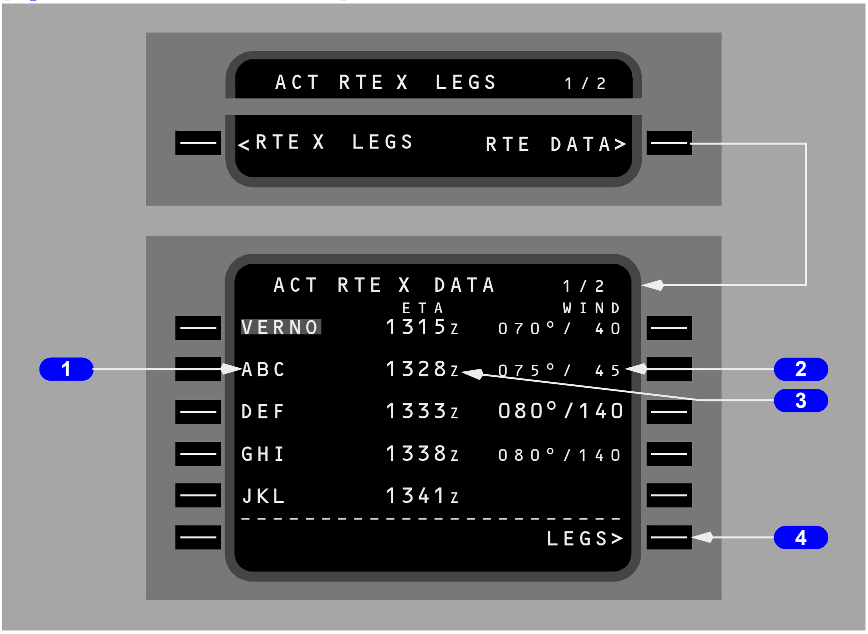
Selecting the SPD DES page and executing the DES NOW prompt initiates a VNAV descent at idle thrust and target speed.

Route and Waypoint Data
Route Data (RTE DATA) Page

The RTE DATA page displays ETA for each waypoint on the RTE LEGS page. This page also displays forecast wind data for cruise waypoints.

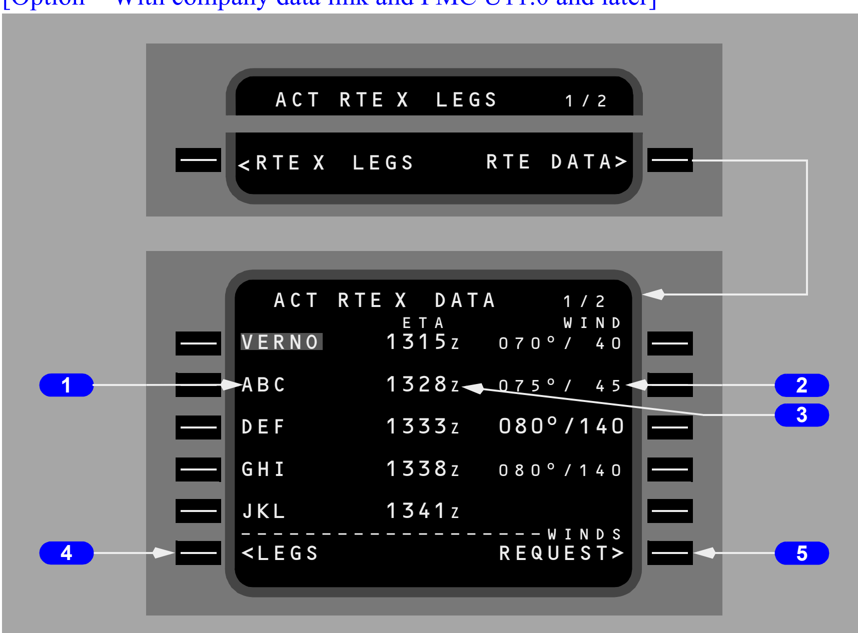
One page displays data for five waypoints.

[Option – FMC U11.0 and later]



[Option – With company data link]

[Option – With company data link and FMC U11.0 and later]



1 **Waypoint**

Displays the identifier for the waypoint from the ACT RTE LEGS page.

2 **WIND**

Used for entry and/or display of the true winds at the cruise waypoint identified on the same line.

Entry may be via the keyboard, or propagated from the CRZ WIND entry on the PERF INIT page.

The CRZ WIND value (075°/45 is depicted) propagates to all cruise waypoints (ABC to GHI is the depicted cruise segment).

If no CRZ WIND entry was made, the FMC assumes 000°/000.

A keyboard entry has priority and propagates to all down path cruise waypoints (an entry of 080°/140 at DEF is depicted). The entry must be executed.

Any entries propagated from the CRZ WIND entry are displayed in small font. Keyboard entries are displayed in large font.

Crew entries of forecast winds (or default 000°/000) are automatically biased with the actual wind computed by the FMC when within 100 NM of a cruise waypoint and within 2000 feet of a cruise altitude. Biased values are not displayed.

Blank for non–cruise waypoints (VERNO and JKL are depicted). Entry is inhibited.

3 **Estimated Time of Arrival (ETA)**

Displays the FMC calculated waypoint ETA.

4 **LEGS**

Push – displays the RTE LEGS page.

[Option – With company data link]
5 **WINDS REQUEST**

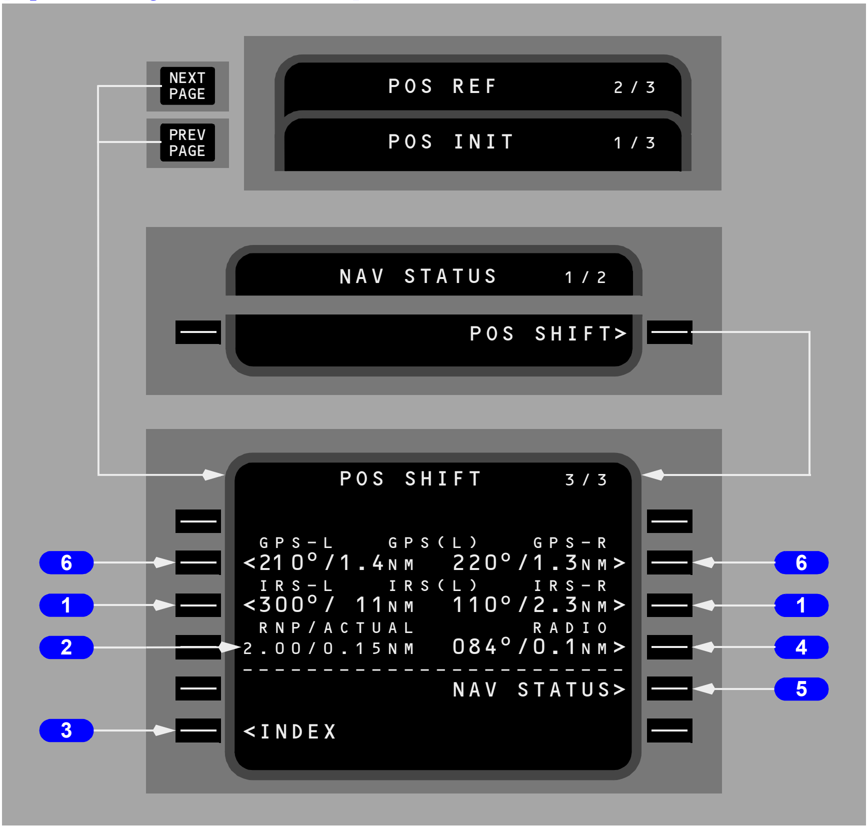
Push – transmits a data link request for winds uplink.

Position Shift Page 3/3

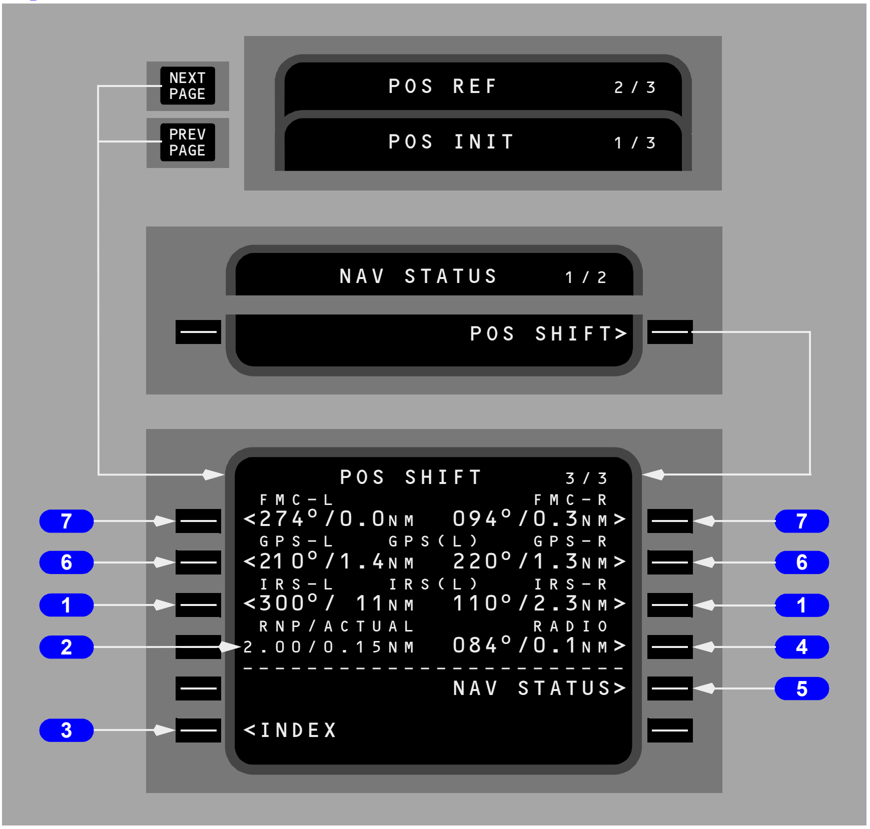
On the POS SHIFT page, each prompt indicates the bearing and distance of the indicated system relative to the FMC position. FMC position is displayed on line 1R of POS REF page 2/3. The entries with parentheses in the center of the page show the active position references.

Data fields are blank when on the ground.

[Option – Single FMC with GPS]



[Option – Dual FMC with GPS]



1 **IRS Position L/R**

Displays left and right IRS position relative to FMC position using current mag/true reference. Blank if IRS position is invalid.

Push – highlights the line, illuminates the EXEC key, and displays the CANCEL prompt.

2 **Required Navigation Position/Actual (RNP/ACTUAL)**

Displays the required navigation accuracy compared to actual navigation accuracy.

Manual entry is allowed.

3 **INDEX**

Push – displays the INIT/REF INDEX page.

4 **RADIO Position**

Displays radio position relative to FMC position using current mag/true reference. Blank if radio position is invalid.

Push – highlights the line, illuminates the EXEC key, and displays the CANCEL prompt.

5 **Navigation Status (NAV STATUS)**

Push – displays the NAV STATUS page.

[Option – With GPS]

6 **GPS Position L/R**

Displays left and right GPS position relative to FMC position using current mag/true reference. Blank if GPS position is invalid.

Push – highlights the line, illuminates the EXEC key, and displays the CANCEL prompt.

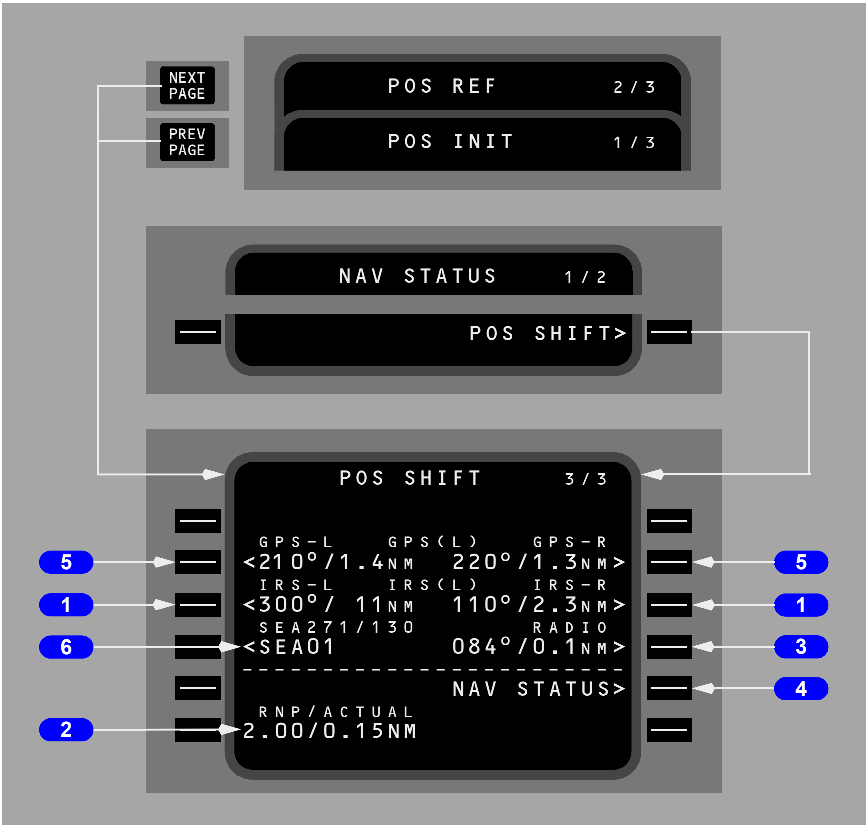
[Option – With dual FMC]

7 **FMC Position L/R**

Displays left and right FMC position relative to FMC position using current mag/true reference. Blank if FMC position is invalid.

Push – highlights the line, illuminates the EXEC key, and displays the CANCEL prompt.

[Option – Single FMC with GPS, U10.6 or later with manual position update]



1 IRS Position L/R

Displays left and right IRS position relative to FMC position using current mag/true reference. Blank if IRS position is invalid.

Push – highlights the line, illuminates the EXEC key, and displays the CANCEL prompt.

2 Required Navigation Position/Actual (RNP/ACTUAL)

Displays the required navigation accuracy compared to actual navigation accuracy.

Manual entry is allowed.

3 **RADIO Position**

Displays radio position relative to FMC position using current mag/true reference. Blank if radio position is invalid.

Push – highlights the line, illuminates the EXEC key, and displays the CANCEL prompt.

4 **Navigation Status (NAV STATUS)**

Push – displays the NAV STATUS page.

[Option – With GPS]

5 **GPS Position L/R**

Displays left and right GPS position relative to FMC position using current mag/true reference. Blank if GPS position is invalid.

Push – highlights the line, illuminates the EXEC key, and displays the CANCEL prompt.

[Option – Single FMC with GPS, U10.6 or later with manual position update]

6 **Manual FIX**

Displays manually entered fix (position).

The fix may be a waypoint, navaid, airport, place bearing/distance, latitude/longitude, or place bearing/place bearing. If the aircraft is within 50NM of the fix, the fix is prefixed with a caret (“<”).

Push – highlights the line, removes caret (if displayed), illuminates the EXEC key, and displays the CANCEL prompt.

If EXEC key is pushed, aircraft position will move to the manual fix position and aircraft MAP displays will be updated.

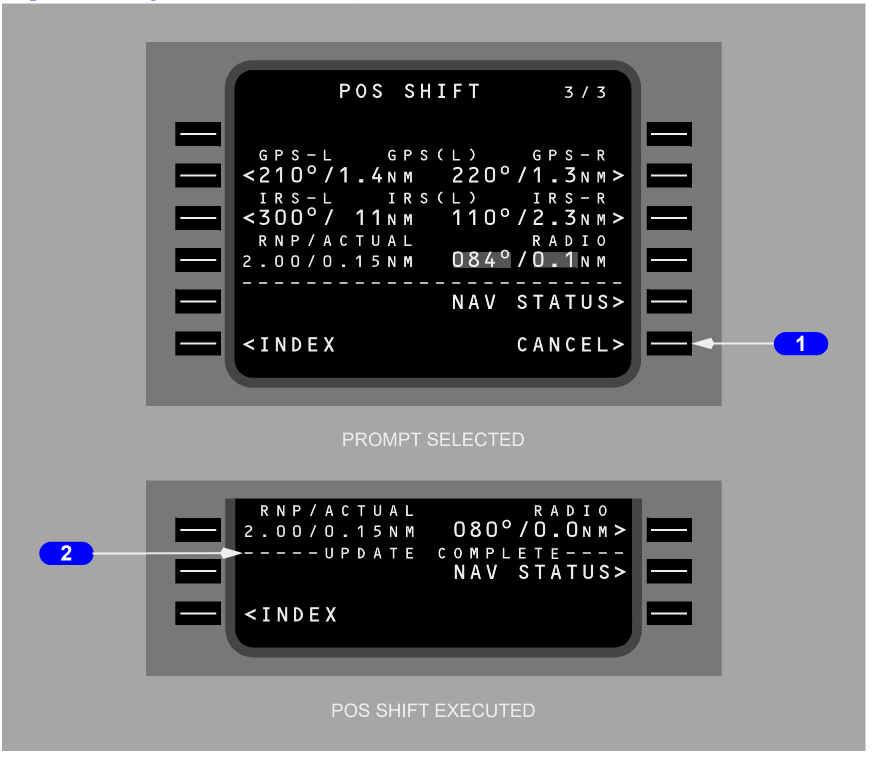
After flight complete or DELETE, the header changes to FIX and field is displayed as dashes.

Inflight Position Update

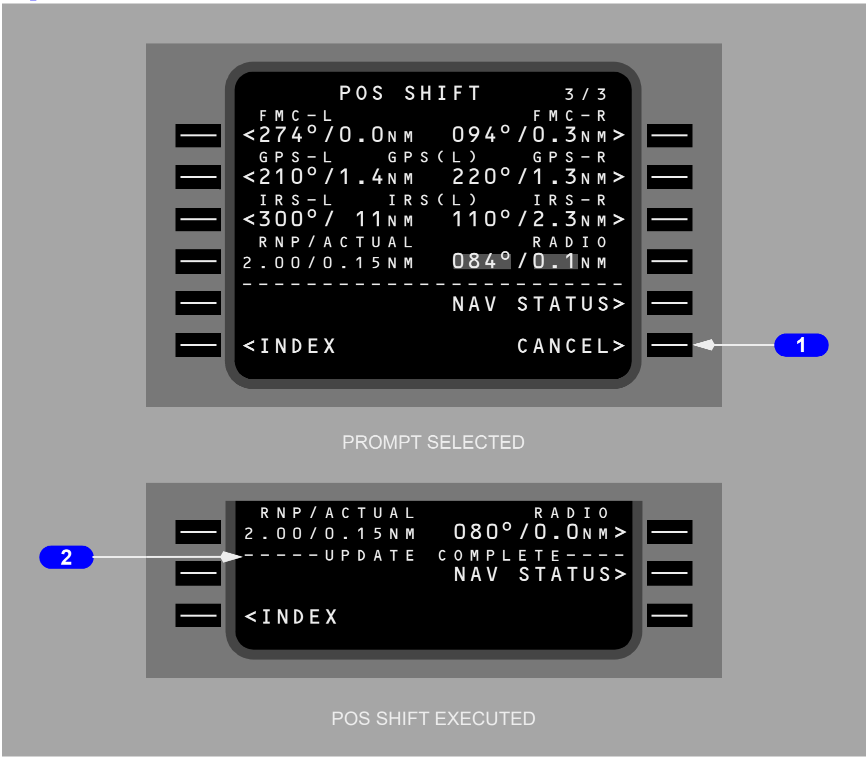
FMC position update is accomplished on the POS SHIFT 3/3 page in flight. Selecting a prompt stops the updating of the relative position. The selection is highlighted, the associated caret is removed, the execute key is illuminated, and the CANCEL prompt is displayed in line 6R.

When the position shift is executed, UPDATE COMPLETE is displayed.

[Option – Single FMC with GPS]



[Option – Dual FMC with GPS]



1 **CANCEL**

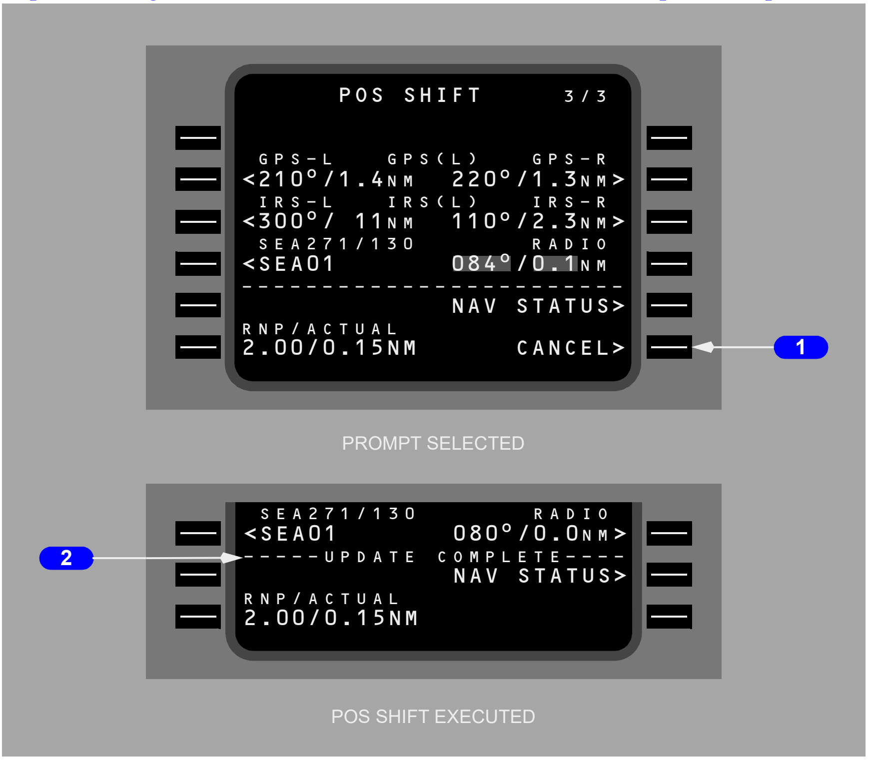
Displayed when a line selection is made for position update.

Push – prior to execution cancels the line selection.

2 **UPDATE COMPLETE**

Displayed after a position shift has been selected and executed.

[Option – Single FMC with GPS, U10.6 or later with manual position update]



1 CANCEL

Displayed when a line selection is made for position update.

Push – prior to execution cancels the line selection.

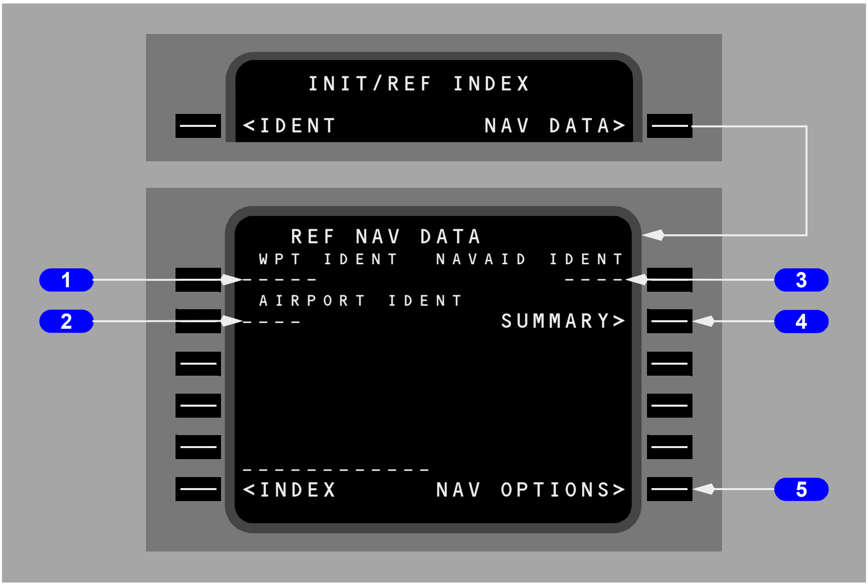
2 UPDATE COMPLETE

Displayed after a position shift has been selected and executed.

Navigation Data

Reference Navigation Data (REF NAV DATA) Page

The reference navigation data page provides information about waypoints, navaids, airports, and runways. Entering the appropriate identifier initiates the display. Writing SUPP in the scratch pad prior to selecting NAV DATA results in display of the supplemental navigation data (SUPP NAV DATA) page.



1 Waypoint Identifier (WPT IDENT)

Displays dashes initially.

Any waypoint, navaid or runway can be entered.

Format for runway entry is “RWnna” where “nn” is a one or two digit numeric (with or without leading zeros) and “a” is an optional character L, R, or C.

In order to access runway data, an airport must be identified.

2 Airport Identifier (AIRPORT IDENT)

Displays dashes initially.

Displays box prompts if runway is entered into 1L prior to airport entry.

An invalid airport/runway pair will result in “NOT IN DATA BASE” displayed in the scratchpad.

3 Navigation Aid Identifier (NAVAID IDENT)

Displays dashes initially.

Valid entries are up to 4 alphanumeric characters.

If the navaid is not contained in the databases, box prompts will appear in related data fields needing entry.

4 SUMMARY

Push – displays NAV SUMMARY pages.

Blank if supplemental and temporary databases are empty.

5 Navigation Options (NAV OPTIONS)

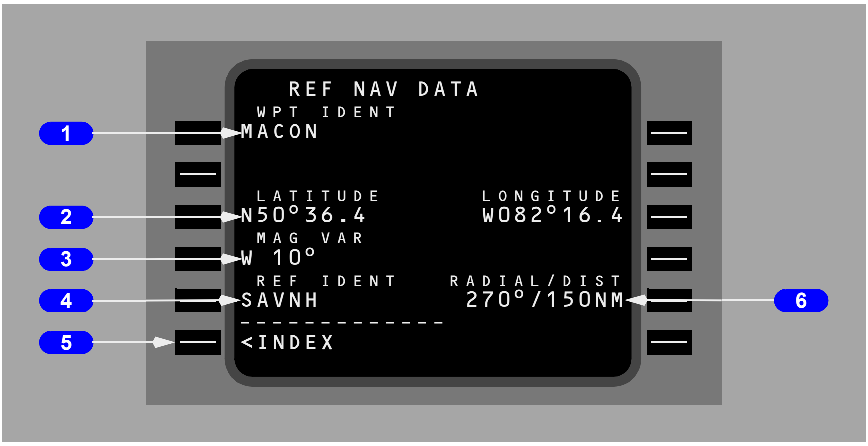
Push – displays NAV OPTIONS page.

If the entered identifier is already stored in the permanent, supplemental, or temporary database, then relevant data propagates to the subsequent REF NAV DATA display.

If the entered identifier is not stored in any database, the subsequent REF NAV DATA display contains box prompts. Following entry of the required information, the new data may be stored in the temporary database by executing (except for runway data). Data may be subsequently deleted from the temporary database by deleting the individual identifier, if the identifier is not presently being displayed on another page (e.g., RTE LEGS, PROGRESS, etc.).

All data stored in the temporary database is cleared at flight completion.

Waypoint Data Display



1 Waypoint Identifier (WPT IDENT)

Displays or permits entry of the desired waypoint. When this entry is complete, the associated data lines are displayed.

2 LATITUDE/LONGITUDE

Displays or permits entry of waypoint latitude and longitude. Entry on the REF IDENT and RADIAL/DIST lines cause latitude and longitude to be computed and displayed.

3 Magnetic Variation (MAG VAR)

Displays or permits entry of waypoint magnetic variation. Data is automatically computed based on latitude and longitude.

Manual entry has priority.

4 Reference Identifier (REF IDENT)

Together with RADIAL/DIST, displays or permits entry of reference point for a created waypoint.

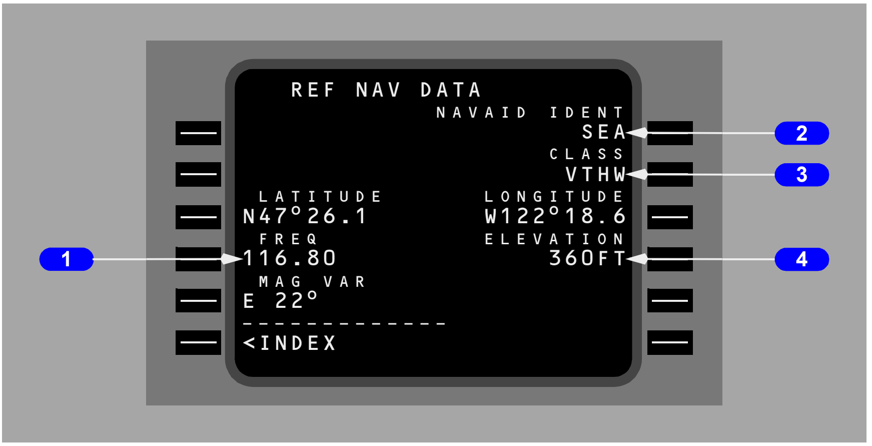
5 INDEX

Push – displays INIT/REF INDEX page.

6 Radial/Distance (RADIAL/DIST)

Together with REF IDENT, displays or permits entry of bearing and distance for a created waypoint.

Navigation Aid Data Display



1 Frequency (FREQ)

Displays or permits entry of the frequency of the entered navaid.

2 Navigation Aid Identifier (NAVAID IDENT)

Displays or permits entry of navaid identifier (5 characters maximum). Following entry, the associated data lines are displayed.

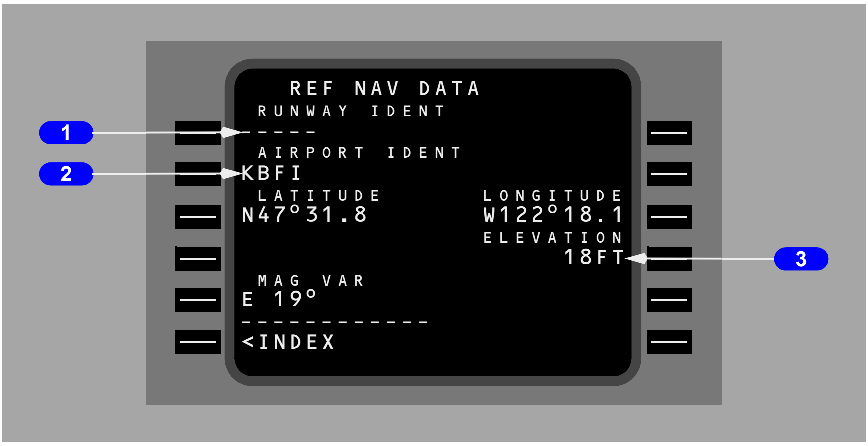
3 Classification (CLASS)

Displays or permits entry of the classification of the entered navaid.

4 ELEVATION

Displays or permits entry of the elevation (feet above MSL) of the entered navaid.

Airport Data Display



1 Runway Identifier (RUNWAY IDENT)

Permits entry of runway identifier.

2 Airport Identifier (AIRPORT IDENT)

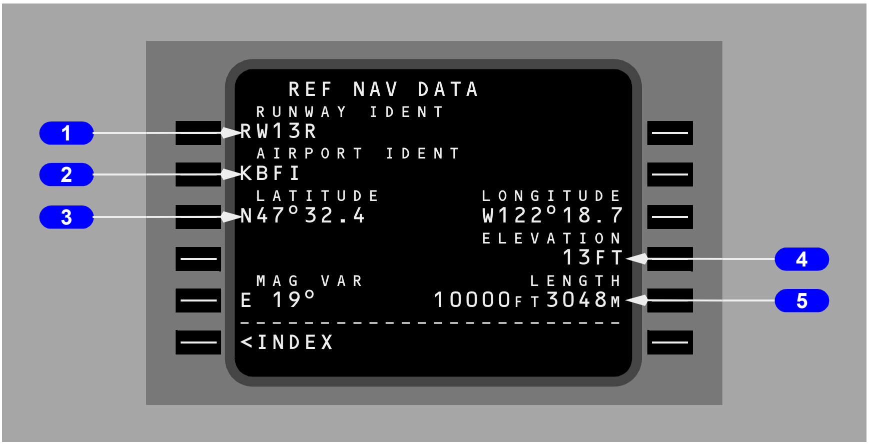
Displays airport identifier.

3 ELEVATION

Displays or permits entry of the elevation (feet above MSL) of the entered airport.

Runway Data Display

A runway identifier may be entered on the airport data display page or as a waypoint on the REF NAV DATA page. On the airport data display page, entry may be in the form of 13R or RW13R. Single digit entries are possible, with or without leading zeros. If the waypoint method is used, entry must be in the form RW13R, and the proper airport identifier must be entered on the runway data display page. Runways must be stored in the permanent navigation database.



1 Runway Identifier (RUNWAY IDENT)

Displays runway identifier.

2 Airport Identifier (AIRPORT IDENT)

Displays airport identifier.

3 LATITUDE/LONGITUDE

Displays latitude and longitude of entered runway.

4 ELEVATION

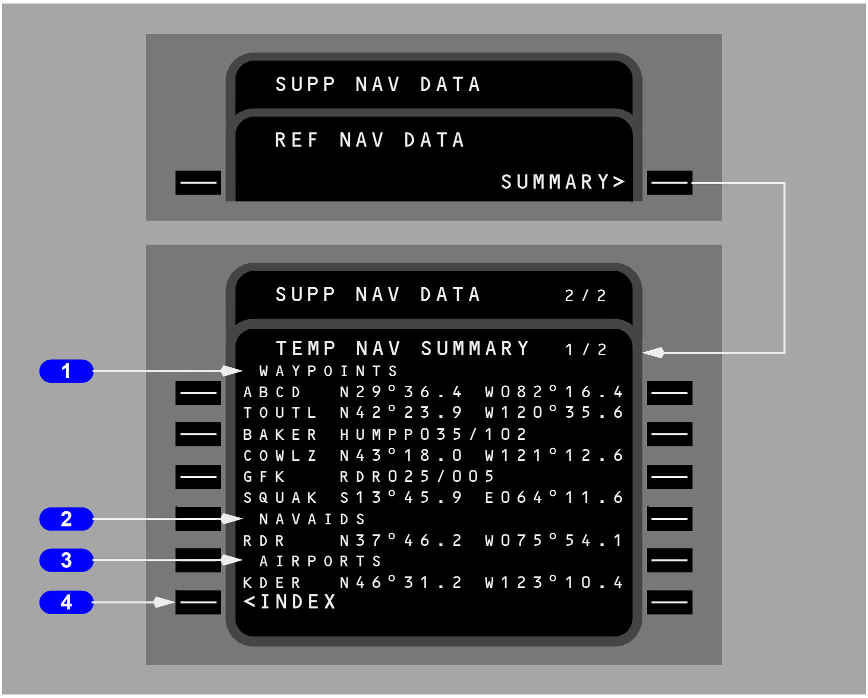
Displays elevation (feet above MSL) of the entered runway.

5 Runway Length (LENGTH)

Displays length of entered runway in feet and meters.

Navigation Summary (NAV SUMMARY)

The NAV SUMMARY pages show the contents of the temporary and supplemental navigation databases. Contents of the temporary navigation database show first, followed by contents of the supplemental navigation database.



1 WAYPOINTS

Shows waypoints stored in related database.

Waypoints show in defining format.

[Option – FMC U11.0 to U13.0]
Waypoints may also be defined on the LEGS pages in either route as part of a flight plan.

[Option – FMC U14.0]
Waypoints may also be defined on the LEGS and RTE pages in either route as part of a flight plan.

2 NAVAIDS

Shows navaids stored in related database.

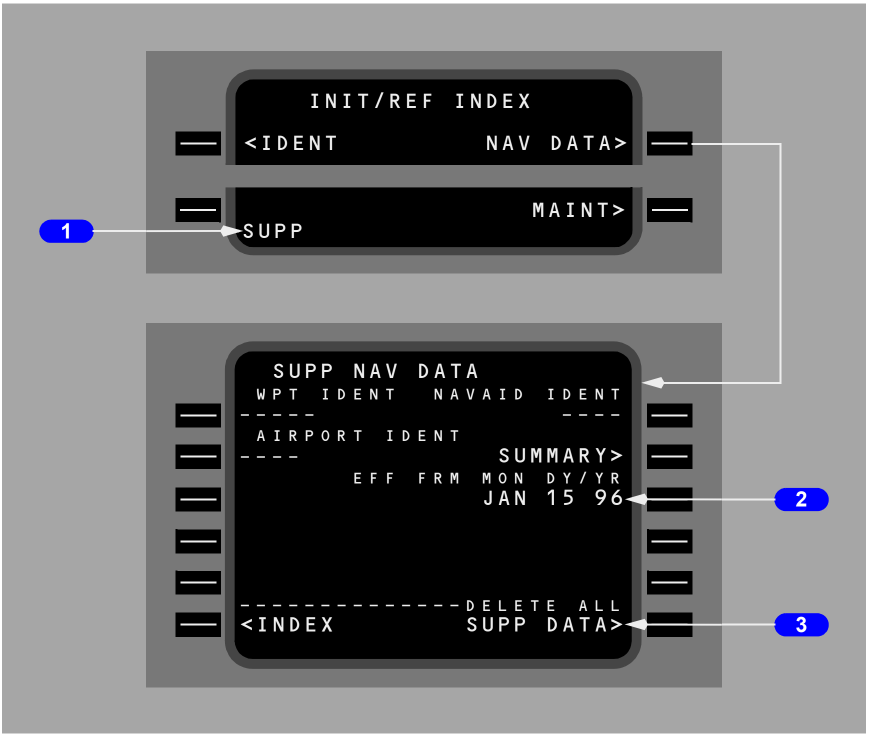
3 **AIRPORTS**

Shows airports stored in related database.

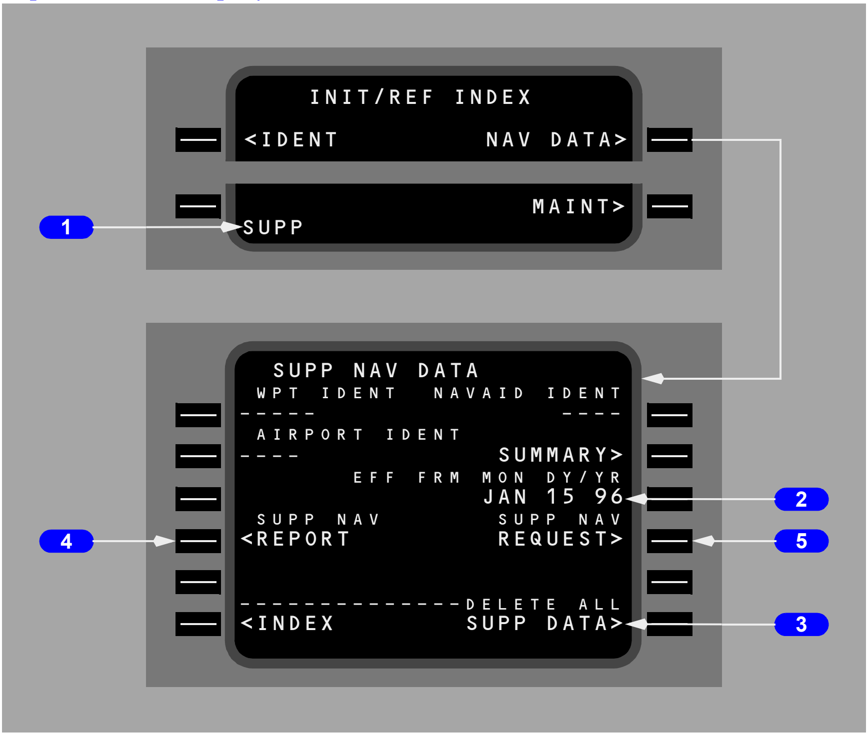
4 **INDEX**

Push – shows page (REF NAV DATA or SUPP NAV DATA) used to access NAV SUMMARY pages.

Supplemental Nav Data



[Option – With company data link]



1 **SUPP Scratchpad Entry**

The supplemental navigation database is accessed by typing SUPP in the scratchpad while on the INIT/REF INDEX page, then selecting the NAV DATA prompt. Access is only available on the ground.

2 **Effectivity Date (EFF FRM MON DY/YR)**

Allows entry of month, day, and year that the supplemental database becomes valid. The date will be displayed on IDENT page 1/2 after entry. Box prompts are displayed if an effectivity date is not entered.

3 **Delete All Supplemental Data (DELETE ALL SUPP DATA)**

Data may be deleted from the supplemental database by two methods. Deletion may be accomplished one item at a time on the display pages, or the entire database may be deleted by selecting this prompt. The prompt is only available before entry of an origin airport.

[Option – With company data link]

4 SUPP NAV REPORT

Push – transmits a copy of supplemental navigation database.

[Option – With company data link]

5 SUPP NAV REQUEST

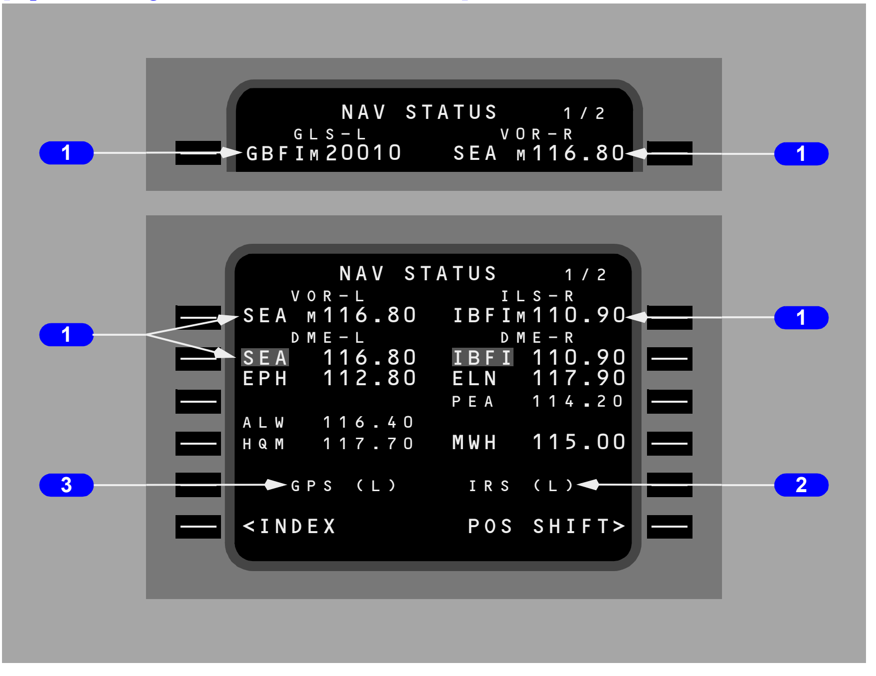
Push – transmits a data link request for a supplemental navigation database uplink.

Navigation Status Display

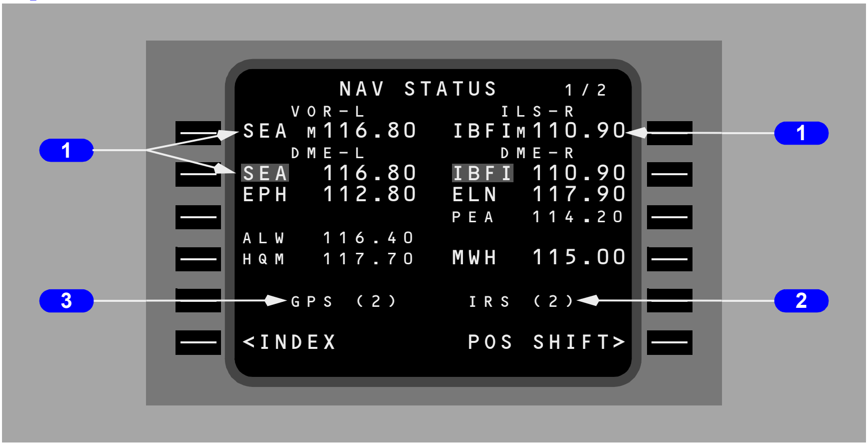
The NAV STATUS page displays the current status of the navaids being tuned.

Access to the NAV STATUS display is from the NAV STATUS prompt on the POS SHIFT page 3/3, the PROGRESS page 1/4, and (in flight) the INIT/REF INDEX page or from the NAV OPTIONS page 2/2, NEXT or PREV PAGE.

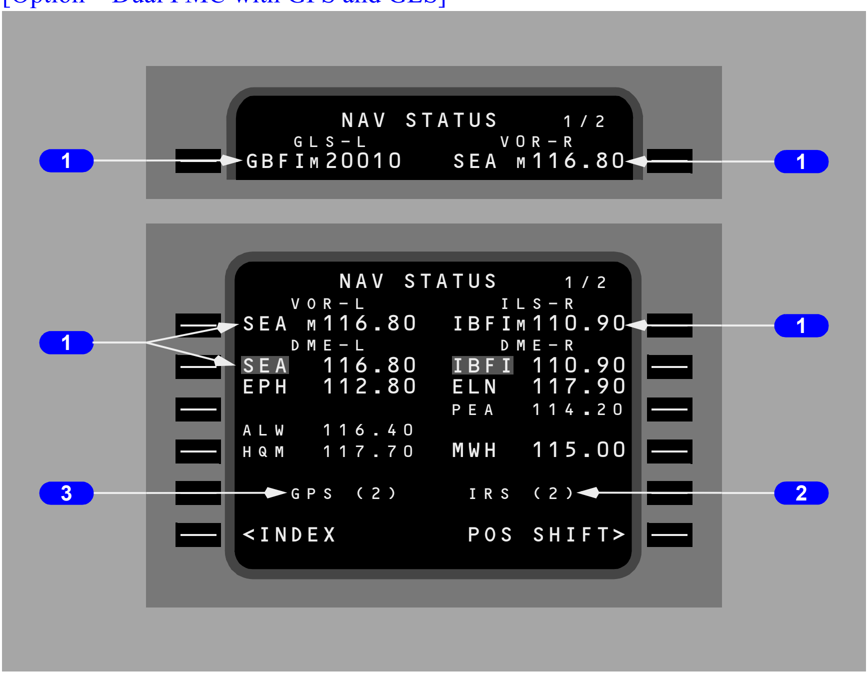
[Option – Single FMC, with GPS and GLS]



[Option – Dual FMC with GPS]



[Option – Dual FMC with GPS and GLS]



1 VOR/ILS and DME Lines

Lines 1L and 1R display VOR or ILS identifier and frequency tuned on the corresponding VHF NAV control panel.

Lines 2L – 2R through 4L – 4R display up to five DME identifiers and frequencies tuned by the corresponding scanning DME receiver.

Data is displayed in large font with the identifier highlighted if that facility is being used for navigation.

Data is displayed in large font with the identifier not highlighted if that facility is being received but not used for navigation.

Data is displayed in small font if that facility is being tuned but not received.

If the navaid has failed, FAIL will be displayed in small font.

If there is no corresponding identifier for the displayed frequency, then the identifier field will be blank and only the frequency will be displayed.

On lines 1L or 1R, for VOR/ILS displays, the mode of tuning will be shown:

- M – Manual
- P – Procedural

On lines 2L – 2R through 4L – 4R, if no DME information is received then the identifier and frequency field is blank.

[Option – FMC U10.4 or later with GLS]

1 VOR, ILS, GLS and DME Lines

Lines 1L and 1R display VOR, ILS or GLS identifier and frequency tuned on the corresponding VHF NAV control panel.

Lines 2L – 2R through 4L – 4R display up to five DME identifiers and frequencies tuned by the corresponding scanning DME receiver.

Data is displayed in large font with the identifier highlighted if that facility is being used for navigation.

Data is displayed in large font with the identifier not highlighted if that facility is being received but not used for navigation.

Data is displayed in small font if that facility is being tuned but not received.

If the navaid has failed, FAIL will be displayed in small font.

If there is no corresponding identifier for the displayed frequency, then the identifier field will be blank and only the frequency will be displayed.

On lines 1L or 1R, for VOR/ILS/GLS displays, the mode of tuning will be shown:

- M – Manual
- P – Procedural

On lines 2L – 2R through 4L – 4R, if no DME information is received then the identifier and frequency field is blank.

2 **IRS Status Display**

Displays the IRS currently selected for use in navigation. “L” or “R” indicates left or right IRS is being used in the FMC position calculation.

[Option – Dual FMC]
“2” indicates a dual system with both IRSs used in the FMC position calculation.

[Option – With GPS]
3 **GPS Status Display**

Displays the GPS currently selected for use in navigation. “L” or “R” indicates left or right GPS is being used in the FMC position calculation.

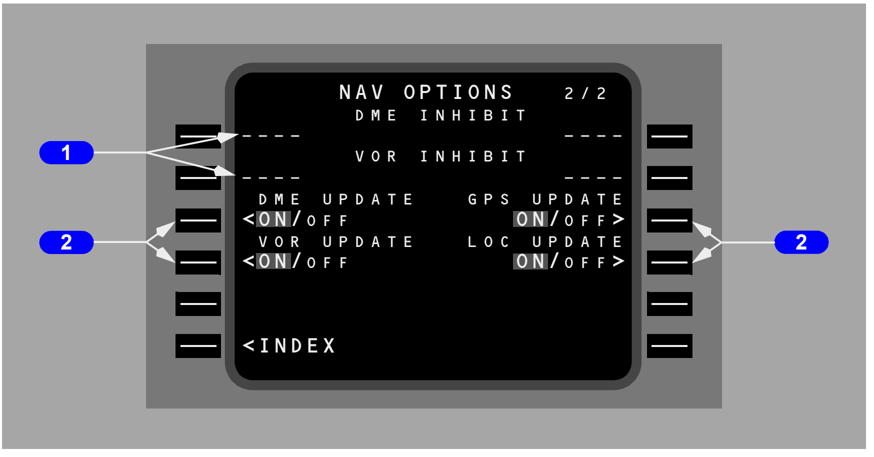
[Option – Dual FMC with GPS]
“2” indicates dual system with both GPSs used in the FMC position calculation.

The display will be blank if GPS is inhibited for use in navigation.

Navigation Options (NAV OPTIONS)

The FMC normally rejects the use of navaids that are not suitable for navigation. However, when the aircrew is aware that unreliable navaids exist (either by NOTAM, ATC, etc.) they should manually exclude these navaids from the FMCs navigation solution. This will prevent the possibility of incorrect position calculations and maximize the FMCs reliability. This is accomplished through the NAV OPTIONS page.

Access to the NAV OPTIONS page may be gained by selecting the NAV OPTIONS prompt on the REF NAV DATA page or by selecting NEXT or PREV PAGE on the NAV STATUS page.



1 DME/VOR INHIBIT

Enter the identifier of up to two VOR/DME, VORTAC, or DME stations that must not be used for FMC position updates.

Entries are blanked at flight completion.

Deleting or overwriting removes a previous inhibit.

The FMC normally uses DME from two different ground stations to update its position solution. When two DME stations are not available, the FMC reverts to single station radial-DME updating to determine position. Only two of the four inhibit entries are utilized at any one time depending upon which update mode the FMC is operating in. The DME INHIBIT entries are excluded from the FMCs update solution whenever the FMC is updating from two DME stations. The VOR INHIBIT entries are excluded from the FMCs update solution whenever the FMC is radial-DME updating.

[Option – With GPS and U10.7 and later]
2 **DME/VOR/GPS/LOC UPDATE**

Push – permits switching between ON and OFF modes for updating FMC position. Default mode is ON. The current mode is highlighted.

[Option – FMC U10.5A and later with Default DME Off]
Push – permits switching between ON and OFF modes for updating FMC position. Default mode is ON for VOR, GPS and LOC. DME defaults to OFF. The current mode is highlighted.

Note: When the DME UPDATE is OFF, the VOR-DME and LOC-DME UPDATES are also inhibited even if the VOR and LOC UPDATES are selected ON. If the FMC hasn't done a GPS UPDATE in the last 5 seconds then the FMC can do a LOC only UPDATE without DME if the LOC UPDATE is selected ON and the DME UPDATE is selected OFF.

Selection is reset to ON at flight completion.

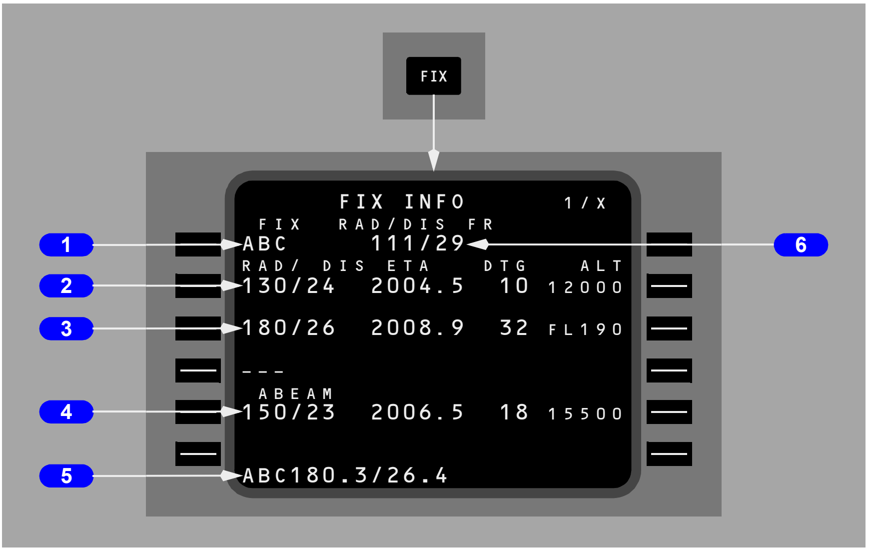
[Option – FMC U10.5A and later with Default DME Off]
Selections are reset to ON at flight completion except for DME which is reset to OFF.

Fix Information Page

Two identical FIX INFO pages are used to identify waypoint fixes for display on the navigation display map mode. If desired, fix information can be copied into the route. Page access is via the FIX key.

[Option – FMC U10.6 and later with Additional Fix Pages]
Six identical FIX INFO pages are used to identify waypoint fixes for display on the navigation display map mode. If desired, fix information can be copied into the route. Page access is via the FIX key.

Radial or distance entries from the fix may be made on any line 2L to 4L. Valid format is a three character numeric entry. Slash rule is used to differentiate between radial and distance in the scratch pad.



1 FIX Name

Enter the desired fix.

Valid entries are airports, navaids, waypoints or runway identifiers from the navigation database.

The selected fix is displayed on the navigation display map mode and highlighted by a green circle.

2 Distance Entry (example)

Enter a distance from the fix. Distances from the fix are displayed on the navigation display map mode as a dashed green circle around the fix.

When the distance intersects the active route, the ETA, DTG, and predicted altitude at the intersection are displayed for that intersection.

If there is more than one intersection, the data will apply to the first occurrence and will sequence as each intersection is passed.

Valid entries are xxx.x:

- distance is limited to 511 NM or less and may contain 1/10 NM entry
- leading zeros can be omitted for distance
- decimal values can be omitted
- distance only entries must start with a /.

Valid entries are xxx.x:

- distance is limited to 999 NM or less and may contain 1/10 NM entry
- leading zeros can be omitted for distance
- decimal values can be omitted
- distance only entries must start with a /.
- entries of 512 NM or greater will appear as 512 NM on the ND, but data displayed on the CDU will match the range entered in the CDU of 512 NM or greater

ETA – displays the estimated time of arrival to the intersection point.

DTG – displays the distance to go to the intersection point.

ALT – displays the predicted altitude at the intersection point.

3 Radial Entry (example)

Enter a radial from the fix. Radials are displayed on the navigation display map mode as green dashed lines from the fix.

When the radial intersects the active route, the ETA, DTG, and predicted altitude at the intersection are displayed.

If there is more than one intersection, the data will apply to the first occurrence and will sequence as each intersection is passed.

Valid entries are xxx or xxx/.

4 ABEAM

Displays the abeam point and calculates the ETA, DTG, and ALT information.

The fix abeam point ahead of the airplane is displayed by a radial line from the waypoint ending at the nearest perpendicular route leg intersection.

If there is more than one intersection, the data will apply to the first occurrence and will sequence as each intersection is passed.

5 Route Intersection Point Copied

Pushing the line select key for one of the RAD/DIS entries copies the fix place/bearing/distance definition into the scratchpad. This fix can be placed into the route on a LEGS page as a waypoint.

6 Radial/Distance From Fix (RAD/DIS FR)

Displays the radial and distance from the fix to the airplane. This information is continually updated as the airplane position changes.

Flight Management, Navigation — Chapter 11
FMC Descent and Approach — Section 43

Introduction

The descent phase begins at the top of descent point and continues to the end of descent point. Planning for the descent phase begins during cruise.

The approach phase begins at the end of descent point and continues to touchdown or go–around. When a go–around is accomplished, the FMC enters the cruise phase.

The only automatic page change provided in the descent/approach modes is the transition from cruise to descent at the top of descent.

Early Descent

Early descent may be commenced prior to reaching the top of descent by using the DES NOW prompt.

[Option – With speed and altitude intervention and FMC U11.0 and later]
A CRZ DES occurs upon lowering the MCP ALT to a lower altitude while at or above any descent constraint altitude and pressing ALT INTV. The airplane must be further than 50 nm from the Top of Descent (T/D) at the current cruise altitude. If within 50 nm of the top of descent, the Early Descent mode will be invoked. In the previous Operational Flight Programs (OFPs), this action resulted in always going into the Early Descent mode of operation regardless of distance from the top of descent.

- A cruise descent can be started by using the altitude intervention feature on the MCP when the airplane is not within a distance of 50 NM to the T/D, or by entering a new cruise altitude on the FMC CRZ page after setting the new level-off altitude in the MCP.
- Altitude Intervention may be used to initiate Early Descent when the airplane is 50 nm or less to T/D.
- If Altitude Intervention is used to initiate descent when 50 NM or less to T/D and the MCP ALT below current altitude, or descent is initiated via DES NOW prompt on the DES page, Early Descent vertical speed commands of -1000 fpm are generated by the FMC for autopilot V/S tracking until path intercept, or next constraint altitude if altitude is reached when VNAV is engaged, or MCP ALT level off occurs.

- If Altitude Intervention is used to initiate descent when more than 50 NM to T/D with VNAV engaged and the MCP ALT below current altitude but at or above any descent constraint altitude, the result will be cruise altitude reset to the MCP ALT and Cruise Descent vertical speed commands of -1000 fpm to the new cruise altitude.
- If Altitude Intervention is used to initiate descent when more than 50 NM to T/D with VNAV engaged and the MCP ALT below current altitude and below a descent constraint altitude, the result will be Early Descent vertical speed commands of -1000 fpm until path intercept or MCP ALT level off occurs.

Descent

During descent, LNAV progress is managed using the RTE LEGS and PROGRESS pages, as in the cruise phase. VNAV descent management is accomplished primarily on the DES page.

The DES FORECASTS page is also available to enter forecast wind data to aid in descent planning.

[Option – With alternate destination prediction]
Other pages which support descent are:

- DES FORECASTS page – to enter forecast wind data to aid descent planning
- ALTERNATE DESTS page – to manage the selection of alternate airports and diversions.

Descent Page (During Cruise)

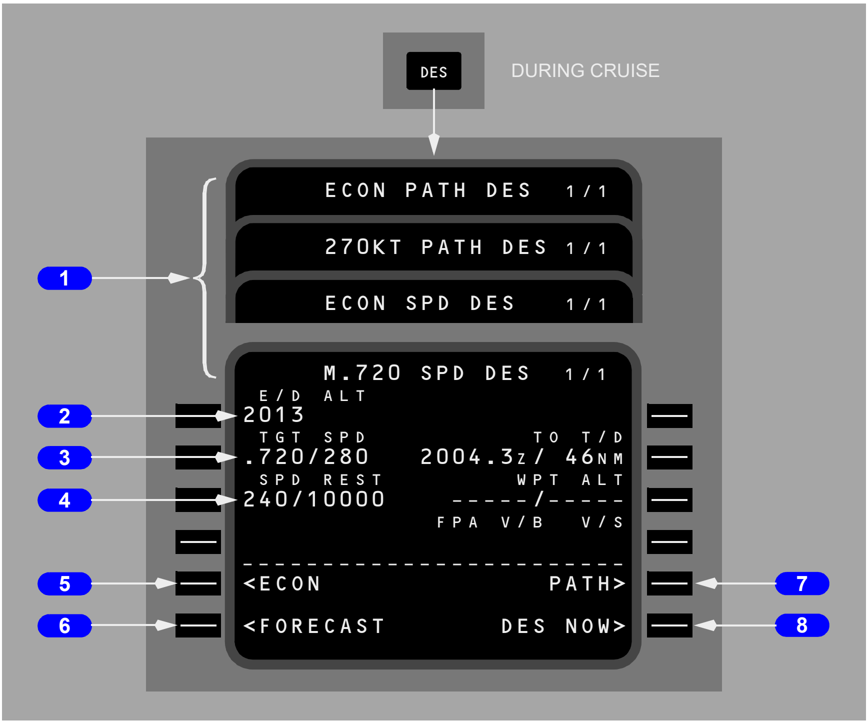
The descent page is used to monitor, revise, or select the descent path. Descent modes are economy (ECON) path or speed and manual path or speed. The default VNAV descent mode is ECON PATH. The crew must select a manual speed descent mode.

[Option – FMC U10.6 or later with Common VNAV]
The descent page is used to monitor, revise, or select the descent path. Descent modes are economy (ECON) path and manual path and speed. The default VNAV descent mode is ECON path. The crew must select a manual speed descent mode.

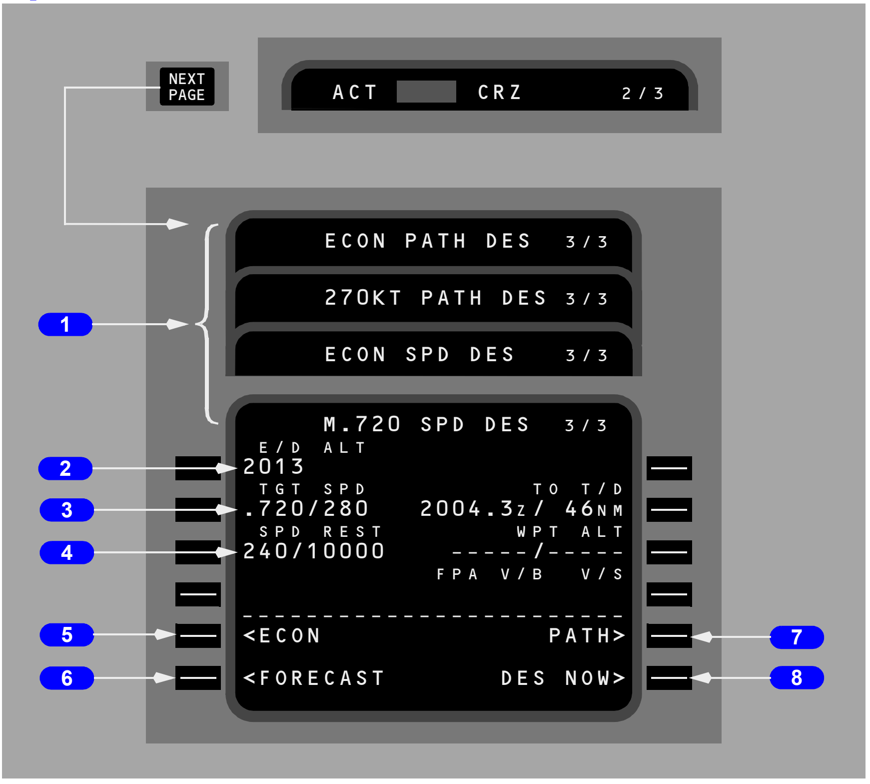
The page title reflects the VNAV descent mode. The path mode controls descent to fly a vertical path which complies with altitude and speed restrictions in the flight plan. The speed mode controls descent at a fixed speed and complies with altitude and speed restrictions in the flight plan.

[Option – FMC U10.6 or later with Common VNAV]

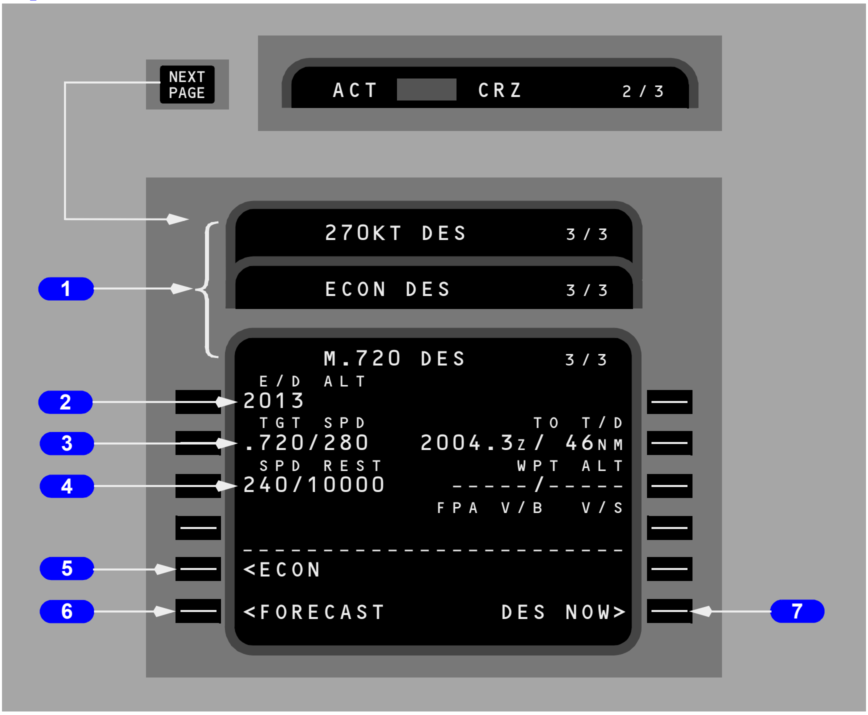
The page title reflects the type of VNAV path descent. The path mode controls descent to fly a vertical path which complies with altitude and speed restrictions in the flight plan.



[Option – With FANS MCDU]



[Option – With FANS MCDU, FMC U10.6 or later and Common VNAV]



1 **Page Title**

The page title identifies the selected mode. When a manual speed is selected, the title includes XXXKT for fixed CAS or M.XXX for fixed Mach selections.

Displays ACT when the descent phase is active.

2 **End of Descent Altitude (E/D ALT)**

Displays the end of descent altitude.

- for a PATH DES page, displays the altitude restriction for the E/D waypoint; blank if path descent not available
- for a SPD DES page, displays the altitude restriction for the E/D waypoint, if an E/D waypoint is present
- for a DES page, displays the altitude restriction for the E/D waypoint, blank if a path descent is not available
- if an approach is selected which ends at RWXXX, the E/D altitude will be Threshold Crossing Height (TCH), 50 feet above the runway.

[Option – FMC U10.6 or later]
The end of descent altitude is the altitude constraint or predicted altitude of the last descent waypoint. End of descent may follow a lateral discontinuity. If a lateral discontinuity exists, the FMC will construct a great circle path across the discontinuity and VNAV will be valid while flying the discontinuity.

3 Target Speed (TGT SPD)

Displays the command speed maintained by VNAV while descending to waypoints, constraints, or speed restrictions.

Displays XXX/MCP when speed intervention is active.

On ECON PATH or ECON SPD DES pages, displays the computed values for target Mach and airspeed. Speeds are performance limited.

The ECON DES page displays the computed values for target Mach and airspeed. Speeds are performance limited.

Manual entries may be made and cause the manual PATH or manual SPD DES page for that value to display (M.720 SPD DES is depicted).

Manual entries may be made and cause the manual DES page for that value to display (M.720 DES is depicted).

Blank for any PATH DES page if a path descent is not available.

Blank for any DES page if a path descent is not available.

Manual CAS or Mach entries are automatically copied to the descent page TGT SPD field.

4 Speed Restriction (SPD REST)

Displays the most restrictive of the following speeds:

- speed restrictions at the destination airport minus 10 knots
- waypoint speed restriction if greater than minimum flaps up maneuvering speed
- minimum flaps up maneuvering speed
- selected Vref + wind correction for landing flap setting
- whenever flaps are extended, the, appropriate flap speed will be displayed as XXX/FLAPS. This will supersede any other speed restriction.
- displays XXX/HOLD when decelerating to hold speed prior to hold entry fix.

Dash prompts displayed when there is no active speed restriction.

Manual crew entries or deletions may be made. HOLD or FLAPS speed may not be deleted or modified.

5 Economy (ECON)

Displayed on the manual DES pages.

Push – selects the corresponding ECON SPD or ECON PATH DES page.

Push – selects the corresponding ECON DES page.

6 Descent Forecasts (FORECAST)

Push – selects the DES FORECASTS page.

7 PATH

Displayed on the SPD DES pages if a path descent is available.

Push – selects the corresponding PATH DES page.

7 Descend Now (DES NOW)

Displayed on the standard DES pages whenever descent is not ACT or MOD.

Blank for any DES page if a path descent is not available.

Push – arms the DES NOW function and illuminates the EXEC light.

On a DES page, execution allows early initiation of a path descent at 1000 fpm until intercepting the computed path.

8 Descend Now (DES NOW)

Displayed on the standard DES pages whenever descent is not ACT or MOD.

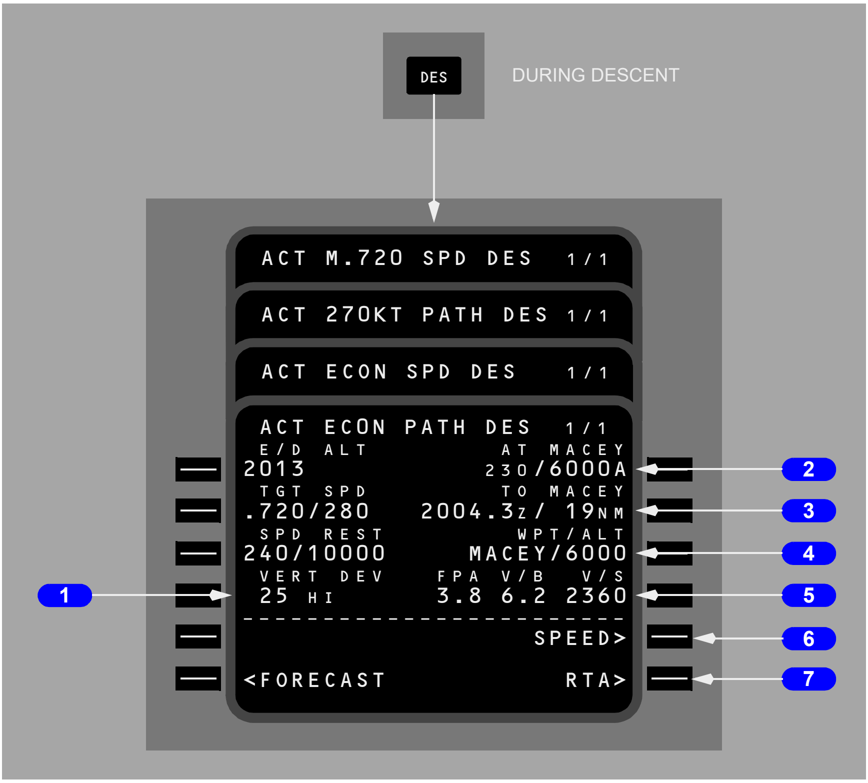
Blank for any PATH DES page if a path descent is not available.

Push – arms the DES NOW function and illuminates the EXEC light.

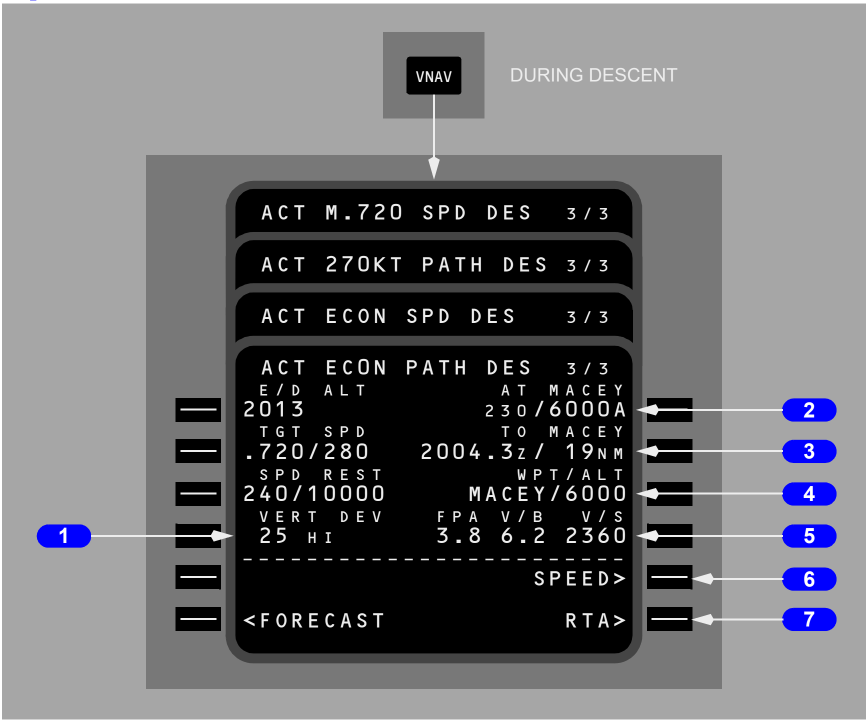
On a PATH DES page, execution allows early initiation of PATH descent at 1000 fpm until intercepting the computed path. On a SPD DES page, execution allows early initiation of a SPD descent at the specified speed (ECON or manual).

Descent Page (During Descent)

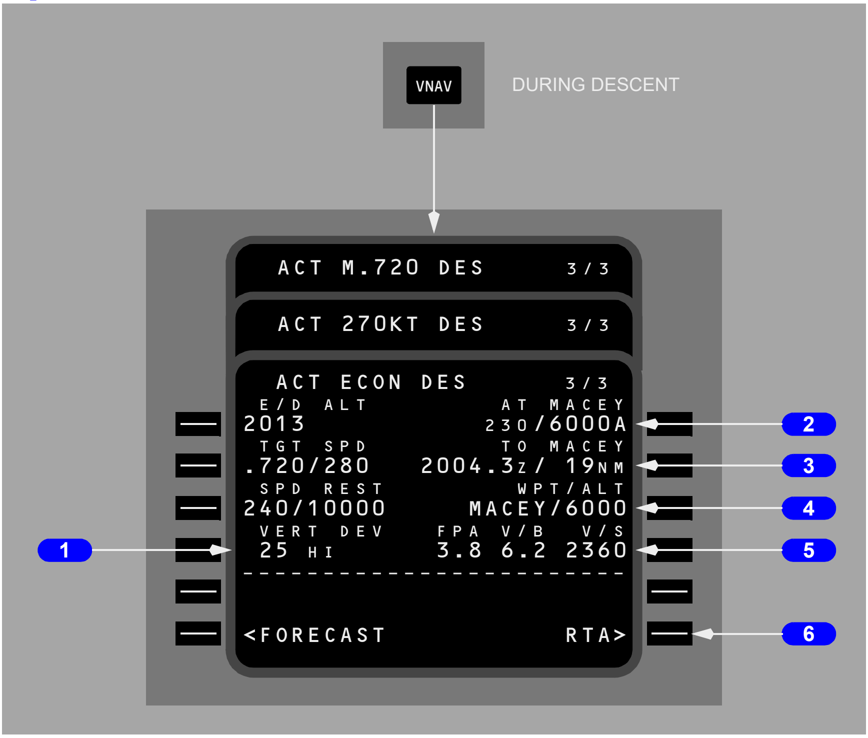
Display when any descent mode is active after beginning of descent.



[Option – With FANS MCDU]



[Option – FANS MCDU with FMC U10.6 or later and Common VNAV]



1 Vertical Deviation (VERT DEV)

Displays present deviation (feet HI or LO) from the computed vertical path.

The deviation is always in relation to the path descent profile, regardless of which page is active (PATH DES or SPD DES).

The deviation is always in relation to the path descent profile.

Blank if a path is not available.

2 Altitude Restriction (AT XXXXX)

Displays the next waypoint constraint from the RTE LEGS page.

The constraint is speed/altitude. If an airspeed restriction exists at the waypoint, it will be displayed in large font; otherwise the predicted speed will be displayed in small font.

Can be deleted on this page.

The display is blank when no constraint exists, or for any PATH DES page if a path descent is not available.

The display is blank when no constraint exists, or for any DES page if a path descent is not available.

3 To Waypoint (TO XXXXX)

Displays computed ETA and distance to go to T/D when not in an active descent mode.

If an early descent is in progress (initiated using DES NOW prompt), ETA and distance to go to original T/D is displayed until passing the T/D.

If a descent mode is active, displays ETA and distance to go to the first of the following points:

- the waypoint in the AT XXXXX line
- an intermediate T/D (TO T/D – XXXXX, where XXXXX is the altitude).

The display is blank if a path descent is not available, or if the AT XXXXX line is blank and no T/D information is displayed.

4 Waypoint/Altitude (WPT/ALT)

Displays the waypoint and altitude that serves as the basis for the vertical bearing (V/B) display on line 4R.

Normally displays the same waypoint/altitude restriction that is displayed on the AT XXXXX line.

May be overwritten by pilot entry.

[Option – FMC U10.5 thru U10.8A]
A runway identifier may be entered for a runway at the destination airport of the displayed flight plan. Format may be either RWXX/, RWXXX/, RWXX/AA, or RWXXX/AA where XX or XXX is the runway designation and AA is the altitude. When RWXX/ or RWXXX/ is used the altitude will automatically be set to runway elevation plus threshold crossing height.

[Option – FMC U 11.0 and later]
A runway identifier may be entered for a runway at the destination airport of the active flight plan. Format may be either RWXX/, RWXXX/, RWXX/AA, or RWXXX/AA where XX or XXX is the runway designation and AA is the altitude. When RWXX/ or RWXXX/ is used the altitude will automatically be set to runway elevation plus threshold crossing height.

Dash prompts are displayed if there is no entry.

5 Vertical Path Parameters (FPA V/B V/S)

Displays the following parameters related to the present vertical path:

- FPA – actual flight path angle based on present ground speed and vertical speed (that is, the present vertical bearing being flown)
- V/B – vertical bearing direct from present position on the WPT/ALT line (that is, the flight path angle required if flying direct to the waypoint and altitude on the WPT/ALT line).
- V/S – the required vertical speed (in fpm, based on present ground speed) to fly the displayed V/B.

Blank if no entry on the WPT/ALT line.

6 SPEED

Displayed on PATH DES pages.

Push – selects the related SPD DES page.

6 RTA

Displayed when DES NOW or ERASE prompt is not displayed.

Push – selects the RTA PROGRESS page.

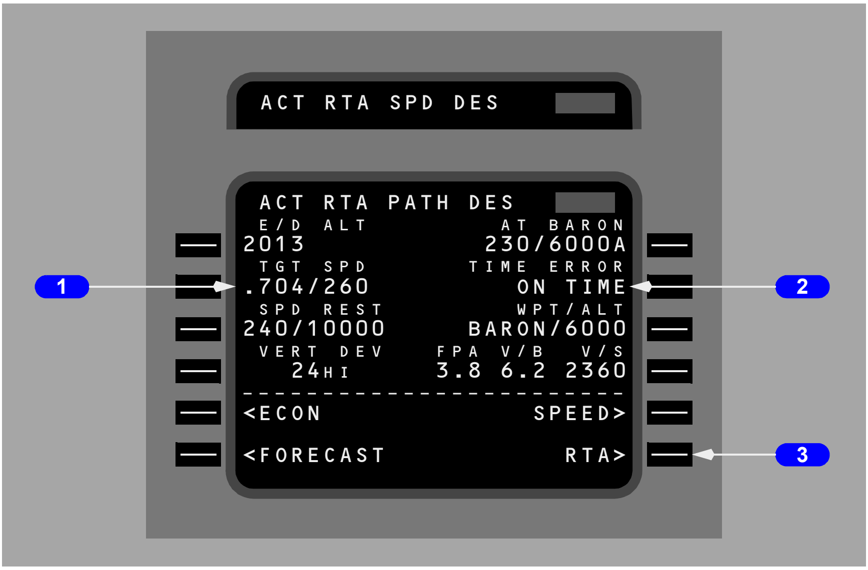
7 RTA

Displayed when DES NOW or ERASE prompt is not displayed.

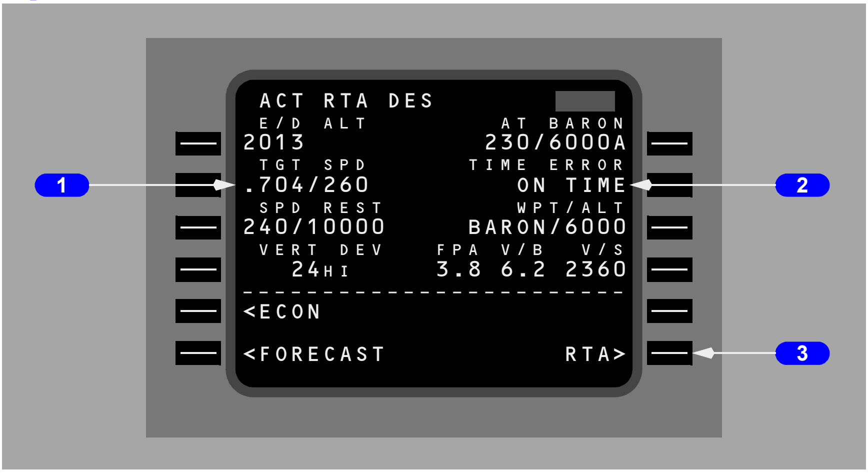
Push – selects the RTA PROGRESS page.

RTA Descent Page

RTA Descent pages are displayed when an RTA mode is active. Displays are the same as on other descent pages except as noted.



[Option – FMC U10.6 or later and Common VNAV]



1 Target Speed (TGT SPD)

Displays computed RTA target speed.

Changes to FMC target speed if the RTA mode is exited.

2 **TIME ERROR**

Displays computed time error at the RTA waypoint.

Same as time error line on RTA PROGRESS page.

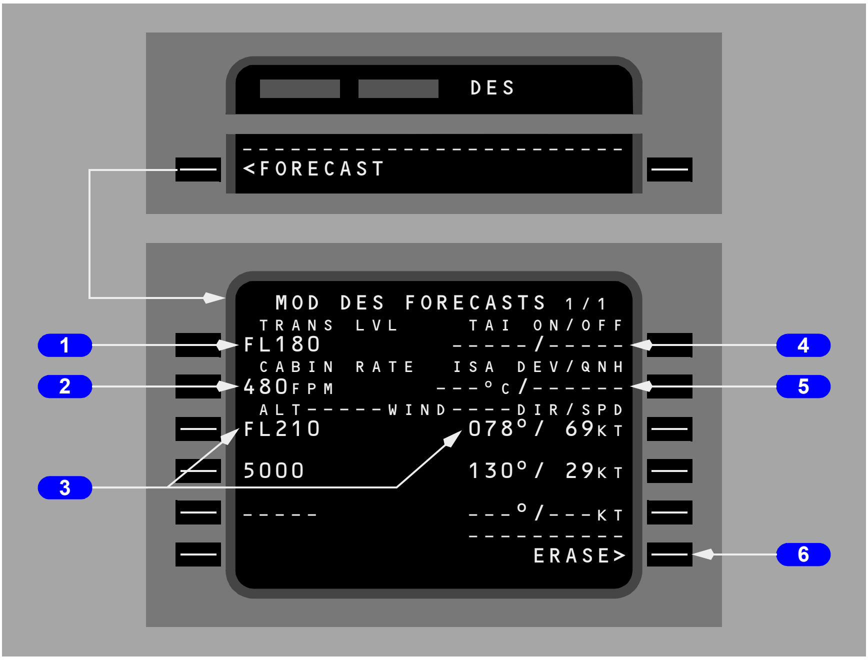
3 **RTA**

Push – selects the RTA PROGRESS page.

Descent Forecast Page

The descent forecast page is used for pre–descent planning to enter forecast data for more precise descent path calculation.

The primary entries are wind direction and speed for up to three descent altitudes, and the altitude that anti–icing is turned on and off.



[Option – With company data link]

1 Transition Level (TRANS LVL)

Normally displays FL180 as the assumed descent transition level.

Changes automatically if an arrival procedure having a different stored value is entered.

[Option – FMC U11.0 and later]
Changes automatically when entering flight plan data based on the following criteria if a pilot entered value has not already been entered:

- the FMC will use the transition level from the NDB stored for the STAR or terminal approach record if the flight plan is active, a STAR or terminal approach has been selected and the transition level exists for the STAR.
- if an active flight plan exists and no transition level exists on the STAR or terminal approach NDB record or a STAR or terminal approach has not been selected, then the FMC will use the transition level from the NDB stored for the DESTINATION airport.

- if there is no trans level for the DESTINATION airport in the NDB for the conditions defined above, then the default transition level will default to the transition altitude from the NDB stored for the DESTINATION airport.
- if the transition level is not available from any of the sources above, then the FMC will default to a transition level of 18000 feet or a value contained in a loaded custom performance default data base.

Manual entry allowed and takes priority.

Data may be up-linked via ACARS message. The up-linked value will appear in small font until EXECuted at which time it will be displayed in large font.

2 CABIN RATE

Displays the predicted cabin rate of descent required by the flight plan descent profile.

[Option – FMC U11.0 and later]
Displays the predicted cabin rate of descent required by the active flight plan descent profile.

3 Descent Wind (ALT – – – – – WIND – – – – DIR/SPD)

Allows entry of altitude and wind direction/speed for up to three forecast wind values.

Entries may be made in any altitude sequence and will be automatically ordered by altitude from highest to lowest.

Data may be up-linked via ACARS message. The up-linked value will appear in small font until EXECuted at which time it will be displayed in large font.

4 Thermal Anti–Ice On/Off (TAI ON/OFF)

Enter the altitudes in flight level or feet at which anti–ice is expected to be turned on and off.

Data may be up-linked via ACARS message. The up-linked value will appear in small font until EXECuted at which time it will be displayed in large font.

5 ISA Deviation and QNH (DEV/QNH)

Enter the average ISA deviation for descent in °C (+/–XX°C) or °F (+/–XX°F)

Enter the destination QNH altimeter setting (IN. HG. or MB). Do not enter a QFE altimeter setting.

Data may be up-linked via ACARS message. The up-linked value will appear in small font until EXECuted at which time it will be displayed in large font.

6 ERASE

Push – deletes modification and returns page to previously displayed descent page.

6 ERASE or LOAD

Push – (ERASE) deletes modification and returns page to previously displayed descent page.

Push – (LOAD) initiates the loading of ACARS up-linked descent forecasts data.

LOAD is displayed when ACARS descent forecasts has the highest load priority and no EXECutes or ACCEPT/REJECTs are pending.

[Option – With company data link]

7 DES WINDS REQUEST

Push – transmits a data link request for descent winds.

Engine Out Descent

There are no specific engine out pages for descent. Use the normal descent planning features and pages.

Approach

During approach, LNAV and VNAV guidance normally transitions to the approach guidance provided by navigation radios. The FMC continues to calculate and display present position and can provide LNAV and VNAV approach guidance for certain types of approaches when radio navigation is not used.

The RTE LEGS and PROGRESS pages are used to manage the airplane until other approach guidance becomes active. Other pages which support approaches are:

- APPROACH REF page – to select the approach VREF
- ARRIVALS page – to select the desired arrival and approach procedures
- HOLD page – to manage holding patterns.

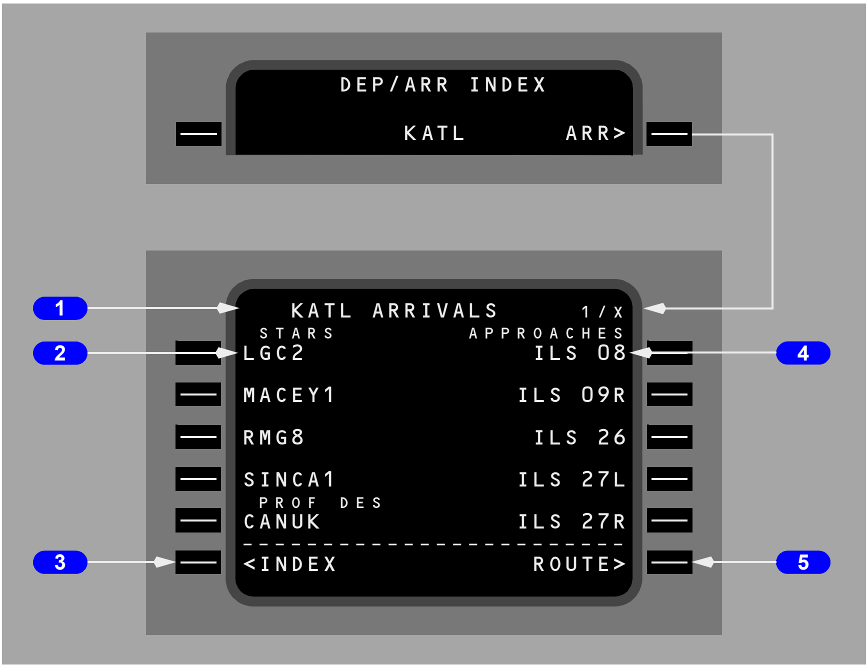
Holding is described in this section but it can be used during any phase of flight.

Arrivals Page – IFR Approaches

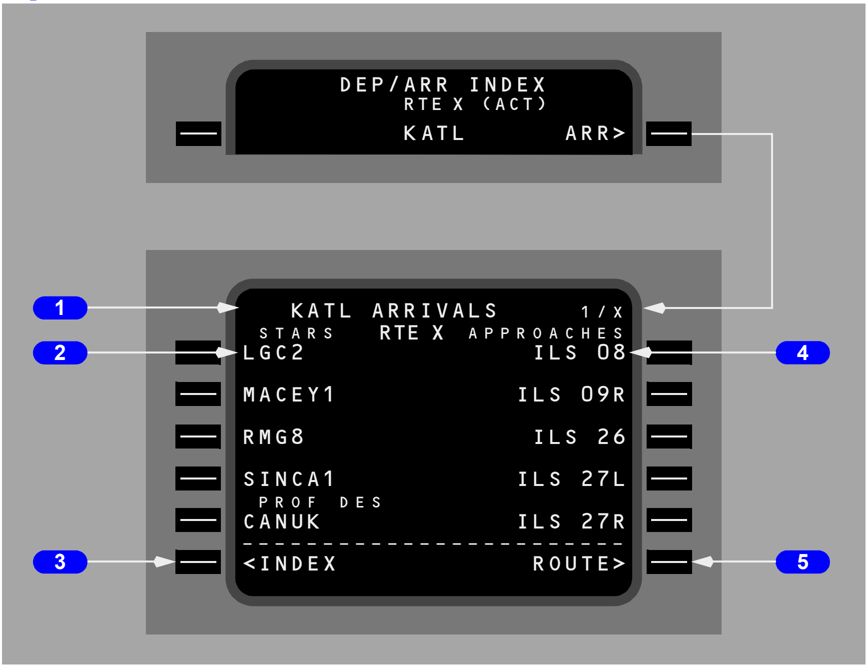
The arrivals page allows selection of an approach, standard terminal arrival route (STAR), and arrival transitions to the destination airport. This page can also be used to view information about a selected airport that is not the destination. Only procedures for the origin and destination airport can be selected for entry into the flight plan.

The approaches, STARS/profile descents, and transitions are displayed and selected on this page.

[Option – FMC U11.0 and later]
With Route 2 software the ARRIVALS page will designate which route the displayed arrivals are for by placing a RTE 1 or RTE 2 at the top center of the ARRIVALS page.



[Option – FMC U11.0 and later]



1 Page Title

The destination airport identifier is displayed in the title.

Airports with more than 5 runways or STARs produce multiple arrivals pages.

2 Standard Terminal Arrival Routes (STARS)

Upon initial selection, an alphabetical listing of all STARS and profile descents is displayed.

STARS are displayed first in a list under the STAR label. Profile descents are listed after the STARS under the PROF DES label.

Selection of the desired STAR deletes all other STARs and non–applicable approaches/runways, and displays a listing of any arrival transitions applicable to that STAR.

The selection of an approach or runway deletes all STARs not related to that approach/runway.

3 INDEX

Push – displays the DEP/ARR INDEX page.

4 Approaches and Runways (APPROACHES)

Upon initial page display, an alphabetical listing of all approaches for the airport, followed by a numerical listing of all runways, is displayed.

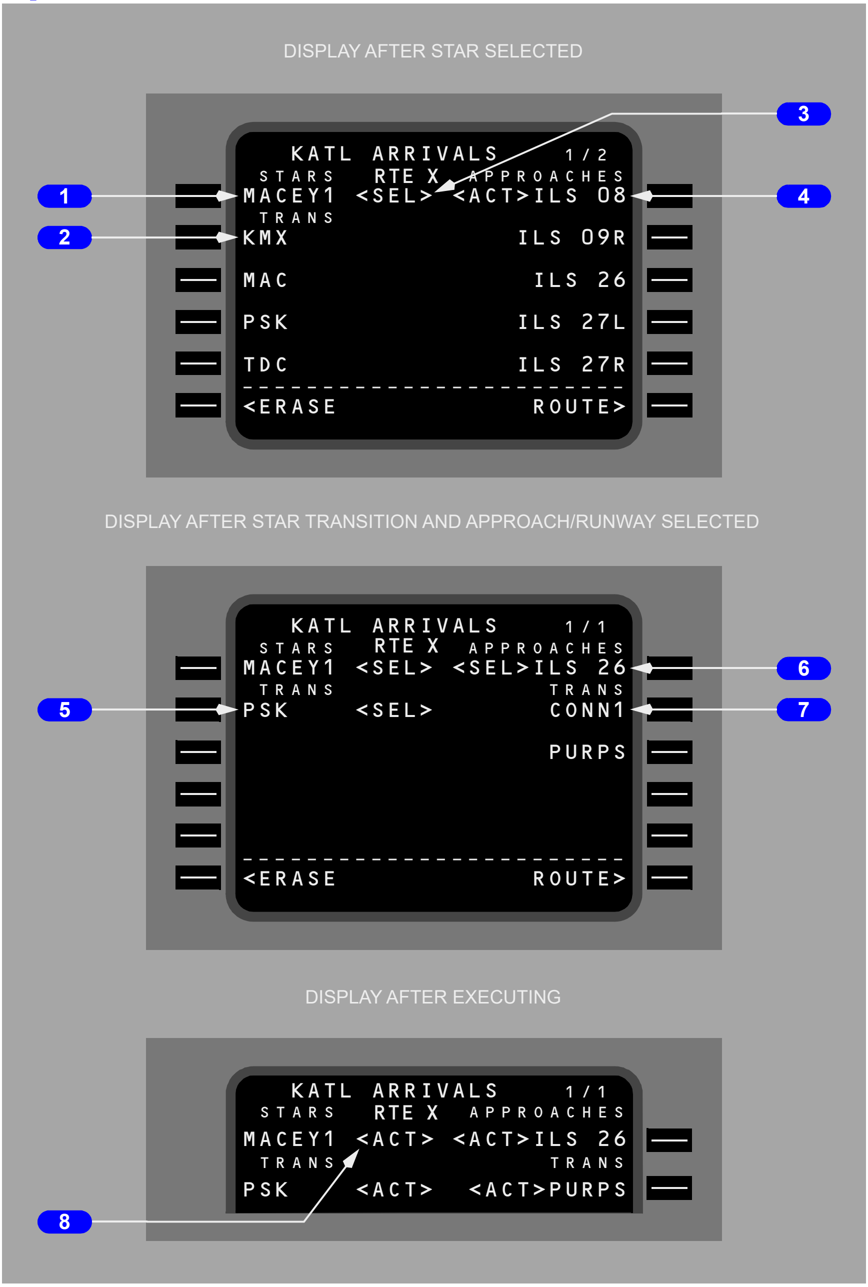
Selection of the desired approach or runway deletes all other approaches/runways.

5 ROUTE

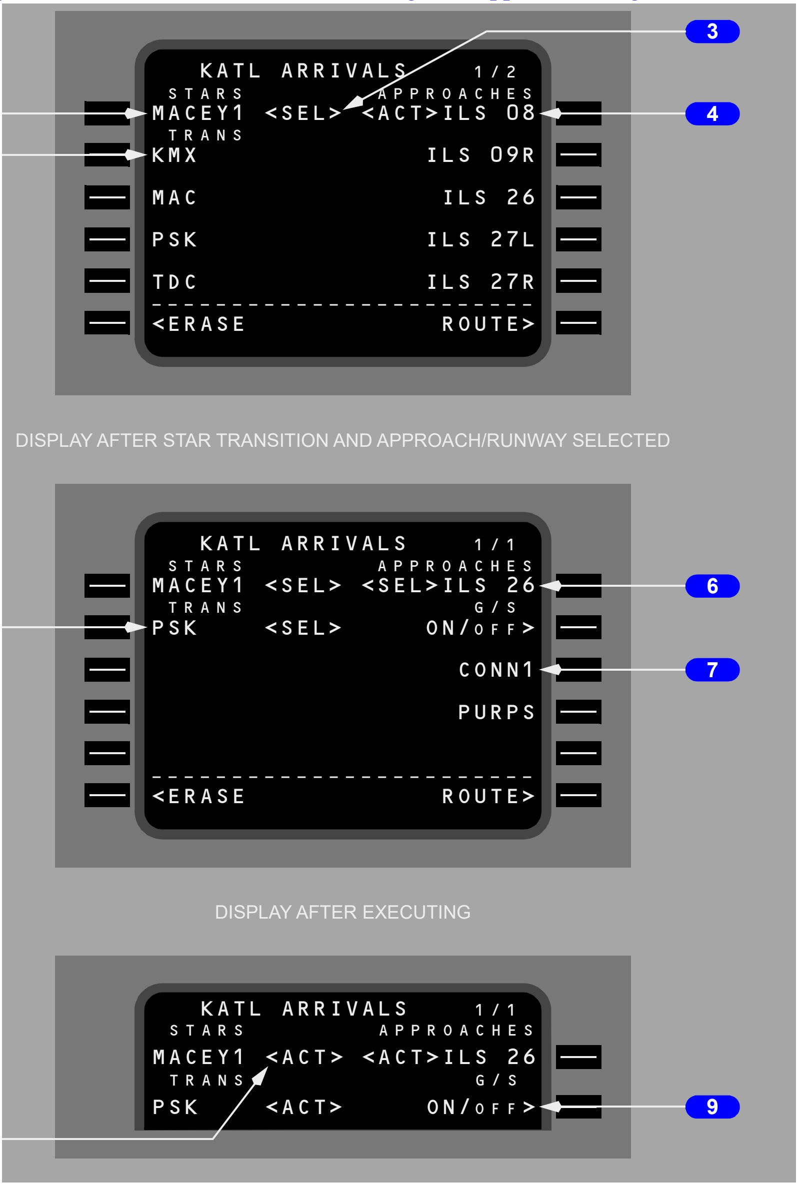
Push – displays the RTE page.

Arrivals Page during approach selection

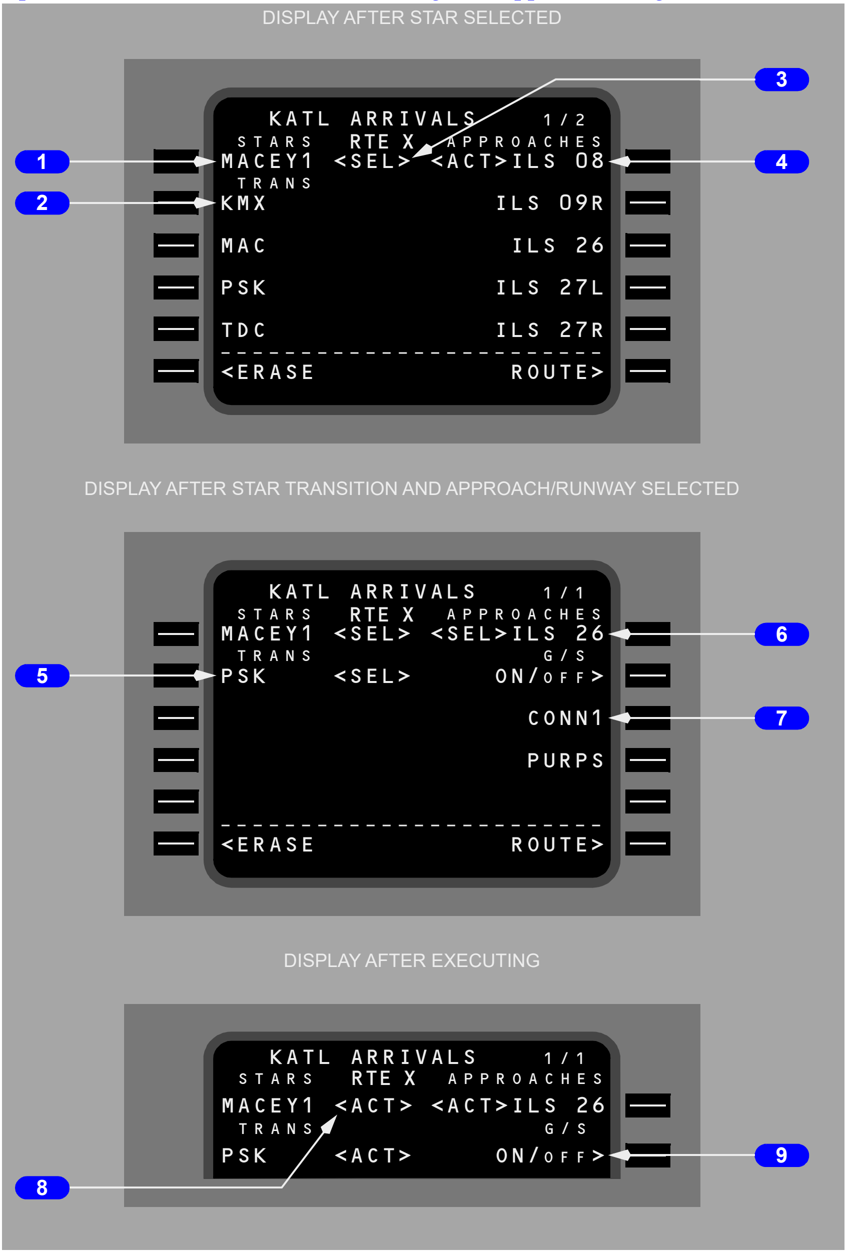
[Option – FMC U11.0 and later]



[Option – FMC U10.5 and later with integrated approach navigation]



[Option – FMC U10.5 and later with integrated approach navigation]



1 STARS

Displays the selected STAR.

2 Arrival Transitions (TRANS)

Displays all arrival transitions related to the selected STAR.

3 Selected Status Label (<SEL>)

Identifies arrival/approach procedures or a runway which has been selected for entry into the route, but not executed.

All <SEL> entries propagate to the MOD RTE and MOD RTE LEGS pages for subsequent execution.

4 Approach and Runway (APPROACHES, RUNWAYS)

Displays all approaches related to the selected STAR, followed by all related runways (unless the desired approach/runway was selected on the initial display).

5 Arrival Transition (TRANS)

Displays the selected arrival transition.

6 APPROACHES

Displays selected approach/runway.

7 Approach Transition (TRANS)

Displays all approach transitions related to the selected approach.

8 Active Status Labels (<ACT>)

Following execution of the selected entries, the arrival/approach procedures and runway are identified as active.

Note: For an existing active route, the execute key illuminates upon STAR or approach/runway selection. Following selections, the ERASE prompt is available. Selections should be executed on the RTE or RTE LEGS pages after linking any route discontinuities.

[Option – FMC U10.5 and later with integrated approach navigation]

9 Glideslope (G/S)

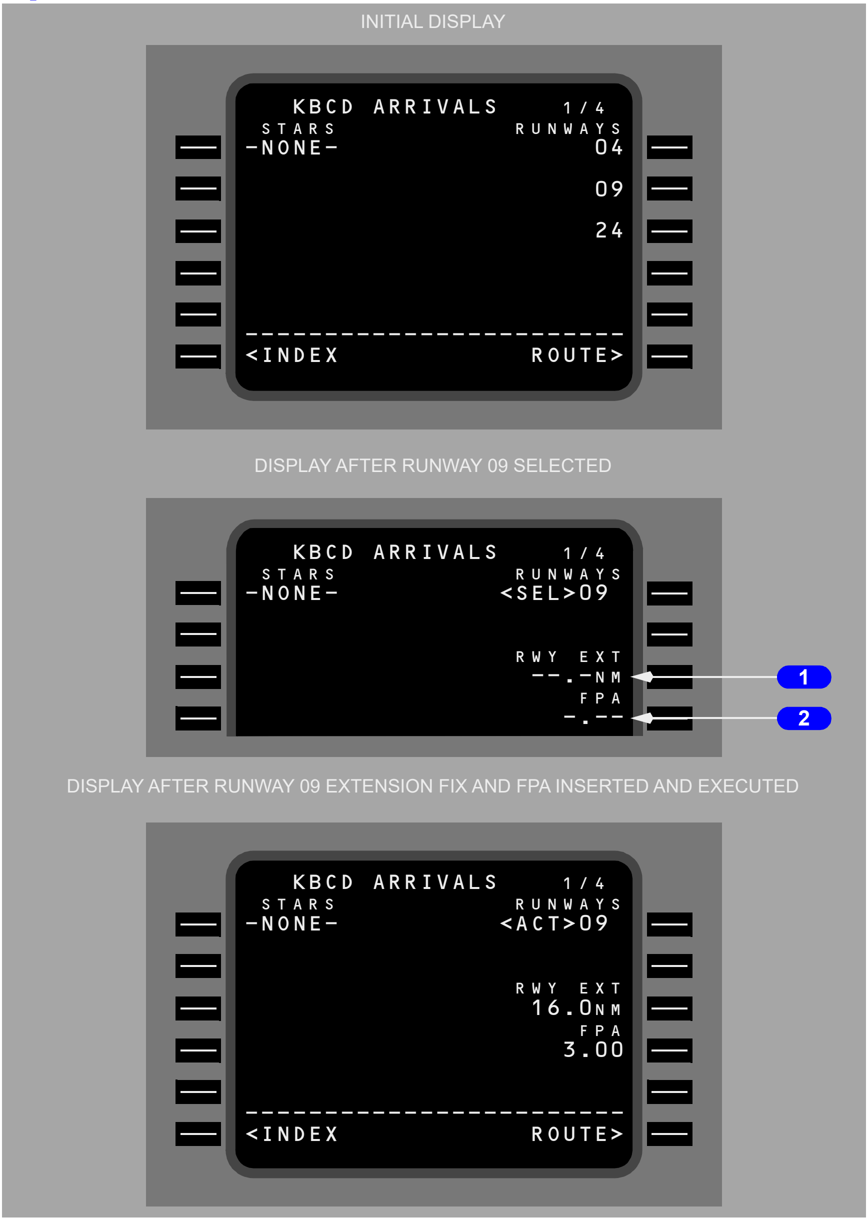
Toggles glideslope ON and OFF for the selected or active approach.

When an ILS or IGS approach is selected in the FMC, G/S defaults to ON.

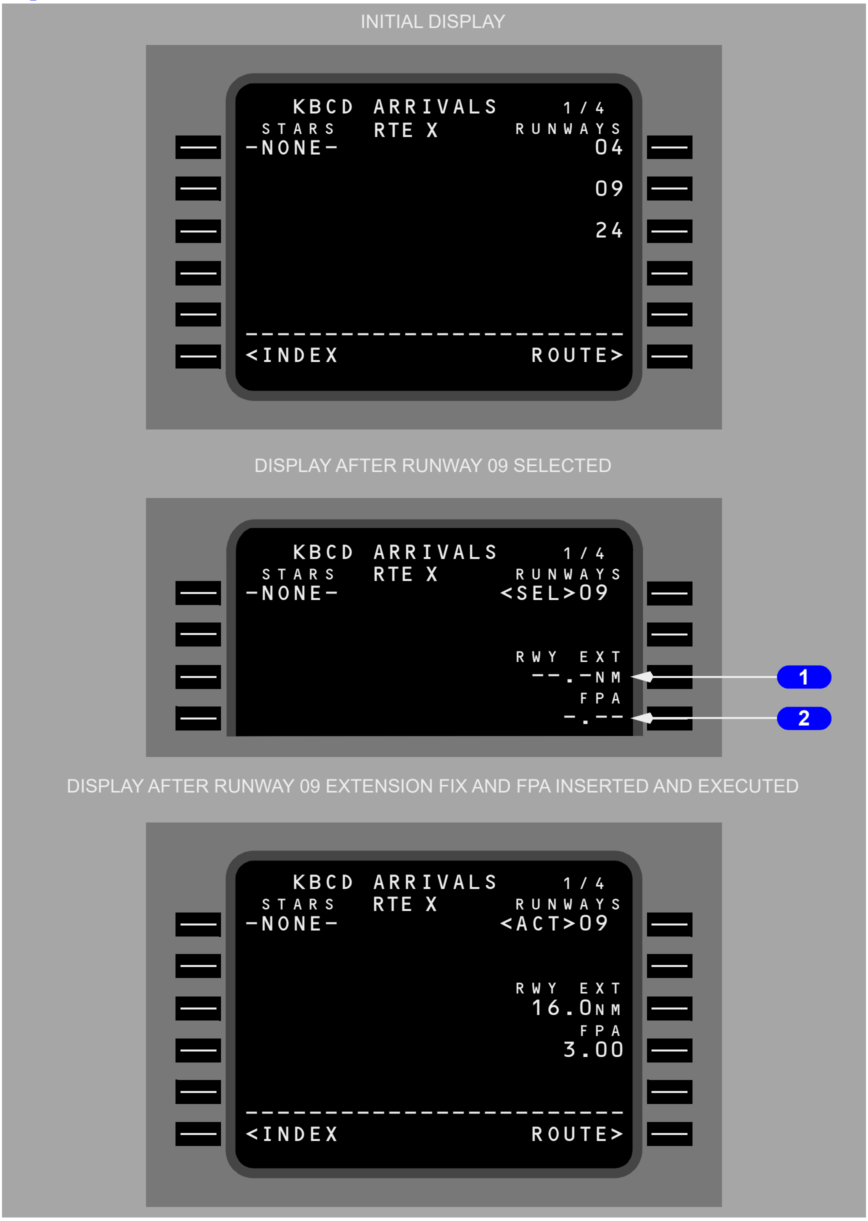
When a LOC, SDF, LDA or BCS approach is selected in the FMC, G/S defaults to OFF.

Arrivals Page – Runway Extension Fix and Flight Path Angle

[Option – FMC U10.6 to U10.8A]



[Option – FMC U11.0 and later]



1 Runway Extension (RWY EXT)

Permits optional entry of a runway extension waypoint following selection of desired runway.

Desired extension distance is entered in scratch pad, then inserted on RWY EXT line. Valid entries are between 1 and 25 NM (.1 NM resolution). This creates a waypoint on the extended runway centerline at the specified distance from the runway threshold.

Waypoint is identified on the RTE and RTE LEGS pages as RX–YYY, where YYY is the runway designation.

A speed/altitude constraint may be entered for the RWY EXT fix from the RTE LEGS page.

2 Flight Path Angle (FPA)

Permits optional entry of a flight path angle between the runway threshold and the runway extension fix. Default is 3.0 degrees. Valid entries are from 2.0 to 5.5 degrees.

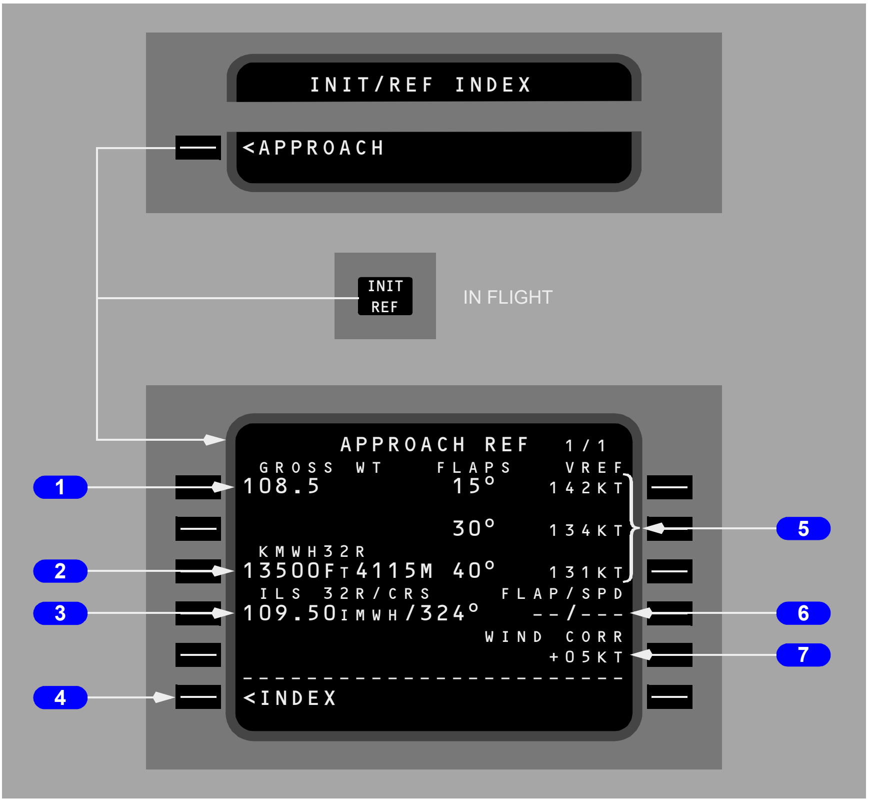
Note: Dashes (–.– –) are displayed on the DEP/ARR page when the default is used.

IAN can be used when the pilot defines a Visual Flight Rule (VFR) approach by entering a flight path angle on the Arrival (ARR) page, for the selected runway. The crew entered angle will be correctly depicted on the Vertical Situation Display (VSD), instead of the default 3 degrees.

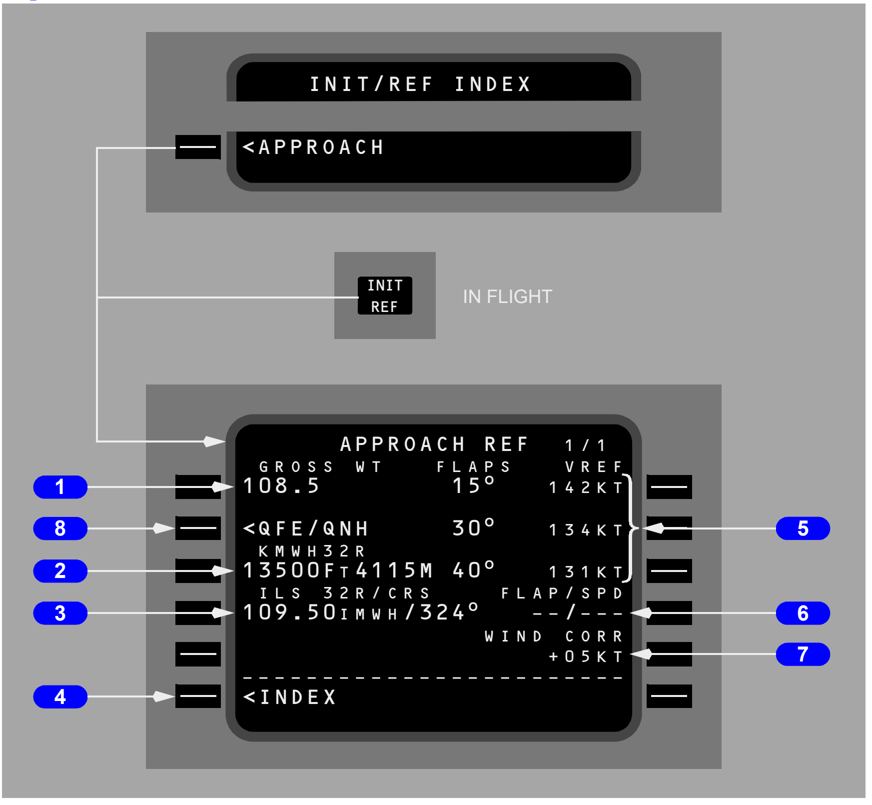
Approach Reference Page

The approach reference page displays approach planning information and approach reference speed (VREF) selection. The displayed data is for the DEST airport and the arrival/ approach entered into the FMC flight plan.

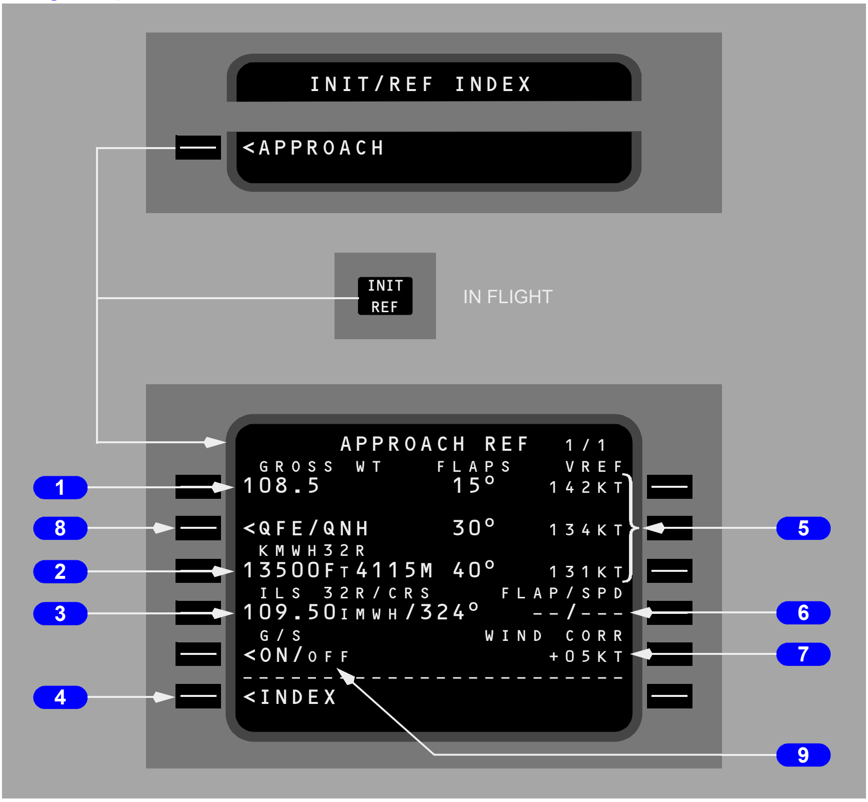
[Option – FMC U10.4 and later]



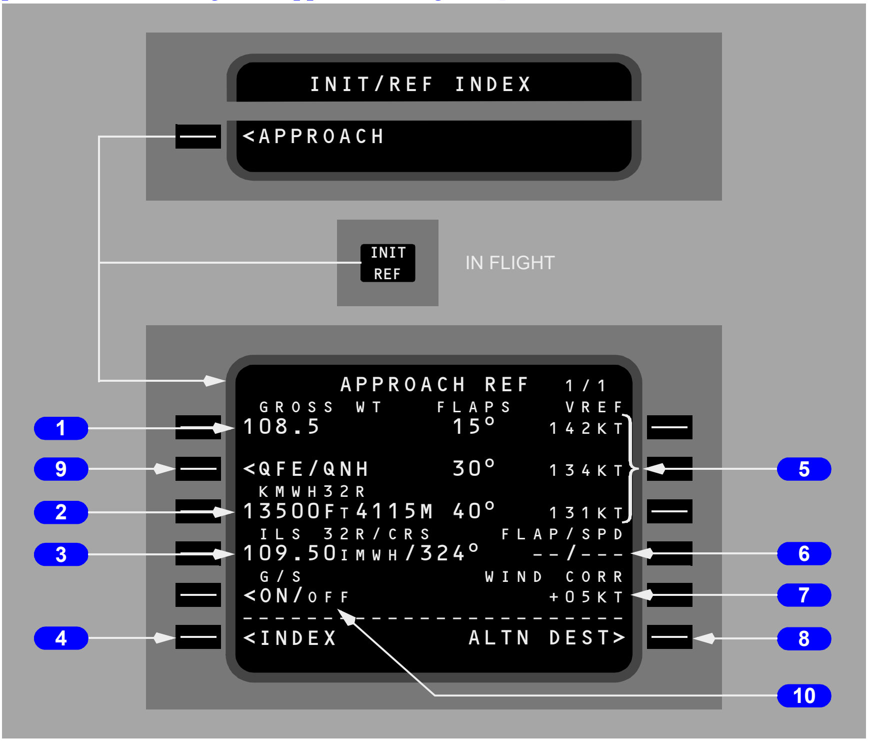
[Option – With QFE/QNH selection]



[Option – FMC U10.5 and later with QFE/QNH selection and integrated approach navigation]



[Option – FMC U10.5 and later with QFE/QNH selection, alternate destination prediction, and integrated approach navigation]



1 Airplane Gross Weight (GROSS WT)

Normally displays the FMC calculated airplane gross weight.

A manual entry of gross weight is allowed.

Displays box prompts when gross weight is not available from the FMC.

Valid entry is XXX.X.

Leaving and returning to this page replaces a manually entered weight with FMC computed gross weight.

2 Runway Length

Displays the length in feet and meters of the referenced runway.

Blank if no runway has been entered and executed.

3 Approach Information

Displays the runway number and associated ILS frequency/identifier for the ILS, LOC, or back course approach in the active flight plan.

Displays front course, if an ILS, localizer, or localizer backcourse is displayed on 4L. If the course is true displays is suffixed with “T”.

Blank if no approach has been executed.

[Option – FMC U10.5 and later with GLS]

3 Approach Information

Displays the runway number, associated ILS frequency (GLS channel) and approach identifier for the ILS, LOC, LDA, SDF, GLS or back course approach in the active flight plan.

Displays front course in large font, if a localizer based or GLS based approach is displayed on 4L. If the course is true displays is suffixed with “T”.

Blank if no localizer or GLS based approach has been executed.

[With GLS and LPV]

3 Approach Information

Displays the runway number, associated ILS frequency (GLS or LPV channel) and approach identifier for the ILS, LOC, LDA, SDF, GLS, LPV or back course approach in the active flight plan.

Displays front course in large font, if a localizer based, GLS or LPV based approach is displayed on 4L. If the course is true displays is suffixed with “T”.

Blank if no localizer, GLS or LPV based approach has been executed.

4 INDEX

Push – selects the INIT/REF INDEX page.

5 Vref (FLAPS – – – VREF)

Displays landing Vref for three flap settings as computed by the FMC. Displayed in small size characters.

Selection causes the flap and VREF speed to be placed in 4R.

Double line selection of a displayed Vref, or manual entry of another value, causes the flap and VREF speed to be placed in 4R and causes Vref to be displayed on the airspeed display. CDU display changes to large size characters.

Speeds are based on displayed gross weights.

Double line selection provides Vref to be used by VNAV in combination with wind correction.

Vref, once selected, will not be updated. To obtain an updated speed, the current speed must be deleted or a different Vref selected or entered.

6 Flap/Speed (FLAP/SPD)

Displays selected approach reference flap and speed setting.

Manual input of desired flap and/or speed settings may be made.

Valid entry format is FF/SSS, SSS, /SSS, FF/ or F/, where F or FF is a flap setting of 0, 1, 2, 5, 10, 15, 25, 30, 40 and SSS is a speed within the range allowed in 1R to 3R.

Entries may be deleted and are blanked at flight completion.

7 Wind Correction (WIND CORR)

Displays current wind correction for approach. Default is +05 knots.

Manual input of desired wind correction may be made up to +20 knots.

[Option – With alternate destination prediction]
8 Alternate Destination (ALTN DEST)

Push – selects alternate Destination page.

[Option – With QFE/QNH selection]
8 Landing Reference (LANDING REF)

Push – Toggles altimeter reference between QFE and QNH.

Default is QNH.

Resets to QNH at flight complete.

Reflects TAKEOFF REF selection on TAKEOFF REF page 2.

Active altimeter reference is highlighted.

During descent with QFE selected, the PFD altitude indications show zero feet at the arrival runway. The PFD altitude indication background colors change to green.

If QFE is the current altimeter reference, and the EFIS control panel STD switch is pushed, the takeoff reference automatically toggles to QNH.

[Option – With QFE/QNH selection]
9 Landing Reference (LANDING REF)

Push – Toggles altimeter reference between QFE and QNH.

Default is QNH.

Resets to QNH at flight complete.

Reflects TAKEOFF REF selection on TAKEOFF REF page 2.

Active altimeter reference is highlighted.

During descent with QFE selected, the PFD altitude indications show zero feet at the arrival runway. The PFD altitude indication background colors change to green.

If QFE is the current altimeter reference, and the EFIS control panel STD switch is pushed, the takeoff reference automatically toggles to QNH.

[Option – With integrated approach navigation]

9 Glideslope (G/S)

Toggles glideslope on and off for the selected or active approach.

When an ILS or IGS approach is selected in the FMC, G/S defaults to ON.

When a LOC, SDF, LDA or BCS approach is selected in the FMC, G/S defaults to OFF.

[Option – With QFE/QNH selection, alternate destination prediction, and integrated approach navigation]

10 Glideslope (G/S)

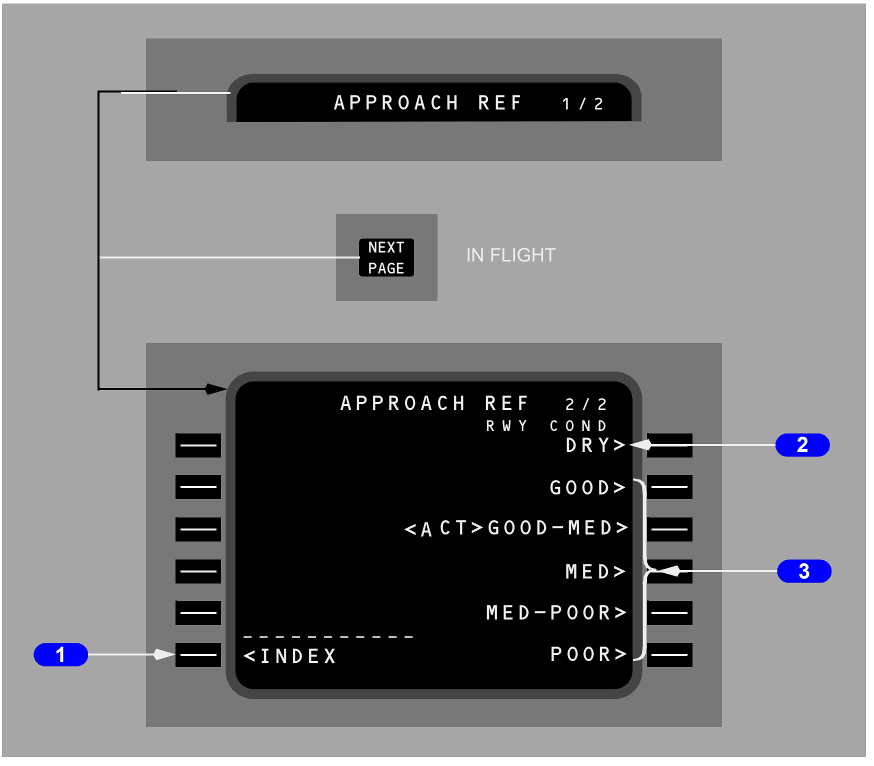
Toggles glideslope on and off for the selected or active approach.

When a localizer based approach is selected or active, and an FMC generated glide path (G/P) is to be flown, glideslope (G/S) must be turned off.

Approach Reference Page (2/2)

[Option – FMC U12.0 and above]

Approach reference page 2/2 enables selection of the landing runway condition.



1 INDEX

Push – selects the INIT/REF INDEX page.

2 DRY

"DRY>" is displayed when the runway overrun alert is enabled. Pressing LSK 1R sets the runway condition to DRY

"DRY", with no caret ">", is displayed when the runway overrun alert is inhibited. Pressing LSK 1R when the overrun alert is inhibited, will not change the runway condition.

A runway condition of DRY will be set upon power up and whenever a change to the active destination airport is executed.

Note: A runway condition of DRY will be set due to a change in the destination airport when the overrun alert is inhibited.

"<ACT>" is displayed next to the active runway condition when the runway alert system is not inhibited.

3 Additional Runway Conditions

A ">" is displayed to the right of the runway condition when the runway overrun alert is not inhibited. Pressing the LSK key sets the runway condition to the appropriate runway condition.

No ">" is displayed when the runway overrun alert is inhibited. Pressing the LSK key will not change the runway condition.

"<ACT>" is displayed next to the active runway condition when the runway alert system is not inhibited.

The FMC outputs a numeric maximum airplane braking coefficient value corresponding to the runway condition selection according to the table below:

Runway Condition Input	Maximum Airplane Braking Coefficient
DRY	0.30
GOOD	0.20
GOOD-MED	0.15
MED	0.10
MED-POOR	0.08
POOR	0.05

TEMP COMP REF Page (X/X)

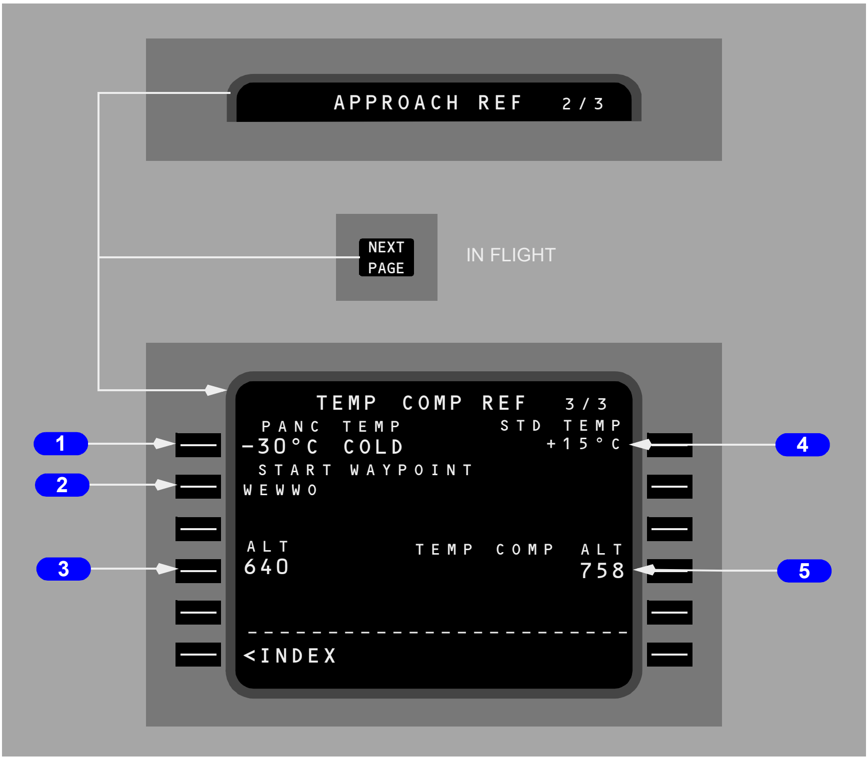
[Option - FMC U14 and Temp Comp]

The Temperature Compensation Reference page is used to adjust the procedure barometric altitude constraints and glide path angles based on a pilot-entered destination airport temperature. On a cold day, the altimeter indicates an altitude higher than the actual altitude. This results in lower true altitude and a geometrically shallower path. On a hot day, the altimeter indicates an altitude lower than the actual altitude, resulting in higher true altitude and a geometrically steeper path. The use of temperature compensation has no impact on geometric glide paths used in ILS or GLS final approach segments.

Temperature Compensation applies to all legs in the active/mod flight plan beginning with the Start Waypoint in 2L on the TEMP COMP REF page, from the first descent altitude constrained fix and continuing through one of the following:

- The last fix in the Missed Approach
- The MAP fix if a Missed Approach is not in the active/mod Flight Plan

When the temperature on LSK 1L of the TEMP COMP REF page is cleared for any reason, all compensated altitude constraints, altitude terminations, and coded glide path angles in the active/mod flight plan return to their un-compensated values. When a temperature at LSK 1L is entered, temperature compensation applies to all altitude constraints in the temperature compensation region, regardless of whether they were manually entered. Manually entered altitude constraints will not be compensated when the TEMP is updated after Temperature Compensation is on. After deleting the TEMP, the manually entered altitude constraint can be temperature compensated by entering a new TEMP.



1 XXXX TEMP

Displays destination airport as entered in the active/mod flight plan. If an approach is in the active/mod flight plan and a temperature is not displayed in the data field, then the data field will contain four dashes, followed by a degree sign, and then a "C" for degrees Celsius.

Displays destination airport as entered in the active/mod flight plan. If an approach is in the active/mod flight plan and a temperature is not displayed in the data field, then the data field will contain four dashes, followed by a degree sign, and then a "F" for degrees Fahrenheit.

If the temperature that was entered is equal to the standard temperature displayed in 1R, a standard "STD" is displayed after the entered temperature.

If the temperature that was entered is less than the standard temperature displayed in 1R, a "COLD" is displayed after the entered temperature.

If the temperature that was entered is greater than the standard temperature displayed in 1R, a "HOT" is displayed after the entered temperature.

Deletion of the entered temperature that is displayed will perform the following:

- Remove pilot entered values from 1L, 2L and 4L data fields.
- Create a MOD flight plan.
- Return the display to dashes.

Entry of a valid temperature in the data field creates a MOD flight plan.

2 START WAYPOINT

The data field displays blanks when any of the following are true:

- A temperature is not displayed in the 1L data field.
- A temperature is displayed in the 1L data field, and the Start Waypoint has been sequenced

Valid entries are any waypoint in the active/mod flight plan prior to the Missed Approach Point.

Entry of a Temp Comp Start Waypoint will create a MOD flight plan.

3 Altitude (ALT)

Published altitude at destination airport.

4 Standard Temperature (STD TEMP)

The reference altitude for the destination airport in the active/mod flight plan is used to compute the standard temperature.

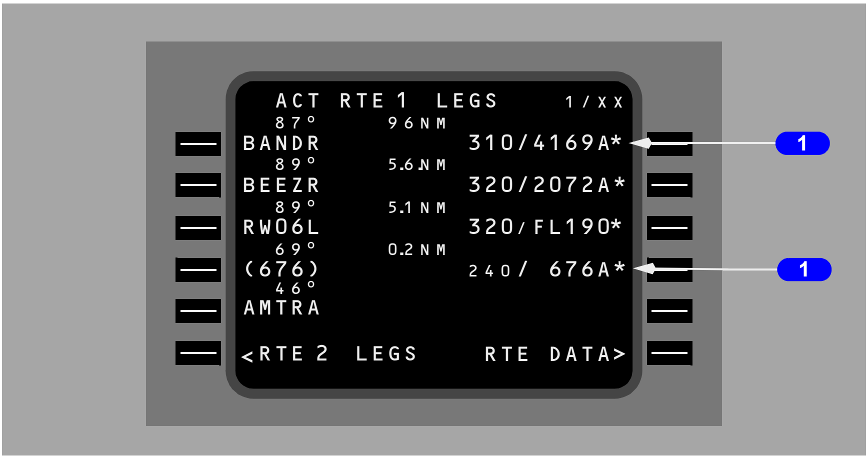
5 Temperature Compensated Altitude (TEMP COMP ALT)

When data is displayed in the 4L data field, the data field 4R displays the temperature compensated altitude for the altitude in 4L based on the temperature in 1L.

Route Legs Page with Temp Comp

On the RTE X LEGS pages, an asterisk (*) is displayed next to altitudes that are compensated by pilot activation of the temperature compensation feature. When temperature compensation is not turned on or temperature is deleted on LSK 1L of the TEMP COMP REF page, the values of constraints and coded vertical angles that were compensated return to the original value:

Note: The numeric display of Navigation Database coded vertical angles on the RTE X LEGS page are not changed when temperature compensation is on because the compensated angle used for vertical path construction now meets the original intent of standard day coded vertical angle.



1 TEMP COMP ALTITUDE

An asterisk (*) is displayed next to altitudes that are compensated by pilot activation of the temperature compensation .

If the Start Waypoint has a descent constraint, it will be temperature compensated. If the Start Waypoint altitude is the same as the FMC cruise altitude, it will not be compensated and the next waypoint with an altitude below the cruise altitude will be compensated.

The default Temperature Compensation Start Waypoint is the first waypoint in the approach transition, if an approach transition is selected, or the first waypoint in the approach for the active/mod flight plan. If the Temperature Compensation Start Waypoint is deleted from the active/mod flight plan, the Start Waypoint reverts to the default Temperature Compensation Start Waypoint as defined in the previous sentence.

Alternate Airport Diversions

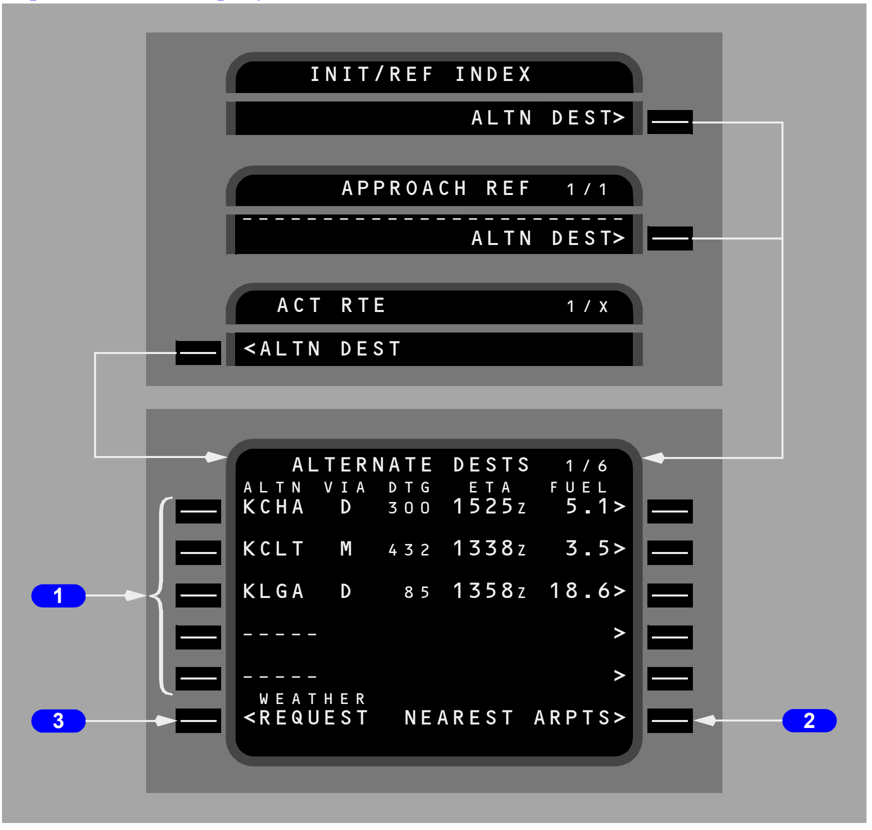
[Option – With alternate destination prediction]

Alternate Dests Page 1/X

The alternate destinations pages allow the selection of alternate airports and the display of data about the alternates.

The ALTERNATE DESTS page 1/X allows entry and display of up to five alternate airports. Pages 2 through 6 allow entry and display of data related only to the selected alternate.

[Option – With company data link]



1 Alternate Airports (ALTN)

Allows entry of alternate destination. Valid entries are airports, navaids, or waypoints.

Related data (VIA, DTG, ETA, FUEL) is automatically displayed.

Push – selects page 2/X–6/X for data on selected alternate.

The DELETE function key can be used to remove manually entered alternates.

2 Nearest Airport (NEAREST ARPTS)

Push – commands FMC to search navigation database for the five airports nearest to the airplane's present position. The following actions occur:

- any alternates already entered are saved
- page title changes to NEAREST ARPTS
- the five nearest airports are displayed on lines 1L to 5L
- the NEAREST ARPTS prompt is replaced with PREVIOUS prompt
  - selection of the PREVIOUS prompt returns the display to the ALTERNATE DESTS page.

Selection cannot be overwritten or deleted.

[Option – With company data link]

3 WEATHER REQUEST

Push – transmits data link request for alternate destination weather uplink.

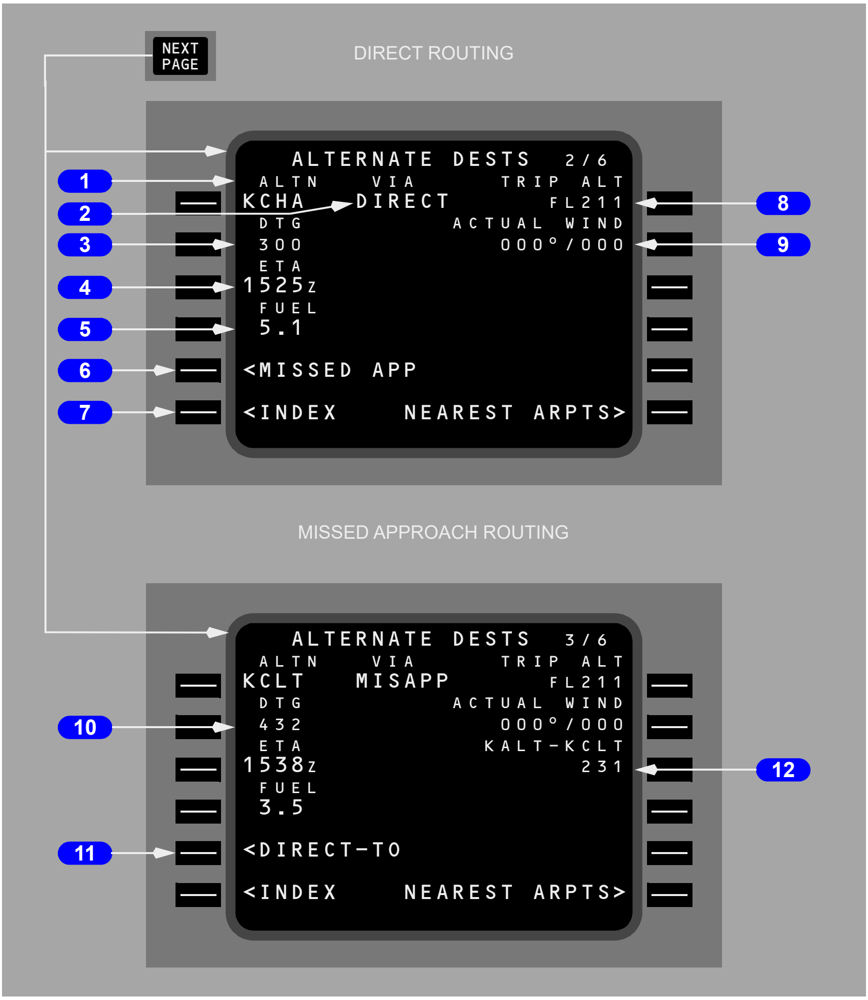
Alternate Dests Page X/X

The ALTERNATE DESTS pages 2 through 6 display specific information about alternate airports and the route used for diversion. All data on the page is related to the alternate airport displayed in the page title.

Two routes to the airport can be selected:

- DIRECT–TO
- MISSED APP

The calculation of ETA and fuel remaining are based on the selected route.



1 Alternate (ALTN)

Allows entry of alternate destination. Alternate and related information will also display on page 1/6.

2 VIA

Displays routing method used for alternate predictions.

3 Distance To Go (DTG)

Displays distance to go to alternate.

Manual entry allowed if DIRECT method is selected. Entered value will be displayed in large font.

4 Estimated Time of Arrival (ETA)

Displays estimated time of arrival at alternate.

5 FUEL

Displays fuel remaining at alternate.

6 Missed Approach (MISSED APP)

Push – changes routing method to missed approach for alternate predictions.

7 INDEX

Push – displays ALTERNATE DESTS Page 1/X.

8 Trip Altitude (TRIP ALT)

Displays computed optimum cruise altitude.

Manual entry is allowed and will be displayed in large font. If manual entry is unsuitable, display will show UNABLE.

9 ACTUAL WIND

Displays current wind direction and velocity.

If manual entry is made, heading will change to EST WIND.

10 Distance To Go (DTG)

Displays distance to go. Manual entry not allowed for missed approach routing.

11 DIRECT–TO

Push – changes routing method to direct to for alternate predictions.

12 **Destination–Alternate**

Displays computed distance from destination to alternate when missed approach is selected. Distance includes missed approach procedure plus great circle distance from last waypoint in missed approach to alternate.

Manual entry is displayed in large font.

Holding

The FMC computes holding patterns with constant radius turns based on current winds and FMC commanded airspeed. The pattern size is limited to FAA or ICAO protected airspace. In LNAV, the AFDS tracks the holding pattern using up to a 30 degree bank angle. Strong winds or airspeed in excess of FAA or ICAO entry speeds may result in the airplane flying outside the protected airspace.

[Option – FMC U11.0 and later]
The FMC generates steering commands to enter, track, and exit a holding pattern inserted into the active flight plan through CDU action by the pilot.

With LNAV active before sequencing the holding fix, holding pattern entries are determined by the following:

- the angle between the flight plan leg into the holding fix and the holding inbound course determines the entry method used (parallel, teardrop or direct entry)
- the airplane flies the initial outbound leg for a specified time (1.0 minute at or below 14,000 feet and 1.5 minutes above 14,000 feet)
- teardrop entries use an FMC calculated offset angle designed to intercept the outbound leg at the point where the inbound turn begins
- parallel and teardrop entries may cause the airplane to fly beyond the displayed holding pattern; however, the airplane remains in protected FAA or ICAO limits.

Descent in Holding

[Option – FMC U11.0 and later]
The FMC provides the capability for starting descents when in the holding pattern airspace with a T/D displayed on one of the holding legs. This is based on the airplane entering the Hold in the Cruise phase of flight.

- The requirement is to descend in VNAV while holding when a T/D is encountered in the holding pattern, the MCP ALT has been lowered, and the EXIT ARMED mode has been executed.

When an exit from a holding pattern is requested by the pilot through a CDU action:

- a turn path to the inbound leg is generated immediately if the airplane is on the outbound leg or in the fix end turn when the T/D does not occur in the hold pattern.
- the entire hold pattern is flown when the T/D does occur in the hold pattern.

After EXIT HOLD has been executed, T/D, if applicable, is displayed on the holding exit lateral path. The FMC switches from cruise to descent upon passing T/D if the MCP altitude is lower than the FMC CRZ altitude. The descent is performed in a VNAV speed mode at hold speed until leaving the HOLD.

HOLD Page

The hold page is used to enter a holding pattern into the route.

When the flight plan does not have a holding pattern, push the HOLD function key to show the LEGS page with the HOLD AT line.

Two versions of the hold page are possible:

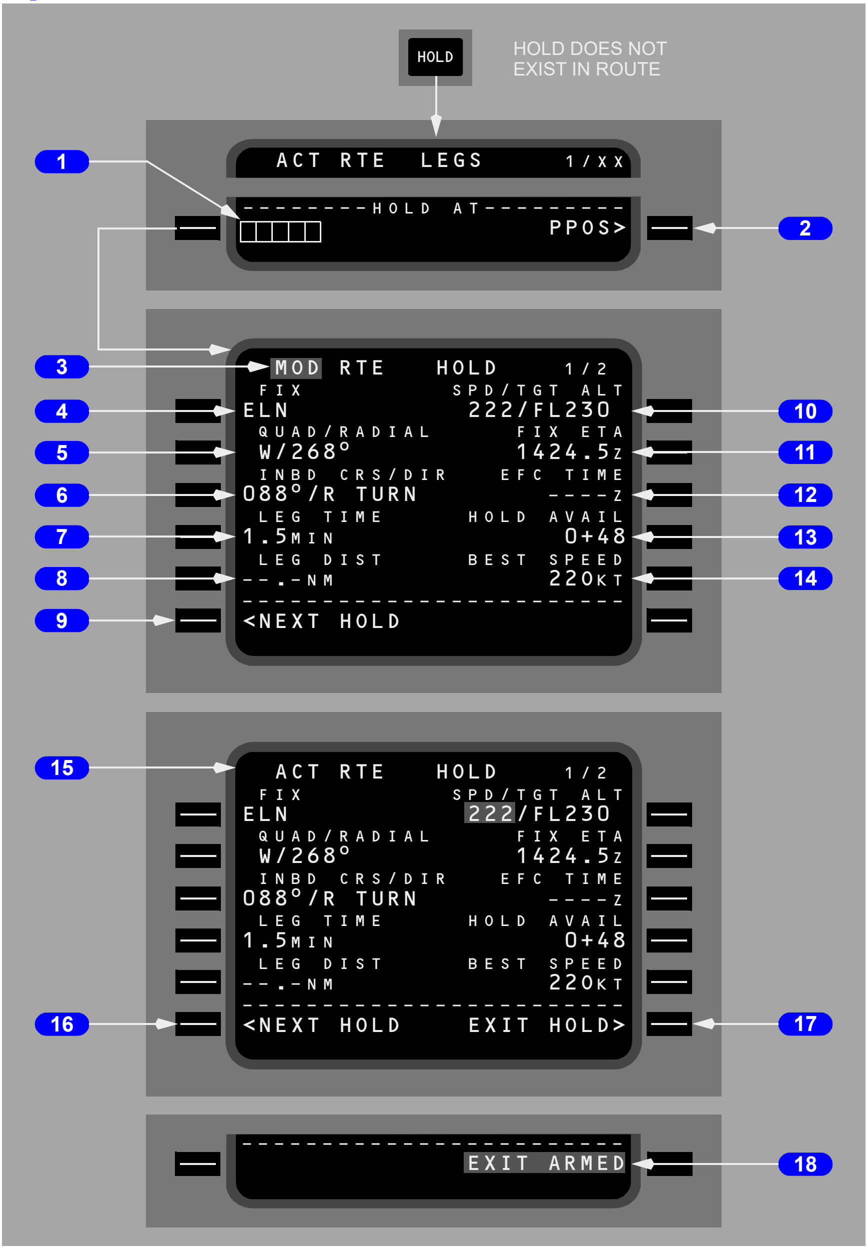
- an airway or procedure holding pattern (from the navigation database)
- a flight crew–entered holding pattern.

The holding page shows actual or default data about the holding pattern.

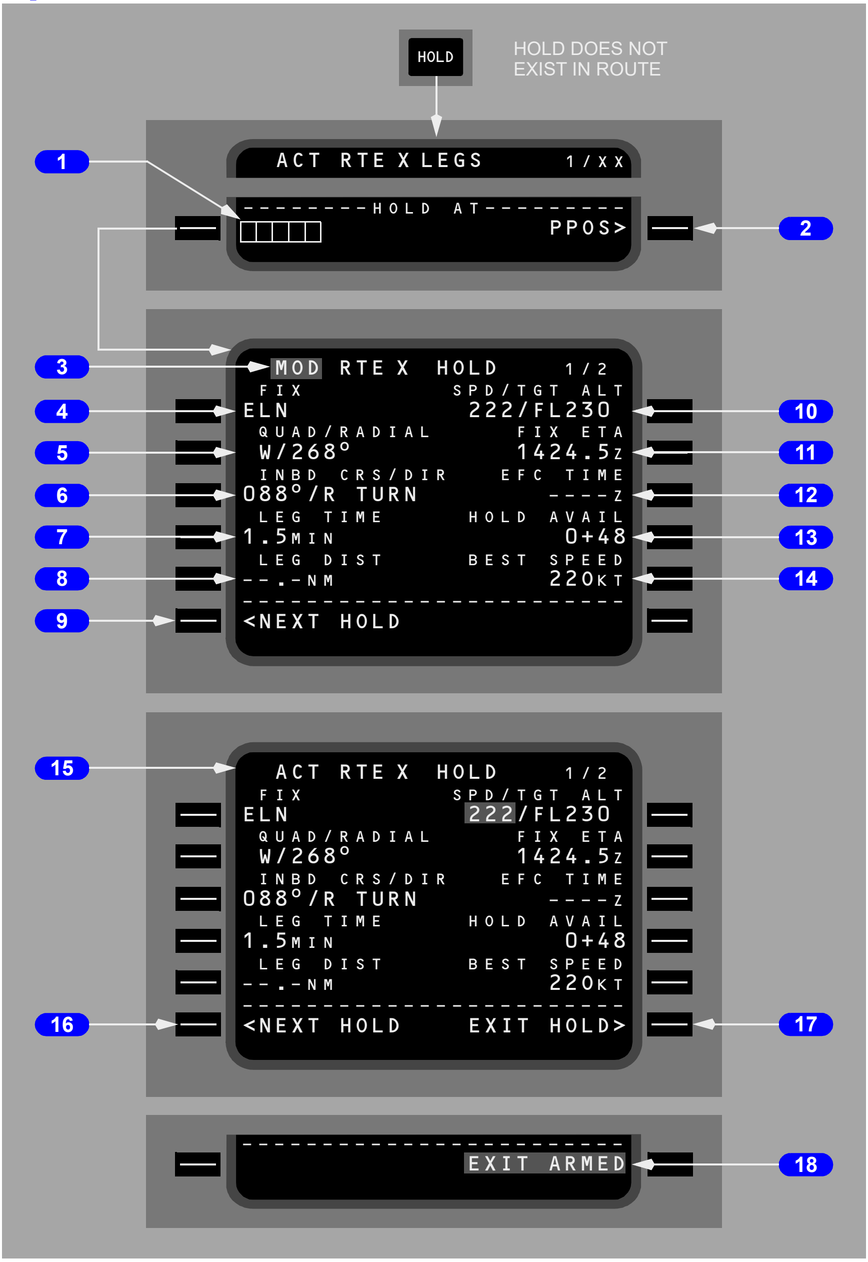
Entries make route modifications, which can be erased or executed.

Active holding patterns are magenta on the navigation display.

[Option – FMC U10.7 to U10.8A]



[Option – FMC U11.0 and later]



1 HOLD AT

When the HOLD function key is pushed and no holding pattern exists in the route, the LEGS page shows prompts to enter the holding fix. Enter the holding fix to show the RTE HOLD page.

Displays a prompt to enter the holding fix, a route waypoint, or present position.

A waypoint is entered as the holding fix.

2 HOLD AT Present Position (PPOS)

Selects the airplane present position as the holding fix.

Only displayed during flight when not in a holding pattern.

3 Modified Route Hold Status

MOD indicates that the holding fix has not been executed.

Execution changes the page title to RTE HOLD (ACT RTE HOLD if holding at PPOS).

4 FIX

Displays waypoint identifier of the holding fix.

Entry is propagated either automatically from the database, or from a manual entry on the HOLD AT page.

If PPOS was selected on the HOLD AT page, then the FMC assigns PPOS as the fix identifier.

5 Quadrant/Radial (QUAD/RADIAL)

Displays holding pattern quadrant and radial.

Entry is propagated either automatically from the database, or from a manual entry on the HOLD AT page.

[Option – FMC U10.4 and later]
The default holding pattern inbound course and turn direction are in small font. Crew entered or holding patterns extracted from the database are in large font.

Valid entry is XXX (radial) or XX/XXX (quadrant/radial). Valid quadrant entry is N, NE, E, SE, S, SW, W, NW.

Quadrant will be determined by the resulting inbound course.

6 Inbound Course/Direction (INBD CRS/DIR)

Displays holding inbound course and turn direction.

Entry is propagated either automatically from the database, or from a manual entry on the HOLD AT page.

[Option – FMC U10.4 and later]
The default holding pattern inbound course and turn direction are in small font. Crew entered or holding patterns extracted from the database are in large font.

Valid entry is XXX (inbound course), XXX/X (inbound course/turn direction), /X or X (turn direction).

Automatically changes QUAD/RADIAL to agree.

For a flight crew–entered holding pattern, the inbound course is initially the same as the preceding leg to the fix.

For a flight crew–entered holding pattern, if no entry is made, the FMC assumes right turns.

[Option – With color]
Magenta when the holding fix is the active waypoint.

7 LEG TIME

Displays holding pattern leg time.

Valid entry is XXX.X. Manual entry has priority.

If no entry is made, the FMC assumes the standard times of 1.0 minute at or below 14,000 feet and 1.5 minutes above 14,000 feet.

[Option – FMC U10.4 and later]
The default leg times are displayed in small font. Crew entered or holding patterns extracted from the database are displayed in large font.

[Option – FMC U10.4 and later]
The holding pattern will automatically be resized when climbing or descending through 14,000 feet if the holding pattern size is not defined in the database or has not been manually entered.

If a LEG DIST is manually entered, then dashes will be displayed.

8 Leg Distance (LEG DIST)

Dash prompts are normally displayed.

Entry may be propagated either automatically from the database, or made by manual entry.

Manual entry has priority.

Overrides

LEG TIME.

9 NEXT HOLD

Displayed when the route contains less than five holding patterns.

Push – displays (RTE LEGS) HOLD AT page and prompts for new holding fix entry.

To delete the hold modification return to the RTE or RTE LEGS page and select ERASE prompt at LSK 6L.

10 Speed/Target Altitude (SPD/TGT ALT)

Displays current speed and altitude (small font).

Speed or altitude constraint may be entered. Manual entries are in large font and propagate to LEGS page.

Note: When a cruise hold exists, cruise speed changes propagate around the hold but have no effect on holding speed.

11 Fix Estimated Time of Arrival (FIX ETA)

Displays computed time for next passage over holding fix.

12 Expect Further Clearance Time (EFC TIME)

Entry of the EFC time will help optimize FMC performance computations.

Computation of destination fuel assumes that departure from the holding fix will occur at this time.

13 Hold Available (HOLD AVAIL)

Displays available holding time in hours + minutes remaining if destination is to be reached with planned fuel reserves as entered on PERF INIT page.

14 BEST SPEED

Displays computed best holding speed based on present altitude and conditions.

Note: May exceed maximum speed permitted by regulatory agency.

15 Active Route Hold Status

ACT indicates that the airplane has entered the holding pattern.

16 NEXT HOLD

Displayed when the route contains less than five holding patterns and there is no route modification in progress.

Push – displays (RTE LEGS) HOLD AT page and prompts for new holding fix entry.

17 EXIT HOLD

Displayed on the holding page when in the holding pattern.

Used when preparing to depart holding pattern.

Push – changes prompt to EXIT ARMED and illuminates execute key.

18 EXIT ARMED

Displayed on the holding page when in the holding pattern and after line selection of EXIT HOLD prompt.

Execution activates LNAV flight back to the holding fix via a shortened holding pattern, departure from holding pattern, and continued flight along the active route. ACT RTE LEGS page 1/XX appears after holding exited.

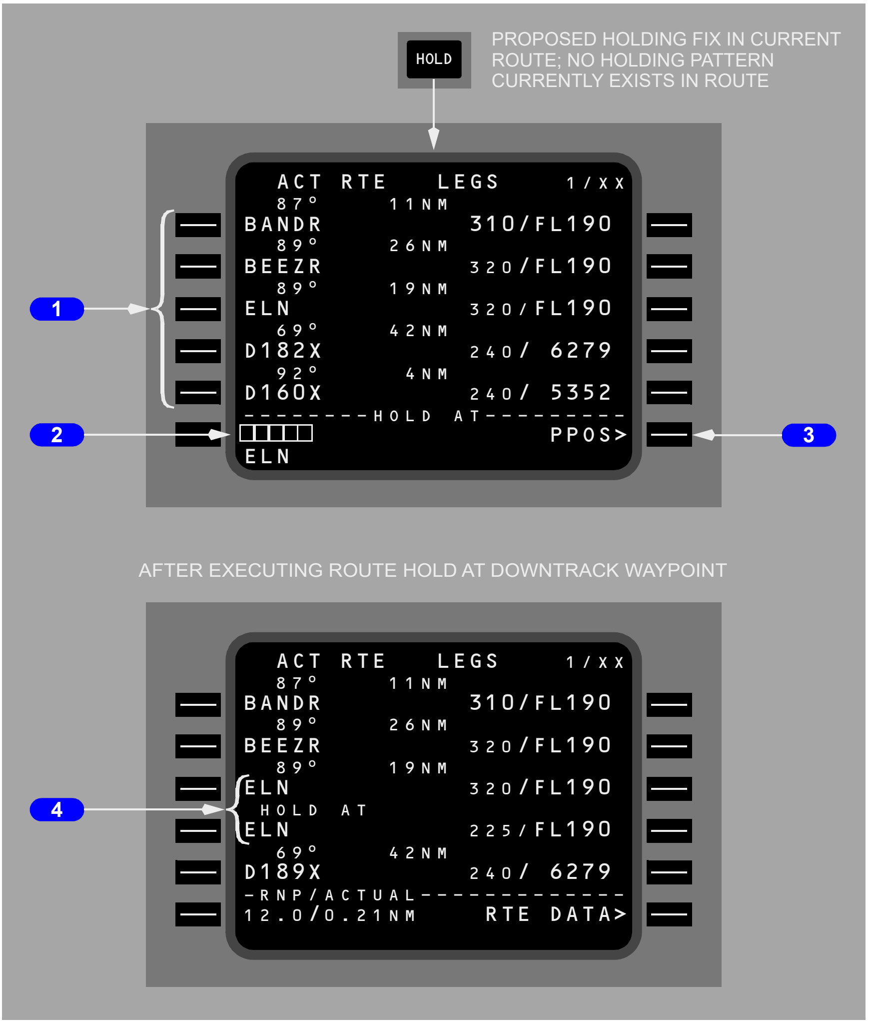
Highlighted in reverse video after execution.

RTE LEGS HOLD AT (Fix in Route)

Used to enter proposed fix for racetrack holding pattern at either present position or any waypoint.

A maximum of five holding patterns may exist at one time.

Two holding patterns may exist at the same waypoint if one is in the route and the other is in the missed approach.


HOLD
PROPOSED HOLDING FIX IN CURRENT ROUTE; NO HOLDING PATTERN CURRENTLY EXISTS IN ROUTE
ACT RTE LEGS 1/XX
87° 11NM
BANDR 310/FL190
89° 26NM
BEEZR 320/FL190
89° 19NM
ELN 320/FL190
69° 42NM
D182X 240/ 6279
92° 4NM
D160X 240/ 5352
HOLD AT
PPOS>
ELN
1
2
3
AFTER EXECUTING ROUTE HOLD AT DOWNTRACK WAYPOINT
ACT RTE LEGS 1/XX
87° 11NM
BANDR 310/FL190
89° 26NM
BEEZR 320/FL190
89° 19NM
ELN 320/FL190
HOLD AT
ELN 225/FL190
69° 42NM
D189X 240/ 6279
RNP/ACTUAL
12.0/0.21NM RTE DATA>
4

[Option – FMC U11.0 and later]

1 Data Lines

Display same data as the corresponding RTE LEGS page.

2 HOLD AT

Used to enter any waypoint identifier, which then defines a holding fix.

Entry may be via keyboard, or by transfer of any downpath waypoint which is in the existing route (the example depicts ELN line selected into the scratch pad).

Following line selection of the desired waypoint into the box prompts, the MOD RTE HOLD page appears and the execute key illuminates.

3 Present Position (PPOS)

Push – selects holding fix at present position. The MOD RTE HOLD page appears and the execute key illuminates ("present" is at the time of execution of the MOD RTE HOLD page).

Displayed only in flight.

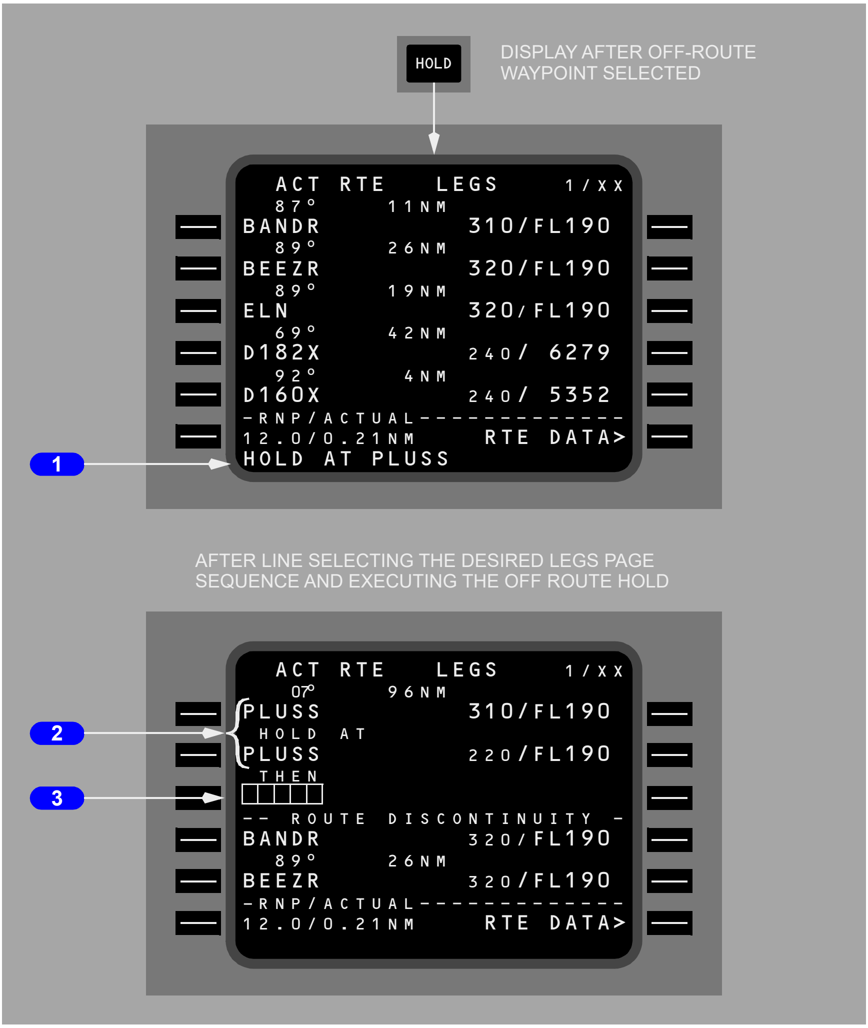
Default parameters are a standard holding pattern on the inbound leg.

4 Hold at Waypoints (HOLD AT)

A holding fix creates a new HOLD AT waypoint following the leg to that waypoint.

Displayed on the RTE LEGS page in the proper route sequence after executing the related MOD RTE HOLD page.

RTE LEGS HOLD AT (Fix not in Route)



[Option – FMC U11.0 and later]

1 Hold at Waypoint (HOLD AT XXXX)

Displayed in the scratch pad whenever the entry in the HOLD AT line is not a waypoint in the existing route (the example above depicts entry of PLUSS).

Route position of the holding fix is defined by line selecting to the desired LEGS page sequence.

Following line selection to the desired LEGS page sequence, the MOD RTE HOLD page appears and the execute key illuminates.

2 Hold at Waypoints (HOLD AT)

A holding fix creates a new HOLD AT waypoint following the leg to that waypoint.

Displayed on the RTE LEGS page in the proper route sequence after executing the related MOD RTE HOLD page.

3 ROUTE DISCONTINUITY

The entered route must always form a continuous path of linked legs.

The example depicts a HOLD AT entry where the entry was not a downpath waypoint.

The FMC computes a direct course to the off–route holding fix.

The HOLD AT waypoint becomes a termination identifier which is not part of the existing route. The resulting route discontinuity is identified by box prompts, requiring entries to define the route after PLUSS.

Intentionally
Blank

Flight Management, Navigation — Chapter 11
FMC Messages — Section 60

Introduction

FMC messages tell the flight crew when system operation is degraded or if there are data input errors.

FMC messages show in the CDU scratchpad. The messages are categorized as:

- alerting messages
- entry error messages
- advisory messages.

[Option – With company data link]
- FMC data link messages (alerting and advisory)

[Option – With ATC data link]
- ATC data link messages (alerting)

The FMC messages are shown according to their level of importance. Alerting messages are most important, followed by entry error messages. Advisory messages are least important. If multiple messages exist, a less important message replaces another message in the scratchpad when the CLR key is pushed or the condition is corrected.

The amber FMC alert light on each pilot's instrument panel illuminates when there is an FMC alerting message. All FMC messages illuminate the CDU message (MSG) light. Clear the message or correct the condition to cancel the message.

The following tables are general lists; some messages may not apply to all FMC configurations.

FMC Alerting Messages

These messages relate to operationally significant conditions which affect FMC operation.

FMC alerting messages:

- are shown in the CDU scratchpad
- cause the amber FMC alert light on each pilot's instrument panel to illuminate
- illuminate message lights (MSG) on both CDUs.

Use the CLR key or correct the condition responsible for the message to remove the message. The message is temporarily removed from the scratchpad when manually entering data. The message returns when the data is removed from the scratchpad.

ALERTING MESSAGE	CAUSE	CORRECTIVE ACTION

[Option – U10.5 and later]

CRZ ALT CHANGED TO XXXXX (U10.5 and later)	An altitude constraint added due to entering a new company route, a new destination airport, or selection of a new procedure conflicts with the cruise altitude, resulting in automatically raising the cruise altitude to match the highest waypoint altitude constraint in the mod plan, when not in active descent.	Clear the message. Verify MCP cruise altitude.

[Option – U10.5 and later]

CHECK ALT TGT (U10.5 and later)	VNAV disengages while airplane is between MCP and FMC altitudes or VNAV button pressed while airplane is between MCP and FMC altitudes.	Clear the message.

[Option – U10.6 and later]

CUTBACK DISARMED (U10.6 and later)	Cutback turned off as a result of changing or deleting the flight plan runway while on the ground.	Clear the message. Re-arm as required.

[Option – U10.3 and later]

CUTBACK UNAVAILABLE (U10.3 and later)	The FMC is unable to compute a Cutback N1 value.	Clear the message.

ALERTING MESSAGE	CAUSE	CORRECTIVE ACTION
CYCLE IRS OFF–NAV	IRS is unable to complete alignment under current conditions.	Cycle IRS mode selector to “OFF” and back to “NAV.”
DATA BASE INVALID	The automatic validity test of the permanent navigation database has failed.	Advise maintenance personnel to check the FMC and reload the database, as required. If desired, consider the use of the temporary nav database.
DISCO INSRTD AFTR XXXXX (waypoint identifier)	A ROUTE DISCONTINUITY has been inserted into the flight plan due to undefined termination of a downpath leg or a triple waypoint BYPASS.	Select the RTE or RTE LEGS pages and modify the waypoints for a continuous route.
DISCONTINUITY	Passing the last waypoint in the route prior to a ROUTE DISCONTINUITY (LNAV disengages) or pressing LNAV while in a discontinuity.	Select the RTE LEGS page. Enter the desired active waypoint into the box prompts. Correct any ROUTE DISCONTINUITY and EXECute. Reengage LNAV.

[Option – U10.7 and later]

DRAG REQ AFTER XXXXX (U10.7 and later)	A waypoint speed constraint greater than 10 knots above the predicted speed exists at waypoint XXXXX.	Modify flight plan as required. Clear the message.

END OF OFFSET	Two minutes prior to passing offset leg termination.	Confirm clearance.

ALERTING MESSAGE	CAUSE	CORRECTIVE ACTION
END OF ROUTE	LNAV engaged and passing the last waypoint in the route (LNAV disengages).	Select the RTE LEGS page. Enter the desired active waypoint into the dash prompts and EXECute. Reengage LNAV.

[Option – U10.3 and later]

ENG OUT SID MOD (U10.3 and later)	An engine–out SID has been automatically inserted into the flight plan as a modification.	Clear the message.

ENTER IRS POSITION	IRS in the alignment mode needs present position to complete alignment. Previous present position entry was not received back from the IRS.	Enter IRS present position into the scratchpad pad and line select 4R on the POS INIT page of the CDU. If present position was previously entered, overwrite displayed data. If necessary, enter present position directly into the IRS control /display unit.

[Option – U10.5 and later]

FMC APP/TUNE DISAGREE (U10.5 and later)	An approach that utilizes FMC generated glide path is in the active flight plan but an approach navaid (ILS/GLS) has been tuned with G/S ON.	Confirm the tuned frequency and approach selected in the FMC are both consistent with the actual approach intended to be flown. Resolve tuning or approach selection inconsistency. Clear the message.

ALERTING MESSAGE	CAUSE	CORRECTIVE ACTION

[Option – U10.8 and later]

FMC DISAGREE (U10.8 and later)	During approach or on the ground, monitored parameters required for dual FMC operation are in disagreement. (Dual FMC as installed) Message will remain displayed until the condition has been resolved. The FMC does not check for mach and indicated air speed miscompares on the ground.	Monitor FMCs closely. Both FMCs remain online. Limit approaches to single FMC only. If desired, revert to SINGLE FMC OPERATION in this section.

[Option – U10.8A and later]

FMC DISAGREE - VERTICAL (U10.8A and later)	A vertical deviation, FMC Airspeed, or FMC Mach value disagreement between the FMCs by more than the allowed tolerance occurs and long enough that all attempts to resynchronize failed while the aircraft is in a path descent. Message display is inhibited when in the Approach Nav environment. (dual FMC as installed)	Do not move the FMC source select switch. Monitor crossing altitudes to ensure compliance.

ALERTING MESSAGE	CAUSE	CORRECTIVE ACTION

[Option – U10.7 and later]

FMC POS/RW DISAGREE (U10.7 and later)	Position information is contradictory.	Refer to FMC Navigation Check Supplementary Procedure.

[Option – U10.7 and later]

GPS-L INVALID GPS-R INVALID (U10.7 and later)	FMC is no longer receiving valid information from the displayed GPS system.	Clear the message. For ADS-B operations (if installed), when one GPS is invalid, ensure that the transponder selector is positioned to the side with the valid GPS. For dual GPS installations, if both GPS-L INVALID and GPS-R INVALID messages show, refer to FMC Navigation Check supplementary procedure. For single GPS installations, refer to FMC Navigation Check supplementary procedure

INSUFFICIENT FUEL (U12.0 and earlier)	A change in conditions or flight plan route causes predicted fuel at destination to be 2000 lbs/900 kilograms or less.	Modify the route plan or cruising altitude, or divert for additional fuel.

ALERTING MESSAGE	CAUSE	CORRECTIVE ACTION
[Option – U13.0 and later]		
INSUFFICIENT FUEL (U13.0 and later)	FMC fuel at the destination is predicted to be less than 2000 lbs/900 kilograms. Scratchpad message shows for Active and Mod Flight Plan. Illuminates the FMC P/RST Light for Active and Mod Flight Plan.	Modify the route plan or cruising altitude, or divert for additional fuel.
IRS MOTION	IRS has automatically restarted the alignment due to detection of excessive motion.	Clear message and attempt to reduce airplane movement, if practicable.
[Option – U11.0 and later]		
IRS-(L or R) DRIFT (U11.0 and later)	An FMC has detected that the IRS-(L or R) position or velocity data is unreasonable, and deselected IRS-(L or R) due to velocity divergence or position blunder checks.	Refer to FMC Navigation Check Supplementary Procedure.
[Option – U10.7 and later]		
IRS POS/ORIGIN DISAGREE (U10.7 and later)	Position information is contradictory.	Refer to FMC Navigation Check Supplementary Procedure.

ALERTING MESSAGE	CAUSE	CORRECTIVE ACTION
[Option – U10.6 and later]		
LNAV BANK ANGLE LIMITED (U10.6 and later)	LNAV is engaged and the airplane is not on a lateral offset and is not near or in an orbit or hold and the airplane is within 5 minutes or less from an LNAV guided course change, and will exceed the airway/route boundaries for non-flyover turns less than or equal to 135 degrees due to performance limited bank angle. This message does not apply to fixed radius turns.	Review the LNAV course change. If course change exceeds airway/route boundary, consider flight plan change.
MAX ALT FLXXX (flight level value)	Altitude intervention (as installed) attempt to raise cruise altitude when MCP altitude is above maximum altitude.	Clear the message.
[Option – FMC U13.0 and before]		
MISSED CAPTURE	Proper localizer capture maneuver was performed, but the AFDS did not capture.	Clear the message
MODEL/ENG DATA INVALID	A valid performance database is not available.	Contact maintenance personnel.
NAV DATA OUT OF DATE	Effectivity dates of nav database do not agree with date input from clock.	Check the IDENT page and reverse the dates for ACTIVE NAV DATA if required.

ALERTING MESSAGE	CAUSE	CORRECTIVE ACTION
NAV INVALID–TUNE XXXXX (navaid identifier)	FMC is unable to auto–tune or receive the navaid for a RNAV or VOR approach procedure.	Cross–check radios and manually tune the desired navaid.

[Option – U11.0 and later]

NO VNAV AFTER XXXXX, (U11.0 and later)	The descent path is monitored independent of path construction for the following scenarios: A) - an “at”, “at or above”, “at or below” or “window” constraint is violated B) - a navigation data base gradient (vertical angle) is violated If a violation is detected and not resolved, VNAV will disconnect after the point of the violation. The alerting message is displayed one minute prior to the violation.	After sequencing waypoint XXXXX, VNAV INVALID - PERF logic applies: Pilot should reenter the CI using either the previous CI displayed or enter a new CI. Reengage VNAV when change has been EXECuted.

[Option – U12.0 and later]

OAT DISAGREE - DELETED (U12.0 and later)	A check of entered OAT versus sensed OAT occurs after first engine start. A difference of +/- 6 degrees Celsius between the OAT value on the N1 LIMIT / TAKEOFF REF page and the engine temperature sensors.	Enter updated/corrected OAT on the N1 LIMIT page.

ALERTING MESSAGE	CAUSE	CORRECTIVE ACTION
[Option – U10.2 and later]		
OVERSPEED DISCONNECT (U10.2 and later)	During path descent and above or below the speed restriction altitude, VNAV disengages when airspeed exceeds FMC speed restriction by more than 15 knots.	Manually reduce speed and reengage VNAV.
[Option – U10.3 to U10.8A]		
PARTIAL ROUTE LOADED (U10.8A and earlier)	A route is loaded which references data not contained in the database.	Clear the message.
[Option – U11.0 and later]		
PARTIAL ROUTE X LOADED (U11.0 and later)	A route is loaded into the active/inactive RTE 1 or 2 flight plan buffer which references data not contained in any of the databases.	Clear the message.
PERF DEFAULTS INVALID	Validity check of performance defaults database has failed.	Contact maintenance personnel.
[Option – U10.5A and later]		
RESET MCP ALT (U10.5A and later)	During the FMC cruise phase with VNAV engaged, when within 5 NM of the top-of-descent point without selecting a lower altitude on the AFDS MCP.	Select lower MCP altitude values as clearances permit.

ALERTING MESSAGE	CAUSE	CORRECTIVE ACTION
RTA UNACHIEVABLE	The RTA is not in the computed RTA window under current parameters.	Enter an achievable RTA or discontinue the RTA mode of navigation. Adjust parameters to meet the RTA.

[Option – U10.4 and later]

RW/APP TUNE DISAGREE (U10.4 and later)	During approach, manual tuned approach frequency or channel does not match active flight plan.	Clear the message and select correct approach frequency.

[Option – U10.4 and later]

RW/APP CRS ERROR (U10.4 and later)	During approach, MCP selected course does not match front course for the approach in the active flight plan.	Clear the message and select correct MCP course.

SCANNING DME FAIL	Inputs from both frequency scanning DME radios have failed.	Clear the message and check position. Radio updating of FMC position is not available.
SELECT MODE AFTER RTA	RTA mode has been discontinued due to sequencing of RTA waypoint or RTA waypoint has been removed from the flight plan.	Select alternate performance mode. (ECON, manual speed, etc.)

ALERTING MESSAGE	CAUSE	CORRECTIVE ACTION
SINGLE FMC OPERATION	The primary FMC has determined that the secondary FMC is not available. (Dual FMC as installed)	If the FMC source selector switch is in the “Normal” position, move to “BOTH ON L”. No action is required if the FMC source selector switch is already positioned to “BOTH ON L” or “BOTH ON R”.

[Option – U10.5 and later]

ALERTING MESSAGE	CAUSE	CORRECTIVE ACTION
SW OPTIONS INVALID (U10.5 and later)	The CRC performed during power up BIT on the current software options data base has failed, or the CRC of the software options data base that has been loaded via the data loader has failed.	Reload the FMC OPC software by maintenance.

[Option – (U10.6 and later) and no CDS BP 15]

ALERTING MESSAGE	CAUSE	CORRECTIVE ACTION
TAKEOFF SPEEDS DELETED (U10.6 and later)	A change to runway, runway data, takeoff thrust selection or performance data is made after the V speeds have been selected, or entered V speeds fail to meet relative value check.	Reselect new V speeds and clear message.

ALERTING MESSAGE	CAUSE	CORRECTIVE ACTION

[Option – (U12.0 and later) and CDS BP 15]

TAKEOFF SPEEDS DELETED (U12.0 and later) and CDS BP 15	A change to runway, runway data, takeoff thrust selection or performance data is made after the V speeds have been selected, or entered V speeds fail to meet relative value check. A check, after first engine start, of entered OAT versus sensed OAT has a difference of +/- 6 degrees Celsius.	Reselect new V speeds and clear message. Enter updated/corrected OAT on the N1 LIMIT page, then reselect new V speeds and clear message.

[Option – U10.5 and later]

THRUST REQUIRED (U10.5 and later)	Airplane is in an underspeed condition.	Clear the message. Increase airspeed to within 15 knots of speed target.

[Option – U10.2 and later]

UNABLE HOLD AIRSPACE (U10.2 and later)	The lateral predicted hold path using the bank angle limit causes protected airspace to be exceeded.	Review the holding pattern. If holding pattern exceeds allowable holding airspace, consider flight plan change.

ALERTING MESSAGE	CAUSE	CORRECTIVE ACTION

[Option – U10.4 and later]

UNABLE NEXT ALTITUDE (U10.4 and later)	Unable to meet the next flight plan altitude constraint in a VNAV climb or descent. The message appears only with VNAV engaged.	Clear the message and review the prediction. For undershoot condition during climb, consider selection of MAX RATE CLB or MAX ANGLE CLB, or a different N1 limit as appropriate.

[Option – U10.6 and later]

UNABLE PROC AIRSPACE (U10.6 and later)	Minimum procedure turn built by guidance exceeds the allowable excursion distance.	Modify flight plan as required. Clear the message.

[Option – U10.7 and later]

UNABLE YYY KTS AT XXXXX (U10.7 and later)	Next waypoint speed restriction (speed YYY, at waypoint XXXXX) cannot be met.	Modify flight plan as required. Clear the message.

ALERTING MESSAGE	CAUSE	CORRECTIVE ACTION
[Option – U10.3 and later]		
UNABLE REQD NAV PERF–RNP (U10.3 and later)	FMC actual navigation performance is not sufficient for the displayed RNP. [Option - FMC U14 and above] UNABLE REQD NAV PERF-RNP message will be displayed if there is a divergence between IRU-L and IRU-R inertial altitude, or between IRS-L and IRS-R inertial vertical speed, when the aircraft is on an RNP-AR approach leg.	Refer to UNABLE REQD NAV PERF-RNP non-normal checklist in the QRH. Note: When on a procedure or airway without an RNP alerting requirement, the FMC Navigation Check supplementary procedure in SP11 can be used to verify position. [Option - FMC U14 and above] If a UNABLE REQD NAV PERF-RNP is shown during the RNP-AR approach, whether the lateral or vertical RNP are exceeded or not, do the Go-Around and Missed Approach Procedure unless suitable visual reference is established and maintained.

ALERTING MESSAGE	CAUSE	CORRECTIVE ACTION
VERIFY GW AND FUEL	Fuel data becomes invalid, PERF INIT fuel value is replaced with dashes. FMC uses last valid fuel quantity for performance predictions until manual entry is made. Shows if 30 minutes have elapsed since last manual entry. Does not show in descent with Vref selected.	Enter fuel weight on PERF INIT page 1/2. Periodic update of fuel weight is required to keep gross weight value current.

[Option – U10.7 and later]

ALERTING MESSAGE	CAUSE	CORRECTIVE ACTION
VERIFY POS: FMC-FMC (U10.7 and later)	Position information is contradictory.	Refer to FMC Navigation Check Supplementary Procedure.

[Option – U10.7 and later]

ALERTING MESSAGE	CAUSE	CORRECTIVE ACTION
VERIFY POS: FMC-GPS (U10.7 and later)	Position information is contradictory.	Refer to FMC Navigation Check Supplementary Procedure.

[Option – U10.7 and later]

ALERTING MESSAGE	CAUSE	CORRECTIVE ACTION
VERIFY POS: FMC-RADIO (U10.7 and later)	Position information is contradictory.	Refer to FMC Navigation Check Supplementary Procedure.

[Option – U10.7 and later]

ALERTING MESSAGE	CAUSE	CORRECTIVE ACTION
VERIFY POS: IRS-FMC (U10.7 and later)	Position information is contradictory.	Refer to FMC Navigation Check Supplementary Procedure.

ALERTING MESSAGE	CAUSE	CORRECTIVE ACTION
[Option – U10.7 and later]		
VERIFY POS: IRS-IRS (U10.7 and later)	Position information is contradictory.	Refer to FMC Navigation Check Supplementary Procedure.
[Option – U10.7 and later]		
VERIFY POS: IRS-RADIO (U10.7 and later)	Position information is contradictory.	Refer to FMC Navigation Check Supplementary Procedure.
VERIFY POSITION (on ground)	Position information is contradictory.	Clear message. Check accuracy of manually entered data. Crosscheck IRS, GPS and FMC positions. Manually re-align both IRS's if needed.
[Option – U10.3 and later]		
VERIFY RNP (U10.3 and later)	Underlying RNP value is less than manually entered value.	Enter appropriate RNP.
VERIFY TAKEOFF SPEEDS	A PERF INIT change has been made after takeoff speeds were specified.	On TAKEOFF REF page 1, accept previous V speeds, or reject previous V speeds and enter new V speeds.

ALERTING MESSAGE	CAUSE	CORRECTIVE ACTION
[Option – U10.7 and later]		
VERIFY TAKEOFF THRUST (U10.7 and later)	With the Takeoff Thrust Auto Selection option enabled, the system determines that the selected takeoff thrust setting is not compatible with the engine thrust rating configuration.	Clear the message. Manually change takeoff thrust setting, or accept uplink of different thrust setting.
[Option – U10.5 and later]		
VERIFY VERT RNP (U10.5 and later)	During an active descent with CDS navigation performance scales enabled, a manually entered vertical RNP is greater than the default vertical RNP.	Clear CDU message. Enter appropriate vertical RNP.
[Option – U10.4 and later]		
VNAV DISCONNECT (U10.4 and later)	The criteria for VNAV engagement is not satisfied (VNAV disengages). On approach with VNAV engaged, the FCC may switch to CWS P	Manually control the vertical path.

ALERTING MESSAGE	CAUSE	CORRECTIVE ACTION
[Option – U10.8 and later]		
VNAV INVALID-PERF (U10.8 and later)	If the exception affects both the MOD and the ACT flight plan, the Cost Index (CI) will be replaced with box prompts on the PERF INIT page and the message will result. LNAV is still valid and can navigate the airplane laterally but VNAV will disconnect. Reference section 11.32 for further Software Exception Logic.	Pilot should reenter the CI using either the previous CI displayed or enter a new CI. Reengage VNAV when change has been EXECuted.

FMC Entry Error Messages

These messages relate to incorrect scratchpad entries. FMC entry error messages:

- are shown in the CDU scratchpad
- illuminate the message light (MSG) of the CDU where the entry error was made
- temporarily overwrite data in the scratchpad.

Use the CLR key or key in new data to remove the message. If the CLR key is used to remove the message, the data previously entered is once again displayed. If new data is keyed in over the message, the message and the data previously entered are removed.

ENTRY ERROR MESSAGE	CAUSE	CORRECTIVE ACTION
ALT CONSTRAINT XXXXX (waypoint identifier)	A flight plan modification has caused an altitude conflict with a waypoint that has an altitude constraint.	Clear the message and revise the entry.

ENTRY ERROR MESSAGE	CAUSE	CORRECTIVE ACTION
DATA BASE FULL	Entry attempted into a supplemental or temporary navigation database category which is full.	Go to the NAV DATA pages and delete unneeded waypoints, navaids, or airports from the appropriate database and re–attempt entry.

[Option – U10.3 and later]

DUPLICATE FLIGHT PLAN ID (U10.3 and later)	The entry attempted is a duplicate of an existing supplemental flight plan name.	Clear the message and select a unique flight plan name.

INVALID DELETE	DEL key operation was attempted for a data line to which it was not applicable.	Clear the message and select the proper line after the DEL key is pressed.
INVALID ENTRY	Attempted data entry has incorrect format, range, etc. for the selected data line. Entered RTA waypoint is not in the flight plan.	Clear the message and scratchpad entry, and repeat the entry with the correct data.

[Option – U10.2 and later]

INVALID QUAD (U10.2 and later)	Attempted HOLD page QUAD entry has incorrect format or range.	Clear the message and revise the QUAD entry.

NO OFFSET AT LEG XXXXX (waypoint)	Attempted entry of a lateral offset start or end waypoint XXXXXX that is not offsetable (lateral offset as installed).	Clear the message and amend the route.

ENTRY ERROR MESSAGE	CAUSE	CORRECTIVE ACTION
NOT IN DATA BASE	FMC does not contain the required data for the entered identifier.	Clear the message and check data entry, or enter the required information into the supplemental or temporary navigation database via the NAV DATA pages.
NOT IN FLIGHT PLAN	RTA waypoint or lateral offset (as installed) start/end waypoint entry is not in the active flight plan.	Clear the message and amend the entry.
ROUTE FULL	Entry of more than maximum allowed number of waypoints or holding patterns attempted.	Clear the message and review existing and desired waypoints and holding patterns for possible deletion.

[Option – U10.3 and later]

SUPP RTE DATA BASE FULL (U10.3 and later)	Attempted save of the 11th supplemental flight plan.	Clear the message, delete unneeded supplemental flight plans and re–attempt entry.

FMC Advisory Messages

These messages relate to FMC status. FMC advisory messages:

- are shown in the CDU scratchpad
- illuminate message lights (MSG) on both CDUs.

Use the CLR key or correct the condition responsible for the message to remove the message. The message is temporarily removed from the scratchpad when manually entering data. The message returns when the data is removed from the scratchpad.

ADVISORY MESSAGE	CAUSE	CORRECTIVE ACTION
ABOVE MAX CERT ALT	The airplane is above its maximum certified altitude.	Descend to an altitude below the maximum certified altitude.
APPRCH VREF NOT SELECTED	Airplane has transitioned into approach environment and Vref has not been selected on APPROACH REF page.	Select Vref on APPROACH REF page.
ARR N/A FOR RUNWAY	Runway or approach does not match the selected arrival procedure.	Go to the ARRIVALS page and modify selection.
BUFFET ALERT (Only appears if flaps are retracted)	Current conditions result in a maneuver margin less than specified.	Bring the airplane back within the operating envelope.
CHECK FMC FUEL QUANTITY	The FMC has detected an unexpected drop in the fuel quantity.	Check the fuel quantity indications for correctness.
DRAG REQUIRED	Airspeed is 10 kts or more above FMC target speed or within 5 kts of Vmo/Mmo.	Use speedbrakes, trim or reduced thrust, as required, to bring the airplane within 5 kts of FMC target speed.

[Option – U10.8 and later]

ENTER EO CRZ SPD AND ALT (U10.8 and later)	Engine-out operation has been terminated and no cruise speed or altitude has been entered.	Enter cruise speed and altitude on cruise page.

ADVISORY MESSAGE	CAUSE	CORRECTIVE ACTION

[Option – U10.5 and later]

FMC APP MODE UNAVAIL–GP (U10.5 and later)	The approach selected in the FMC does not have a specified glide path angle for final approach. The FMC approach mode cannot be used for this approach.	Select an alternate approach. Clear the message.

[Option – U10.5 and later]

FMC APP MODE UNAVAIL–QFE (U10.5 and later)	An approach that utilizes FMC generated glide path is in the flight plan, but QFE is selected on the FMC.	Select QNH as the landing altimeter reference on the APPROACH REF page. Clear the message.

[Option – U10.8 and later]

INVALID INACTIVE PLAN (U10.8 and later)	An exception has occurred in the INACTIVE plan prior to execution and it has been deleted as a result.	Reenter a new version of the INACTIVE plan.

[Option – U10.8 and later]

INVALID MOD PLAN (U10.8 and later)	An exception has occurred in the MOD plan and it has been deleted as a result.	Reenter a new version of the MOD plan.

INVALID OFFSET	Desired offset does not meet FMC offset criteria.	Clear the message and amend the entry.
KEY/FUNCTION INOP	A mode key is pressed for which an FMC function has not been implemented or has not been enabled. (FANS MCDU only)	Clear the message or select another CDU page for display.

ADVISORY MESSAGE	CAUSE	CORRECTIVE ACTION

[Option – FMC U13.0 and before]

LOC CAP ACTIVE	The airplane is approaching its turn onto the localizer or GLS course and will maintain an intercept heading.	Clear the message manually, or wait for the AFDS to signal reset status to the FMC.

[Option – FMC U13.0 and below]

LOC CAP CANCELLED	Flight plan modifications or the airplane condition did not facilitate localizer capture.	Clear the message manually, or wait for the AFDS to reset to LOC CAP ACTIVE

MAX ALT FLXXX (flight level value)	Altitude entry on any page is above the maximum altitude for current selected performance margins.	Clear the message or amend the data entry.
MAX MACH .XXX/MIN MACH .XXX OR MAX CAS .XXX/MIN CAS .XXX	FMC target speed is greater than the maximum or less than the minimum buffet speed for the entered cruise or step climb altitude.	Change the target speed to within the message limits or enter a lower altitude.
NO DES PATH AFTER XXXXX (waypoint)	FMC is unable to construct a PATH DES that satisfies all altitude restrictions after XXXXX.	Modify speed or altitude restrictions on the RTE LEGS pages.

ADVISORY MESSAGE	CAUSE	CORRECTIVE ACTION
NOT ON INTERCEPT HEADING	Airplane is not within the LNAV capture criteria for the active leg (LNAV disengages). If the LNAV button is pressed and the airplane is not within the capture criteria. (LNAV will not engage)	Manually place the airplane on an intercept heading and reengage LNAV.
OFFSET DELETED	The entered start waypoint has been deleted from the flight plan. (lateral offset as installed)	Clear the message and amend the route.
OFST ENDS ABEAM XXXXXX	An invalid offset leg exists between the end waypoint (XXXXXX) and the start of offset or no end waypoint exists.	Clear the message and amend the route.
PERF DEFAULTS DELETED	Performance database has been automatically deleted due to conflict with performance database limits.	Contact maintenance personnel.

[Option – U10.6 and later]

POS SHIFT OVER 50NM (U10.6 and later)	A viable position shift is currently selected that will result in an FMC position shift in excess of 50nm when executed.	Clear the message.

PROGRAM PIN ERROR	FMC connector wiring is incorrect.	System unusable; advise maintenance personnel. The CLR key will not clear the message.

ADVISORY MESSAGE	CAUSE	CORRECTIVE ACTION
PROGRAM PIN NOT IN DB	FMC connector wiring or performance database is incorrect.	Advise Maintenance Personnel
RESET MCP ALT	Normal FMC operation would require flying away from MCP altitude.	Select a MCP altitude value in the proper direction (higher for climb, lower for descent).

[Option – U10.5 and later]

RESET MCP APP MODE (U10.5 and later)	A change in the expected approach is made with an FCC approach mode armed or engaged.	Clear and rearm FCC approach mode. Clear the message.

RUNWAY N/A FOR SID	The selected runway is not applicable to the selected departure procedure.	Clear the message and check selections on the DEPARTURES page. Modify as required.
SELECT ACTIVE WPT/LEG	Power–up restart or insertion of a different flight plan while airborne.	EXECute a direct–to or leg intercept to tell the FMC which leg of the route is active.
STEEP DESCENT AFTER XXXXXX	An excessive vertical discontinuity exists after point XXXXXX.	Check routing.
TAI ON ABOVE 10°C	Airplane is operating with anti–icing with TAT above +10°C.	Clear the message and check the use of anti–icing for engines and/or wings.
UNABLE CRZ ALT	FMC predicts that no cruise time is possible at the entered CRZ ALT.	Clear the message and review the CRZ ALT selection.
UNABLE MACH. XXX	The entered cruise Mach is unattainable based on present gross weight.	Select a smaller Mach number or wait until gross weight is reduced sufficiently.

ADVISORY MESSAGE	CAUSE	CORRECTIVE ACTION
UNABLE TO OFFSET	A valid offset cannot be constructed due to geometric limitations.	Clear the message and amend the route.

[Option – U13.0 and above]

ADVISORY MESSAGE	CAUSE	CORRECTIVE ACTION
USING RSV FUEL	Predicted fuel remaining at DEST is less than the RESERVES entry on the PERF INIT page.	Clear the message and change routing if required.
V SPEEDS UNAVAILABLE	FMC cannot compute V speeds (as installed) due to unreasonable inputs on the RTE, PERF INIT, or TAKEOFF REF pages.	Correct inputs that affect V speed computation.
VERIFY RNP VALUE	When entering an RNP the underlying RNP value is smaller than the manually entered value or the ANP is greater than the manually entered RNP.	Change or delete the manually entered RNP.

[Option – U10.5 and later]

ADVISORY MESSAGE	CAUSE	CORRECTIVE ACTION
VERIFY VERT RNP VALUE (U10.5 and later)	With CDS navigation performance scales enabled, a manually entered vertical RNP is greater than the default vertical RNP or manually entered vertical RNP is less that vertical ANP.	Clear the message. Change or delete the manually entered RNP.

ADVISORY MESSAGE	CAUSE	CORRECTIVE ACTION
XXXX (airport identifier)	A REF AIRPORT is entered on the POS INIT page and no entry of ORIGIN yet appears on RTE page 1.	Enter the airport identifier on the ORIGIN data line.
XXXXX (MCP altitude value)	With the CRZ page displayed, resetting the AFDS MCP altitude to a value different from the CRZ ALT causes the value to appear in the scratchpad.	Enter the MCP altitude value on the appropriate target altitude data line.

FMC Data Link Messages

[Option – With company data link]
These messages relate to FMC data link message status. FMC data link alerting and advisory messages function the same as the alerting and advisory messages described above:

FMC Data Link Alerting Messages

ALERTING MESSAGE	CAUSE	CORRECTIVE ACTION
[Option – U14.0 and above]		
ATC DATABASE INVALID (U14.0 and later)	ATC data base is not available/loaded at power up on the ground.	Clear CDU Message
ALTN DEST UPLINK	An FMC alternate destinations uplink message has been loaded on the ALTERNATE DESTS page, and is ready for flight crew review. (Alternate destinations as installed)	Review the alternate destinations uplink.

ALERTING MESSAGE	CAUSE	CORRECTIVE ACTION
CRZ WIND UPLINK LOADING	An FMC cruise wind uplink message is loading (after LOAD selected on the RTE DATA page).	Wait for load to complete.

[Option – U10.8A and earlier]

CRZ WIND UPLINK READY (U10.8A and earlier)	An FMC cruise wind uplink message has been received and is available for loading on the RTE DATA page.	Select RTE DATA page, LOAD cruise wind, and execute or ERASE.

[Option – U11.0 and later]

CRZ WIND UPLINK READY (U11.0 and later)	Receipt of an ACARS uplink that contains cruise wind data, and the cruise wind data LOAD prompt is displayed on the RTE 1 or 2 DATA page.	Select RTE DATA page, LOAD cruise wind, and execute or ERASE.

CRZ WIND XXXXX (cruise altitude) UPLINK	An FMC cruise wind uplink message has been loaded on the RTE DATA page, and is ready for flight crew review.	Review the cruise wind uplink, and execute or ERASE.
DATALINK CONFIG INVALID	Validity check of the FMC datalink configuration file has failed.	Contact maintenance personnel.
DESCENT FORECASTS UPLINK	An FMC descent forecasts uplink message has been loaded on the DESCENT FORECASTS page, and is ready for flight crew review.	Review the descent forecasts uplink, and execute or ERASE.

ALERTING MESSAGE	CAUSE	CORRECTIVE ACTION
FORECASTS UPLINK READY	An FMC descent forecasts uplink message has been received and is available for loading on the DESCENT FORECASTS page.	Select DESCENT FORECASTS page, LOAD descent forecasts winds, and execute or ERASE.
INVALID TAKEOFF XXX/YYY (runway or runway/intersection identifier)	Runway (RTE page) or runway/intersection (TAKEOFF REF page) has been entered that matches runway takeoff data in FMC memory. However, the airplane is performance limited for the selected runway.	Clear the message. Enter correct takeoff data, request new takeoff data uplink, or enter new runway or runway/intersection identifier.
NAV DATA LOADING	An FMC supplemental navigation data uplink message has been received and is loading.	Wait for load to complete.
NAV DATA UPLINK	An FMC supplemental navigation data uplink message has been loaded on the SUPP NAV DATA page, and is ready for flight crew review.	Review the supplemental navigation data uplink, and execute or ERASE.
PARTIAL ALTN DEST UPLINK	An FMC alternate destinations uplink message has been loaded on the ALTERNATE DESTS page, but errors were encountered during the loading process. (Alternate destinations as installed)	Review the alternate destinations uplink, and execute or ERASE.

ALERTING MESSAGE	CAUSE	CORRECTIVE ACTION
PARTIAL FORECASTS UPLINK	An FMC descent forecasts uplink message has been loaded on the DESCENT FORECASTS page, but errors were encountered during the loading process.	Review the descent forecasts uplink, and execute or ERASE.
PARTIAL LIMITS UPLINK	An FMC performance limits uplink message has been loaded on the PERF LIMITS page, but errors were encountered during the loading process.	Review the performance limits uplink, and execute or ERASE.
PARTIAL NAV DATA UPLINK	An FMC supplemental navigation data uplink message has been loaded on the SUPP NAV DATA page, but errors were encountered during the loading process.	Review the supplemental navigation data uplink, and execute or ERASE.
PARTIAL PERF INIT UPLINK	An FMC performance initialization uplink message has been loaded on the PERF INIT page, but errors were encountered during the loading process.	Review the performance initialization uplink, and execute or ERASE.

[Option – U10.8A and earlier]

PARTIAL ROUTE UPLINK (U10.8A and earlier)	An FMC route uplink message has been loaded on the RTE page, but errors were encountered during the loading process.	Review the route uplink, and execute or ERASE.

ALERTING MESSAGE	CAUSE	CORRECTIVE ACTION

[Option – U11.0 and later]

PARTIAL ROUTE X UPLINK (U11.0 and later)	Receipt of an ACARS non-ATC uplink message that contains route data. The route data has been partially loaded into the active/inactive RTE 1 or 2 flight plan buffer due to errors.	Review the route uplink, and execute or ERASE.

PERF INIT UPLINK	An FMC performance initialization uplink message has been loaded on the PERF INIT page, and is ready for flight crew review.	Review the performance initialization uplink, and execute or ERASE.
PERF INIT UPLINK READY	An FMC performance initialization uplink message has been received and is available for loading on the PERF INIT page.	Select PERF INIT page, LOAD performance initialization data, and execute or ERASE.
PERF LIMITS UPLINK	An FMC performance limits uplink message has been loaded on the PERF LIMITS page, and is ready for flight crew review.	Review the performance limits uplink, and execute or ERASE.
PERF LIMITS UPLINK READY	An FMC performance limits uplink message has been received and is available for loading on the PERF LIMITS page.	Select PERF LIMITS page, LOAD performance limits, and execute or ERASE.

ALERTING MESSAGE	CAUSE	CORRECTIVE ACTION
RESEND MESSAGE	An FMC downlink message was attempted, but the FMC was unable to deliver the message to the ACARS MU.	Re–send the downlink message.

[Option – U10.8A and earlier]

ROUTE DATA UPLINK (U10.8A and earlier)	An FMC route uplink message has been loaded on the RTE page, and is ready for flight crew review.	Review the route uplink, and execute or ERASE.

[Option – U11.0 and later]

ROUTE X DATA UPLINK (U11.0 and later)	An FMC route uplink message has been loaded into the active/inactive RTE 1 or 2 flight plan buffer, and is ready for flight crew review.	Review the route uplink, and execute or ERASE.

[Option – U10.8A and earlier]

ROUTE UPLINK LOADING (U10.8A and earlier)	An FMC route uplink message is loading (after LOAD selected on the RTE page).	Wait for load to complete.

[Option – U11.0 and later]

ROUTE X UPLINK LOADING (U11.0 and later)	Receipt of an ACARS non-ATC uplink message that contains route data. The route data is currently being loaded into the active or inactive RTE 1 or 2 flight plan.	Wait for load to complete.

ALERTING MESSAGE	CAUSE	CORRECTIVE ACTION

[Option – U10.8A and earlier]

ROUTE UPLINK READY (U10.8A and earlier)	An FMC route uplink message has been received and is available for loading on the RTE page.	Select RTE page, LOAD route, and execute or ERASE.

[Option – U11.0 and later]

ROUTE X UPLINK READY (U11.0 and later)	Receipt of an ACARS non-ATC uplink that contains route data, and the route data LOAD prompts are displayed on the active/inactive RTE 1 or 2 and active/inactive LEGS 1 or 2 pages.	Select the active/inactive RTE 1 or 2 page or active/inactive LEGS 1 or 2 page, LOAD route, and execute or ERASE.

RTA DATA UPLINK	An FMC RTA uplink message has been loaded on the RTA PROGRESS page, and is ready for flight crew review.	Review the RTA uplink, and execute or ERASE.
RTA UPLINK READY	An FMC RTA uplink message is has been received and is available for loading on the RTA PROGRESS page.	Select RTA PROGRESS page, LOAD RTA data, and execute or ERASE.
TAKEOFF DATA LOADED	Uplink takeoff data matching Runway (RTE page) or runway/intersection (TAKEOFF REF page) has been loaded on the TAKEOFF REF page, and is ready for flight crew review.	Select TAKEOFF REF page, accept or reject takeoff data.

ALERTING MESSAGE	CAUSE	CORRECTIVE ACTION
TAKEOFF DATA UPLINK	An FMC takeoff data uplink message containing one or more sets of runway takeoff data has been received and loaded in FMC memory.	Enter appropriate runway (RTE page) or runway/intersection (TAKEOFF REF page) to access runway takeoff data.

FMC Data Link Advisory Messages

ADVISORY MESSAGE	CAUSE	CORRECTIVE ACTION
INVALID ALTN DEST UPLINK	An FMC alternate destinations uplink message was received, but was rejected due to errors.	Clear the message.
INVALID CRZ WIND UPLINK	An FMC cruise wind uplink message was received, but was rejected due to errors.	Clear the message.
INVALID FORECASTS UPLINK	An FMC descent forecasts uplink message was received, but was rejected due to errors.	Clear the message.
INVALID LIMITS UPLINK	An FMC performance limits uplink message was received, but was rejected due to errors.	Clear the message.
INVALID NAV DATA UPLINK	An FMC supplemental navigation data uplink message was received, but was rejected due to errors.	Clear the message.
INVALID PERF INIT UPLINK	An FMC performance initialization uplink message was received, but was rejected due to errors.	Clear the message.

ADVISORY MESSAGE	CAUSE	CORRECTIVE ACTION
INVALID ROUTE or ROUTE X UPLINK	An FMC route uplink message was received, but was rejected due to errors.	Clear the message.
INVALID RTA UPLINK	An FMC RTA uplink message was received, but was rejected due to errors.	Clear the message.
INVALID TAKEOFF UPLINK	An FMC takeoff data uplink message was received, but was rejected due to errors.	Clear the message.

ATC Data Link Messages

[Option – With ATC data link]
These messages relate to ATC data link message status. ATC data link alerting and advisory messages function the same as the alerting and advisory messages described above:

ATC Data Link Alerting Messages

ALERTING MESSAGE	CAUSE	CORRECTIVE ACTION
ATC COMM ESTABLISHED	Active ATC connection established.	Clear message.
ATC COMM TERMINATED	ATC connection terminated without transfer to another service station.	Clear message.
ATC MESSAGE	Receipt of valid ATC datalink message.	Clear message and display the received ATC uplink.
ATC REPORT LIST FULL	ATC REPORT buffer is full.	Clear message and send or delete reports listed on the ATC REPORT page.

ALERTING MESSAGE	CAUSE	CORRECTIVE ACTION

[Option – U10.8A and earlier]

ATC ROUTE DATA UPLINK (U10.8A and earlier)	Receipt of am ATC ACARS uplink message containing route data. The route data has been loaded into the flight plan buffer.	Review the route uplink, and execute or ERASE.

[Option – U11.0 and later]

ATC ROUTE X DATA UPLINK (U11.0 and later)	Receipt of am ATC ACARS uplink message containing route data. The route data has been loaded into the active RTE 1 or 2 flight plan buffer.	Review the route uplink, and execute or ERASE.

[Option – U10.8A and earlier]

ATC ROUTE UPLINK LOADING (U10.8A and earlier)	ATC uplink route loading into flight plan buffer.	Clear message.

[Option – U11.0 and later]

ATC ROUTE X UPLINK LOADING (U11.0 and later)	Receipt of an ATC ACARS uplink message containing route data. The route data is currently being loaded into the active RTE 1 or 2 FMC flight plan buffer.	Clear message.

[Option – U10.8A and earlier]

ATC ROUTE UPLINK READY (U10.8A and earlier)	An ATC ACARS route uplink message has been received and is available for loading on the RTE page.	Select RTE page, LOAD route, and execute or ERASE.

ALERTING MESSAGE	CAUSE	CORRECTIVE ACTION

[Option – U11.0 and later]

ALERTING MESSAGE	CAUSE	CORRECTIVE ACTION
ATC ROUTE X UPLINK READY (U11.0 and later)	Receipt of an ATC ACARS uplink that contains route data, and the route data LOAD prompts are displayed on the active/inactive RTE 1 or 2 and active/inactive LEGS 1 or 2 pages.	Select the active/inactive RTE 1 or 2 page or active/inactive LEGS 1 or 2 page, LOAD route, and execute or ERASE.

[Option – U10.8A and earlier]

ALERTING MESSAGE	CAUSE	CORRECTIVE ACTION
ATC RTA DATA UPLINK (U10.8A and earlier)	An ATC ACARS uplink message has been loaded on the RTA PROGRESS page, and is ready for flight crew review.	Review the RTA uplink, and execute or ERASE.

[Option – U11.0 and later]

ALERTING MESSAGE	CAUSE	CORRECTIVE ACTION
ATC RTA DATA UPLINK (U11.0 and later)	Receipt of an ATC ACARS uplink message containing RTA data. The RTA data is currently being loaded into the active RTE 1 or 2 flight plan.	Review the RTA uplink, and execute or ERASE.

[Option – U14.0 and above]

ALERTING MESSAGE	CAUSE	CORRECTIVE ACTION
CLEARANCE CONDITION MET (U14.0 and later)	The clearance being monitored is met..	Perform clearance instruction

[Option – U14.0 and above]

ALERTING MESSAGE	CAUSE	CORRECTIVE ACTION
CLEARANCE COND NOT MET (U14.0 and later)	The clearance being monitored is executed prior satisfying clearance.	Review clearance being monitored, select "MONITOR" on ATC INDEX page. Comply with ATC clearance

ALERTING MESSAGE	CAUSE	CORRECTIVE ACTION

[Option – U14.0 and above]

CLR COND NOT IN RTE (U14.0 and later)	When the waypoint in the clearance being monitored is deleted from the active route or a clearance is accepted and the waypoint is not in the active route..	Review clearance being monitored, select "MONITOR" on ATC INDEX page. Comply with ATC clearance

[Option – U14.0 and above]

ATN DATA BASE INVALID (U14.0 and later)	ATN Data Base is not available/loaded and FANS-2 option is enabled	Load ATN Data Base

[Option – U14.0 and above]

ATC TIMEOUT-RESEND (U14.0 and later)	CPDLC downlink has been sent and the required response has not been received	Resend message

[Option – U12.0 and later]

DATALINK LOST (U12.0 and later)	If a FANS ATC connection is established, the alert is issued after the system is in NO COMM for 90 seconds consecutively.	Notify ATC of the loss of FANS datalink connectivity.

INVALID ATC (ROUTE or ROUTE X) UPLINK	ATC uplink received by FMC contains errors.	Clear message.
INVALID ATC UPLINK	ATC uplink received by FMC contains errors.	Clear message.
MESSAGE LIMIT EXCEEDED	Crew attempts to select more than five message elements for inclusion in downlink message.	Clear message.

ALERTING MESSAGE	CAUSE	CORRECTIVE ACTION

[Option – U10.8A and earlier]

PARTIAL ATC ROUTE UPLINK (U10.8A and earlier)	An ATC ACARS route uplink message has been loaded on the RTE page, but errors were encountered during the loading process.	Review the route uplink, and execute or ERASE.

[Option – U11.0 and later]

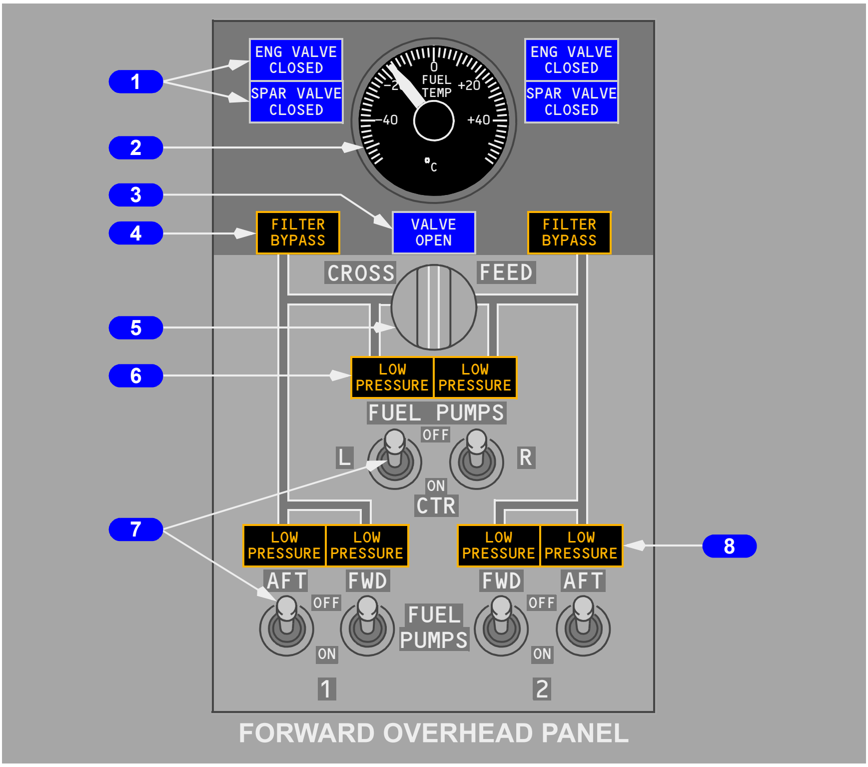
PARTIAL ATC ROUTE X UPLINK (U11.0 and later)	Receipt of an ATC ACARS uplink message containing route data which passed syntax error checks, but contained errors in the data, and part of the active RTE 1 or 2 flight plan data has been loaded.	Review the route uplink, and execute or ERASE.

PARTIAL CLEARANCE LOADED	FMC able to load only a portion of data.	Clear message and reject uplinked clearance.
RE–LOGON TO ATC COMM	No response to logon message after 10 minutes.	Clear message and re-send logon message.
RESPOND TO ATC UPLINKS	ATC uplink pending storage full.	Clear message and respond to open uplinks.
UNABLE TO LOAD CLEARANCE	FMC unable to load any data from uplink.	Clear message and reject uplinked clearance.
UNABLE TO SEND MSG	Manual initiation of downlink failed.	Clear message.

Fuel
Table of Contents

Intentionally
Blank

Fuel Control Panel



1 Engine Valve Closed (ENG VALVE CLOSED) and SPAR VALVE CLOSED Lights

Extinguished – related engine or spar fuel shutoff valve is open.

Illuminated (blue) –

- bright – related engine or spar fuel shutoff valve is in transit, or valve position and engine start lever or engine fire switch disagree.
- dim – related engine or spar fuel shutoff valve is closed.

2 FUEL Temperature (TEMP) Indicator

Indicates fuel temperature in No. 1 tank.

3 Crossfeed VALVE OPEN Light

Extinguished – crossfeed valve is closed.

Illuminated (blue) –

- bright – crossfeed valve is in transit, or valve position and CROSSFEED selector disagree.
- dim – crossfeed valve is open.

4 FILTER BYPASS Lights

Extinguished – fuel filter operating normally.

Illuminated (amber) – impending fuel filter bypass due to a contaminated filter.

5 CROSSFEED Selector

Controls fuel crossfeed valve.

Closed – isolates engine No. 1 and No. 2 fuel feed lines.

Open – connects engine No. 1 and No. 2 fuel feed lines.

[Option - without Center Tank Fuel Pump Auto-shutoff]

6 Center Tank FUEL PUMP LOW PRESSURE Lights

Illuminated (amber) – fuel pump output pressure is low and FUEL PUMP switch is ON.

Note: With both Center (CTR) tank FUEL PUMP switches ON, illumination of both LOW PRESSURE lights illuminate MASTER CAUTION and FUEL system annunciator lights. Illumination of one LOW PRESSURE light illuminates MASTER CAUTION and FUEL system annunciator lights on MASTER CAUTION light recall.

Note: With one CTR tank FUEL PUMP switch OFF, illumination of opposite CTR tank LOW PRESSURE light illuminates the MASTER CAUTION and FUEL system annunciator lights.

Extinguished – fuel pump output pressure is normal, or FUEL PUMP switch is OFF.

[Option - with Center Tank Fuel Pump Auto-shutoff]

6 Center Tank FUEL PUMP LOW PRESSURE Lights

Illuminated (amber) – fuel pump output pressure is low and FUEL PUMP switch is ON.

Note: With the Center (CTR) tank FUEL PUMP switches ON, continuous illumination of one LOW PRESSURE light for 10 seconds illuminates MASTER CAUTION and FUEL system annunciator lights.

Extinguished – fuel pump output pressure is normal, or FUEL PUMP switch is OFF.

7 FUEL PUMP Switches

ON – activates fuel pump.

OFF – deactivates fuel pump.

[Option - with Center Tank Fuel Pump Auto-shutoff]

Note: When a center tank fuel pump switch is set to OFF, the auto shutoff logic for that pump is reset. When the center tank fuel pump switch is set to ON after being OFF, the pump will again activate until the switch is set to OFF or auto shutoff logic deactivates it.

8 Main Tank FUEL PUMP LOW PRESSURE Lights

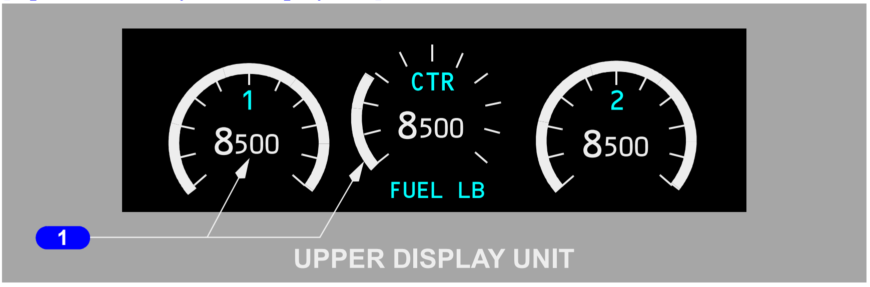
Illuminated (amber) – fuel pump output pressure is low, or FUEL PUMP switch is OFF.

Note: Two LOW PRESSURE lights illuminated in same tank illuminate MASTER CAUTION and FUEL system annunciator lights. One LOW PRESSURE light causes MASTER CAUTION and FUEL system annunciator lights to illuminate on MASTER CAUTION light recall.

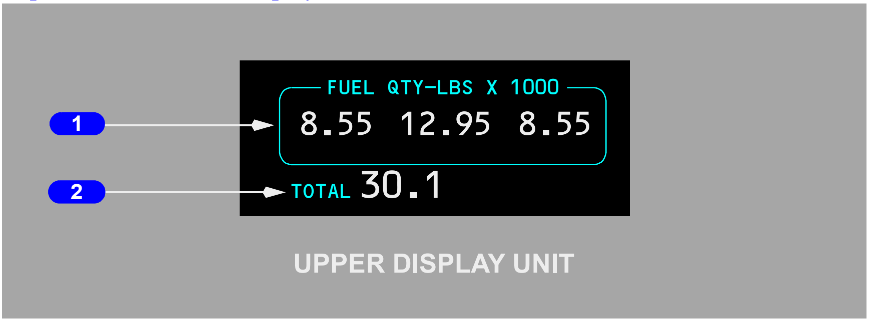
Extinguished – fuel pump output pressure is normal.

Fuel Quantity Indications

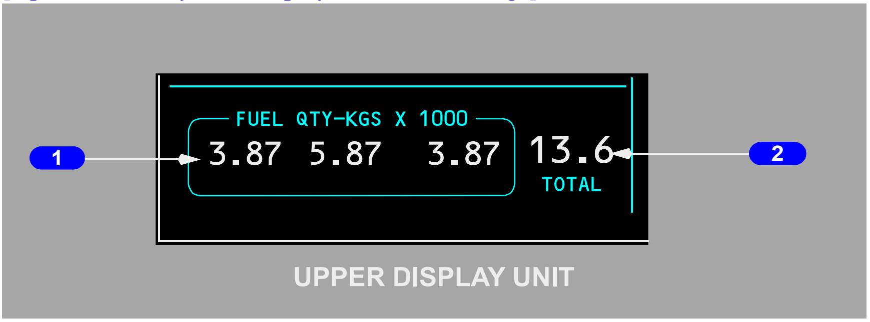
[Option - Side By Side display, lbs]



[Option - Over/Under display, TOTAL fuel, lbs]



[Option - Side By Side display, TOTAL fuel, kgs]



1 FUEL Quantity Indicators

Displayed (white) – indicates usable fuel in related tank:

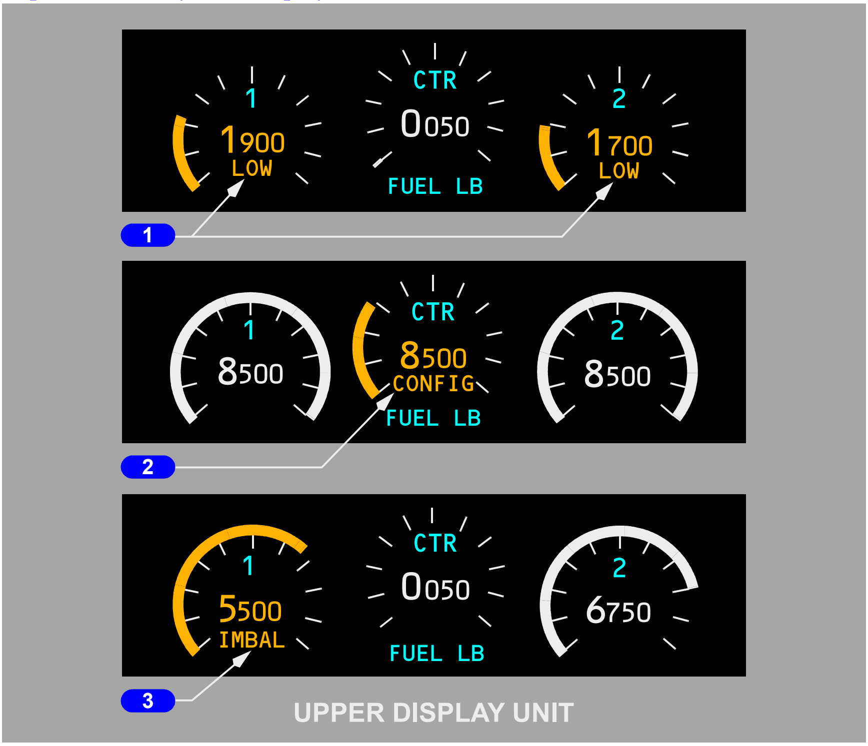
- available with AC or DC power.

2 Total Fuel Quantity Indicator

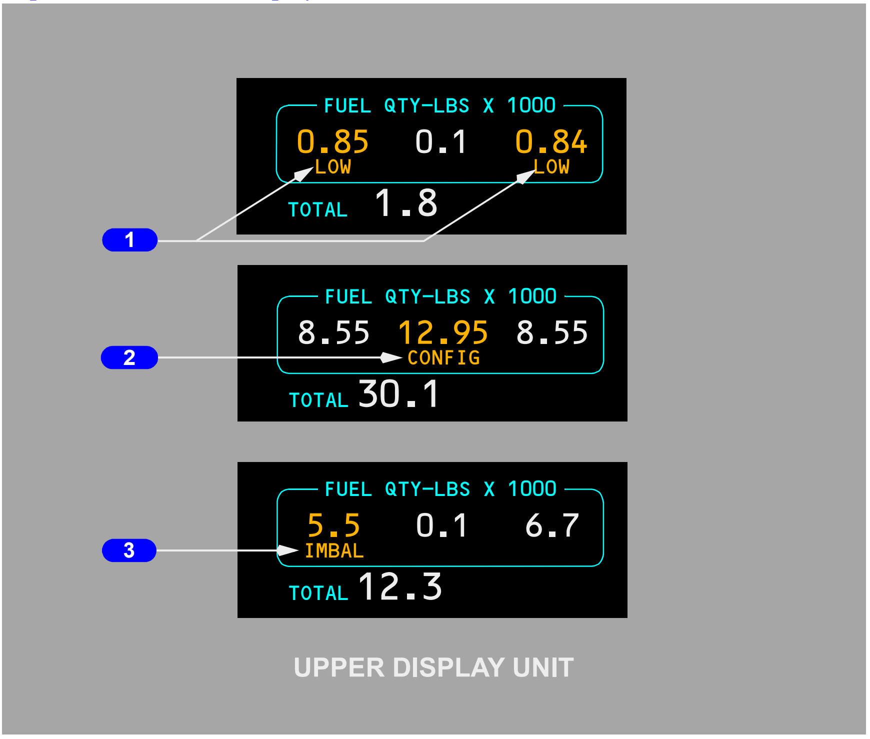
Displayed (white) - indicates total useable fuel.

Fuel Alert Indications

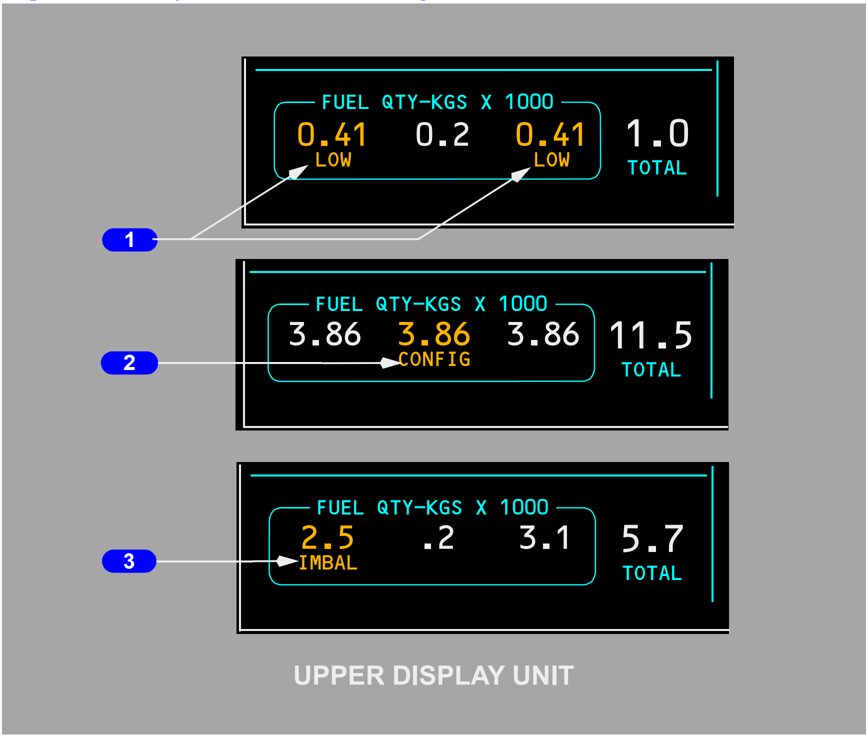
[Option - Side By Side display, lbs]



[Option - Over/Under display, TOTAL fuel, lbs]



[Option - Side by Side, TOTAL fuel, kgs]



1 Fuel LOW Alert

Displayed (amber) –

- fuel quantity less than 2000 lbs in related main tank
- display remains until fuel tank quantity is increased to 2500 lbs

[Option - LOW Alert below 1000 lbs/453 kgs]

- fuel quantity less than 1000 lbs/453 kg in related main tank
- display remains until fuel tank quantity is increased to 1250 lbs/567 kgs

The fuel quantity digits on tank(s) with low fuel quantity turn amber.

2 Fuel Configuration (CONFIG) Alert

Displayed (amber) –

- either engine running
- center fuel tank quantity greater than 1600 lbs/726 kgs; and

[Option - CONFIG Alert Prior to L/N 1494]

- both center fuel tank pumps producing low or no pressure

[Option - CONFIG Alert, L/N 1494 and On]

- both center fuel tank pump switches positioned OFF

The quantity digits on the center tank fuel quantity indicator turn amber.

Display remains until –

- both engines not running
- center fuel tank quantity less than 800 lbs/363 kgs

[Option - CONFIG Alert Prior To L/N 1494]

- one center fuel tank pump producing high pressure

[Option - CONFIG Alert, L/N 1494 and On]

- one center fuel tank pump switch ON

The quantity digits on the center tank fuel quantity indicator return to normal.

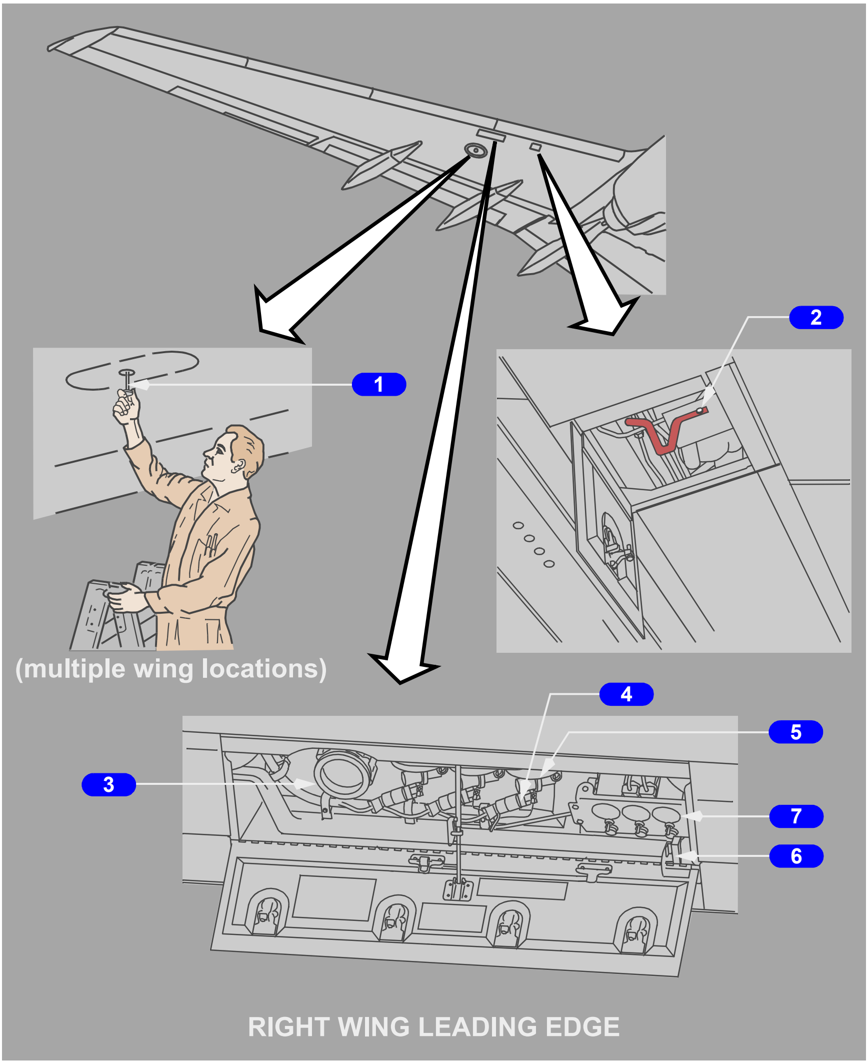
3 Fuel Imbalance (IMBAL) Alert

Displayed (amber) –

- main tanks differ by more than 1000 lbs/453 kgs
- displayed below main tank with lower fuel quantity
- inhibited by fuel LOW indication when both indications exist
- displayed until imbalance is reduced to 200 lbs/91 kgs

The fuel quantity digits on tank with lower fuel quantity turn amber.

Fueling / Defueling / Measurement



1 Fuel Measuring Stick

Allows comparison of fuel quantity or weight as determined from measuring stick reading and fuel weight indicated by fuel quantity indicators:

- six fuel measuring sticks are installed in each main tank and four are installed in center tank
- reading is obtained by withdrawing measuring stick from tank and latching it magnetically to an internal float. Fuel depth is read where stick passes through wing skin.

2 Manual Defueling Valve

Open – interconnects engine feed system and fueling station for:

- defueling
- ground transfer of fuel.

Closed – isolates engine feed system from fueling station.

3 Fueling Receptacle

Hose connection receptacle for single point fueling.

4 Solenoid Override

Mechanically opens solenoid operated valve. Fuel valve opens if fuel pressure is available.

5 Fueling Valves

With the battery switch ON, and the refueling door open, fuel pressure opens valve.

6 Refueling Power Control Relay

Door closed – proximity sensor deactivates power to fueling system.

Door open – the fueling system is powered and panel lights illuminate.

7 Test Gages & Fueling Panel

Test Gages and Fueling Panel

[Option - lbs]

[Option - Fuel Quantity Selector, kg]

8 **FUELING INDICATION TEST SWITCH**

(spring–loaded to OFF position)

TEST GAGES – checks operation of fuel quantity indicators.

FUEL DOOR SWITCH BYPASS – energizes fueling panel if refueling power control relay fails.

9 **Fueling VALVE POSITION LIGHTS**

Extinguished –

- fueling valve switch is OPEN and related tank is full
- fueling valve switch is CLOSED.

Illuminated (blue) – fueling valve switch is OPEN and related tank is not full.

10 **Fueling Valve Switches**

OPEN – energizes fueling valve in related tank.

CLOSED – de–energizes fueling valve in related tank.

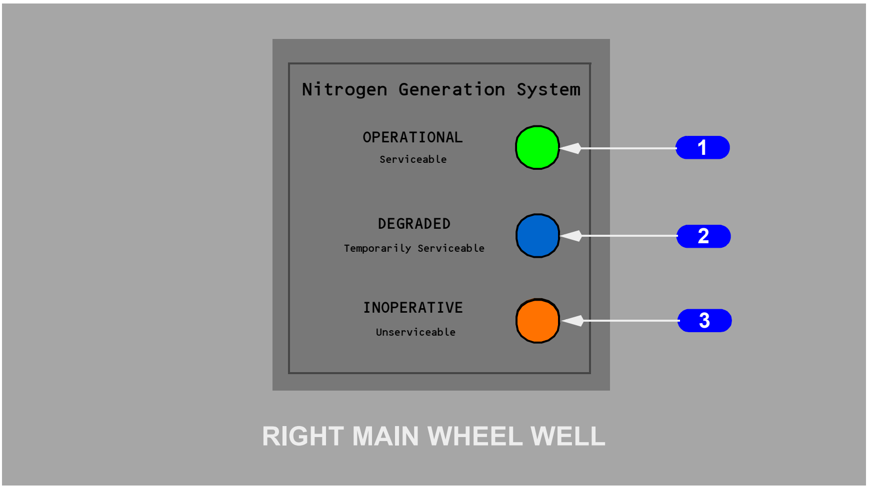
11 **FUEL Quantity (QTY) Indicators**

Indicates total usable fuel tank quantity in related tank.

[Option]
12 **Fuel Quantity Selectors**

Rotate – sets total fuel quantity desired in related tank.

Nitrogen Generation System (NGS)



1 OPERATIONAL Light (green)

NGS is fully operational.

2 DEGRADED Light (blue)

NGS is operational, but is operating in a degraded condition.

3 INOPERATIVE Light (amber)

NGS is inoperative.

Note: No lights illuminated also indicates NGS is inoperative.

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Introduction

The fuel system supplies fuel to the engines and the APU. Fuel is contained in three tanks located within the wings and wing center section.

Refer to Chapter 7, Engines, APU, for a description of the engine and APU fuel systems.

Fuel Feed

Both engines are normally pressure fed from the center tank until the center tank quantity decreases to near zero. The engines are normally then pressure fed from their respective main tanks. Check valves are located throughout the fuel system to ensure the proper direction of fuel flow and to prevent transfer of fuel between tanks.

Nitrogen Generation System (NGS)

The NGS converts bleed air to nitrogen-enriched air (NEA) during all phases of flight. The NEA is delivered to the center fuel tank to reduce flammability of the tank. The operation of the NGS is transparent to the flight crew; it does not require any flight crew action to operate the system, nor are there any flight deck indications. The NGS automatically starts operating after take-off and runs continuously through climb, cruise, descent, landing and during taxi for a short period of time. The NGS shuts down after a specified period of time or when bleed pressure is no longer available. The NGS also automatically shuts down during the following non-normal flight conditions:

- Aircraft on the ground and not in test mode
- Either engine is not running in flight
- Fire or smoke detection in the cargo or main deck areas
- Left air conditioning pack overheat
- Center tank refueling valve is open

The fuel tanks are primarily protected by precluding ignition sources; hence dispatch with the NGS inoperative is acceptable under MEL procedures.

The NGS has an operability indicator located in the main wheel well adjacent to the APU fire control panel.

Fuel Pumps

Each fuel tank uses two AC powered fuel pumps which are cooled and lubricated by fuel passing through the pump. Center tank pumps produce higher pressure than main tank pumps. This ensures that center tank fuel is used before main tank fuel, even though all fuel pumps are operating. Individual pressure sensors monitor the output pressure of each pump.

[Option - with Center Tank Fuel Pump Auto-shutoff]
Each center tank pump will automatically shut off, after a short delay, when that pump's sensor detects low output pressure.

Note: Fuel pump LOW PRESSURE lights may flicker when tank quantity is low and the airplane is in a climb, descent, or on the ground with a nose-down attitude.

Note: Center tank fuel pump LOW PRESSURE lights may flicker when tank quantity is low and the airplane is in cruise. One pump may indicate low pressure sooner than the other due to aircraft attitude and/or slight variation between pump inlet position. Low pressure indication may occur after center tank quantity reads zero. Low pressure light flickering can continue for as long as 5 minutes before the Fuel System Annunciator light and the Master Caution lights are illuminated for the associated center tank pump.

Suction Feed

When main tank fuel pump pressure is low, each engine can draw fuel from its corresponding main tank through a suction feed line that bypasses the pumps. As the airplane climbs, dissolved air is released from the fuel in the tank due to the decrease in air pressure. This air may collect in the suction feed line and restrict fuel flow. At high altitude, thrust deterioration or engine flameout may occur as a result of the fuel flow reduction.

The dissolved air in the fuel tank will eventually deplete after reaching cruise altitude. The depletion time is dependent upon airplane altitude, fuel temperature, and type of fuel. Once the dissolved air is depleted, the engine may be capable of suction feed operation at cruise power.

The main tank bypass valves may also be used for suction defueling.

Fuel Crossfeed

The engine fuel manifolds are interconnected by use of the crossfeed valve. The valve is DC motor operated from the battery bus.

Fuel pressure can be provided from a main tank with operating fuel pumps to both engines by opening the fuel crossfeed valve. Continued crossfeed use will result in a progressive fuel imbalance.

Fuel Shutoff Valves

Spar fuel shutoff valves are located at the engine–mounting wing stations. The valves are DC motor operated from the hot battery bus. The engine fuel shutoff valves are fuel actuated, solenoid controlled valves powered from the battery bus. Both the spar fuel shutoff valve and the engine fuel shutoff valve close whenever their respective engine fire switch is pulled or engine start lever is placed to CUTOFF.

Center Tank Fuel Scavenge Jet Pump

With the main tank fuel pump No. 1 FWD Switch ON, the center tank fuel scavenge jet pump operates automatically to transfer any remaining center tank fuel to main tank No. 1. Fuel transfer begins when main tank No. 1 quantity is about one-half. Once the fuel scavenge process begins, it continues for the remainder of the flight.

Fuel Temperature

The FUEL TEMP indicator located on the fuel control panel displays fuel temperature. A sensor in main tank No. 1 allows monitoring of fuel temperature. The temperature indicating system uses AC electrical power.

APU Fuel Feed

When AC fuel pumps are operating, fuel for the APU is supplied from the left side of the fuel manifold. If the AC fuel pumps are not operating, fuel is suction fed from main tank No. 1.

[Option - APU DC Fuel Pump]
A DC operated APU fuel boost pump is installed to ensure positive fuel pressure to the APU fuel control unit. During APU start and operation, the pump operates automatically when the APU fuel control unit senses low fuel pressure. The pump shuts off automatically when an AC fuel pump pressurizes the fuel manifold.

Fuel Quantity Indication

The fuel quantity indication system calculates the usable fuel quantity in each tank. The fuel quantity in each tank is displayed on the center upper display unit in the flight deck. During refuel operations, each tank has its own refuel panel indicator fuel quantity display. In flight, each tank fuel quantity could show higher or lower than the actual fuel quantity by up to 2.5% due to system accuracy constraints.

[Option - Total Fuel Indication]
The total fuel quantity is displayed under the fuel quantities in each tank on the center upper display unit in the flight deck.

[Option - Fuel Densitometer]
The system provides a correction for variance in fuel density.

Fueling/Defueling/Ground Transfer

Rapid fueling and defueling is accomplished at the single–point pressure fueling station in the right wing. The fueling station is also used for the ground transfer of fuel between tanks.

The manual defueling valve, located outboard of engine No. 2, interconnects the engine feed system and the fueling station. It is opened for defueling and tank to tank transfer operations.

A shutoff system is used during fueling to automatically close the fueling valve in each fuel tank when the tank is full.

Fuel Tank Location and Capacities (Usable Fuel)

Main tanks No. 1 and No. 2 are integral with the wing structure. The center tank lies between the wing roots within the fuselage area and extends out into the wing structure.

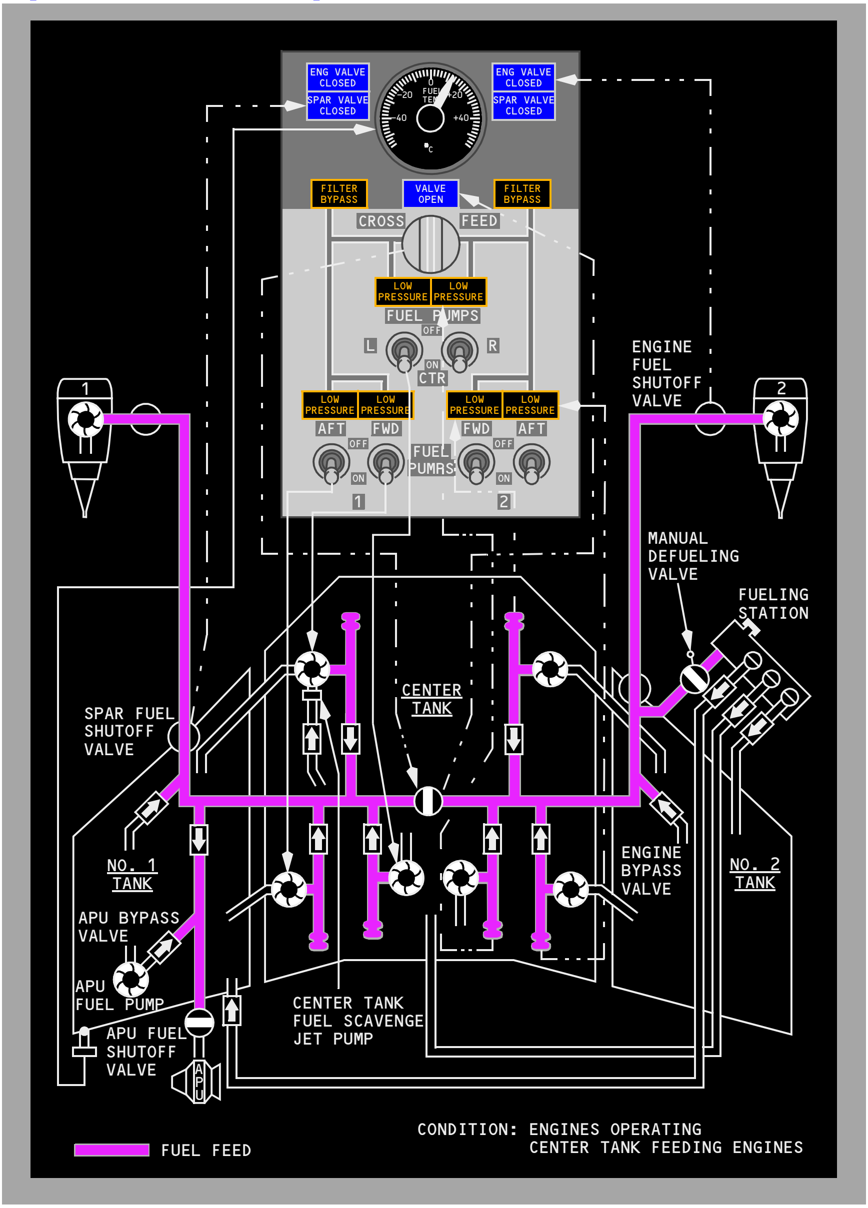
These figures represent approximate amounts of usable fuel. The appropriate weight and balance control and loading manual gives exact figures for all conditions.

TANK	GALLONS	POUNDS*	LITERS	KILOGRAMS*
NO. 1	1,288	8,630	4,876	3,915
NO. 2	1,288	8,630	4,876	3,915
CENTER	4,299	28,803	16,273	13,066
TOTAL	6,875	46,063	26,025	20,896

*Usable fuel at level attitude, fuel density = 6.7 pounds per U.S. Gallon/0.8029 kilograms per liter.

Fuel Schematic

[Option - APU DC Fuel Pump]



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Hydraulics — Chapter 13
Table of Contents — Section TOC

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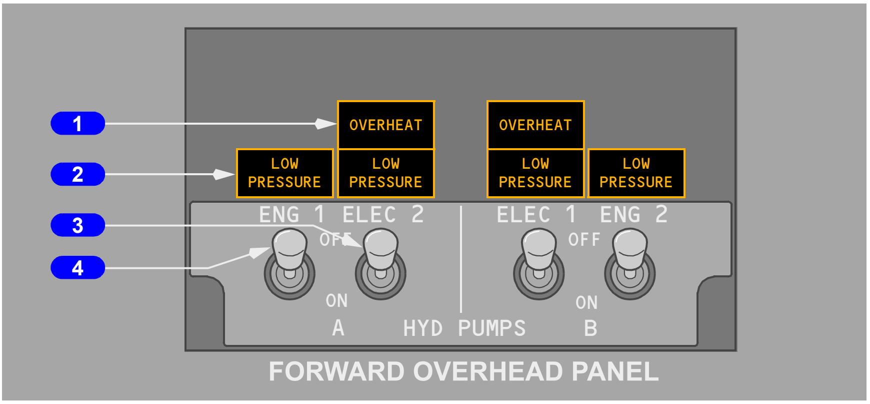
Hydraulic Panel



1 Electric Hydraulic Pump OVERHEAT Lights

Illuminated (amber) – Hydraulic fluid used to cool and lubricate the corresponding electric motor driven pump has overheated or the pump itself has overheated.

2 Hydraulic Pump LOW PRESSURE Lights

Illuminated (amber) – output pressure of associated pump is low.

Note: When an engine fire switch is pulled, the low pressure light is deactivated.

3 ELECTRIC HYDRAULIC PUMPS Switches

ON – provides power to associated electric motor–driven pump.

OFF – electrical power removed from pump.

4 ENGINE HYDRAULIC PUMPS Switches

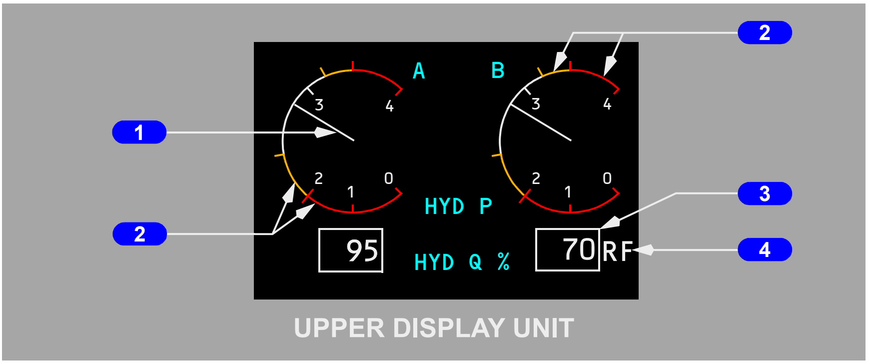
ON – de–energizes blocking valve in pump to allow pump pressure to enter system.

Note: Should remain ON at shutdown to prolong solenoid life.

OFF – energizes blocking valve to block pump output.

Hydraulic Indications

[Option - Side by Side display]



1 HYDRAULIC System PRESSURE Indications

Indicates system pressure:

- displayed (white) - normal operating range
- displayed (amber) - caution range
- displayed (red) - operating limit reached.

Note: When both pumps for a system are OFF, respective pointer reads zero.

2 Hydraulic Pressure Amber Bands/Redlines

Displayed (amber) - low/high hydraulic pressure caution range.

Displayed (red) - low/high hydraulic pressure operating limit.

3 HYDRAULIC System QUANTITY Indications

Indicates digital percentage (0% to 106%) of hydraulic quantity.

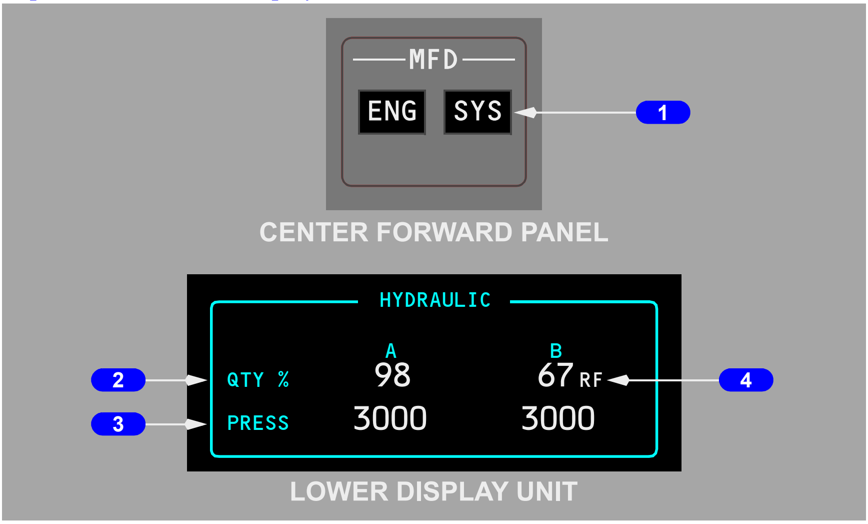
Note: Quantity also displayed at each reservoir.

4 REFILL Indication (RF) (white)

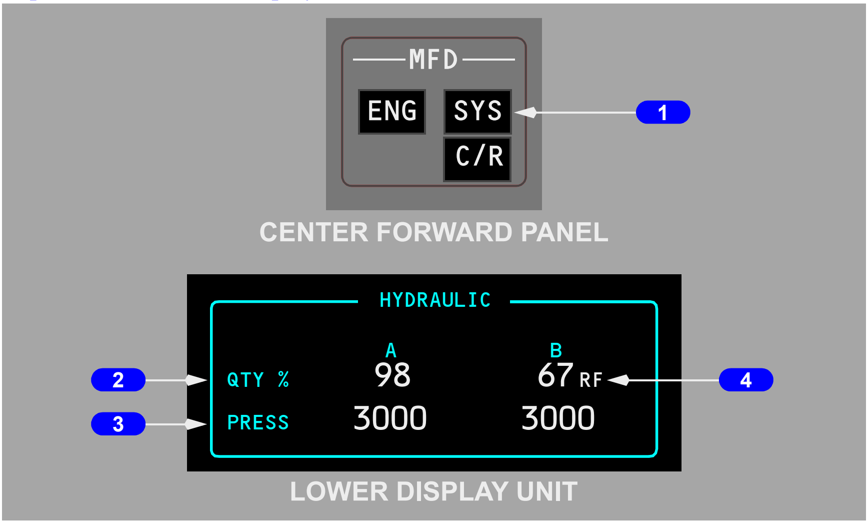
Illuminated (white) – hydraulic quantity below 76%.

Note: Valid only when airplane is on ground with both engines shutdown or after landing with flaps up during taxi–in.

[Option - Over/Under display]



[Option - Over/Under display]



1 MFD System (SYS) Switch

Push – SYS

- displays hydraulic indications on lower DU; or the inboard DU if the MAIN PANEL DUs switch is placed to the INBD MFD position.
- second push removes indications from the respective DU.

2 HYDRAULIC System QUANTITY Indications (white)

Indicates digital percentage (0% to 106%) of hydraulic quantity.

Note: Quantity also displayed at each reservoir.

3 HYDRAULIC System PRESSURE Indications (white)

Indicates system pressure:

- Normal pressure – 3000 psi
- Maximum pressure – 3500 psi.

Note: When both pumps for a system are OFF, the indication may read hydraulic system reservoir pressure, normally less than 100 psi.

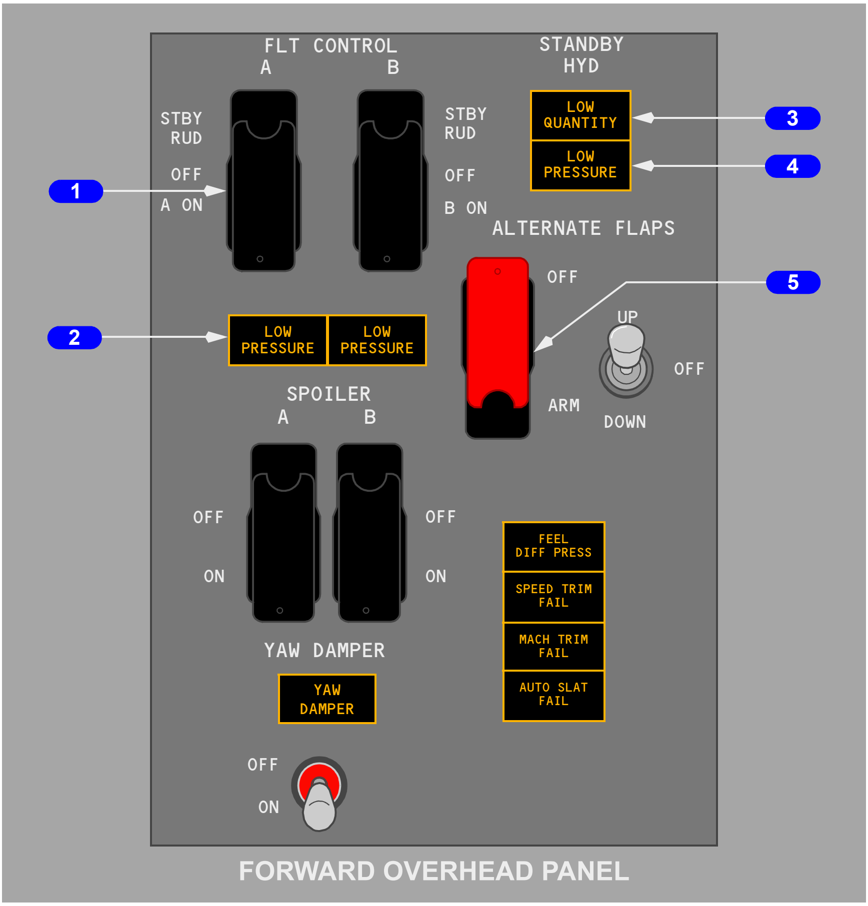
4 REFILL Indication (RF) (white)

Illuminated (white) – hydraulic quantity below 76%.

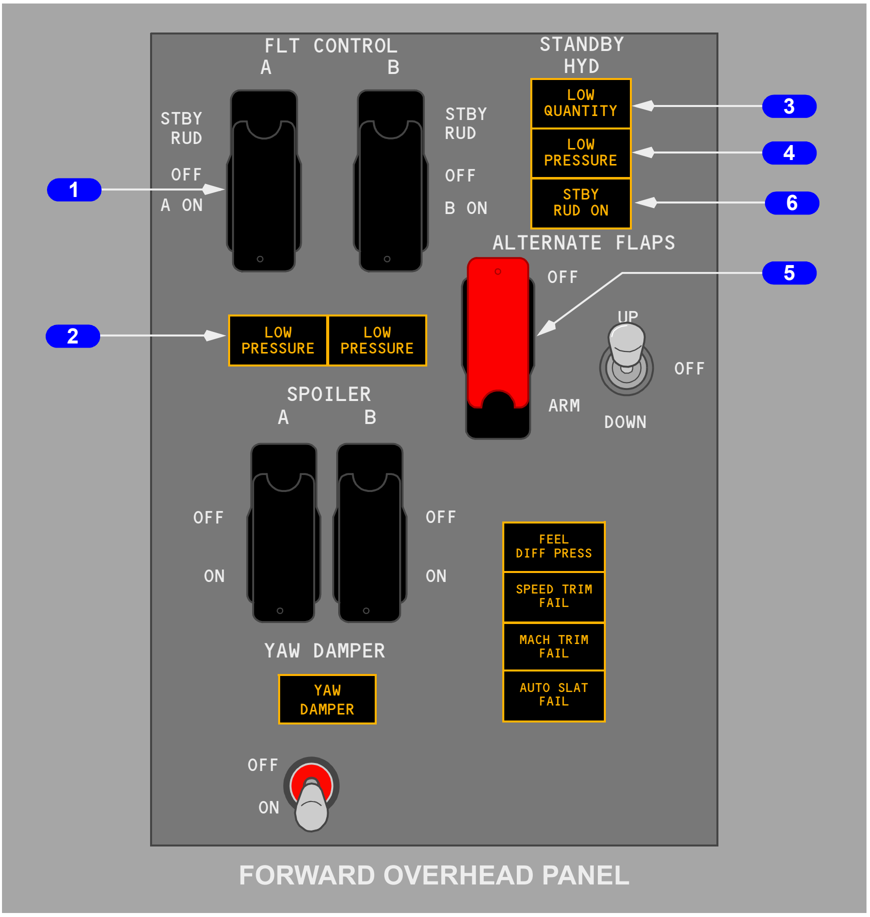
Note: Valid only when airplane is on ground with both engines shutdown or after landing with flaps up during taxi–in.

Flight Control Panel

[737 modified rudder - not installed]



[737 modified rudder - installed]



1 FLIGHT CONTROL Switches

STBY RUD – activates standby pump and opens standby rudder shutoff valve to pressurize standby rudder power control unit.

OFF – closes flight control shutoff valve isolating ailerons, elevators and rudder from associated hydraulic system pressure.

ON (guarded position) – normal operating position.

2 Flight Control LOW PRESSURE Lights

Illuminated (amber) –

- indicates low hydraulic system (A or B) pressure to ailerons, elevator and rudder
- deactivated when associated FLIGHT CONTROL switch is positioned to STBY RUD and standby rudder shutoff valve opens.

3 STANDBY HYDRAULIC LOW QUANTITY Light

Illuminated (amber) –

- indicates low quantity in standby hydraulic reservoir
- always armed.

4 STANDBY HYDRAULIC LOW PRESSURE Light

Illuminated (amber) –

- indicates output pressure of standby pump is low
- armed only when standby pump operation has been selected or automatic standby function is activated.

5 ALTERNATE FLAPS Master Switch

OFF (guarded position) – normal operating position.

ARM – closes trailing edge flap bypass valve, activates standby pump, and arms ALTERNATE FLAPS position switch.

[737 modified rudder - installed]

6 STBY RUD ON Light

Illuminated (amber) - indicates the standby hydraulic system is commanded on to pressurize the standby rudder power control unit.

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Hydraulics — Chapter 13
System Description — Section 20

Introduction

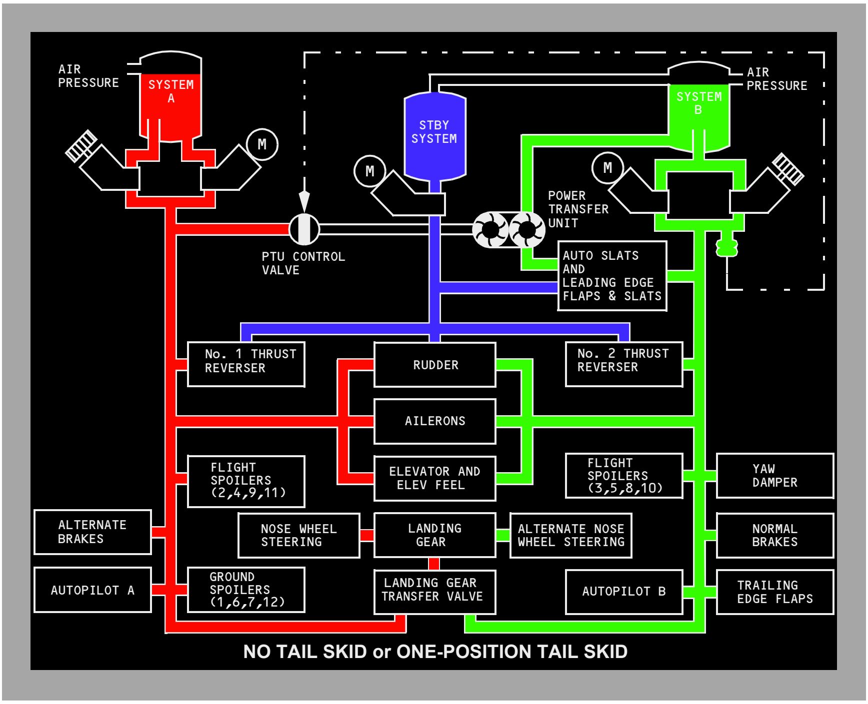
The airplane has three hydraulic systems: A, B and standby. The standby system is used if system A and/or B pressure is lost. The hydraulic systems power the following airplane systems:

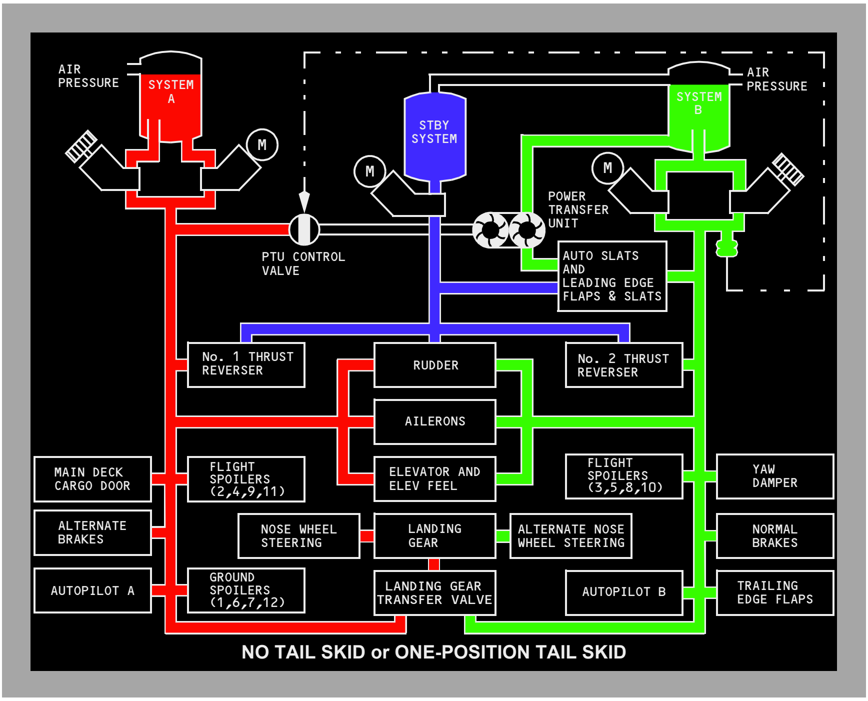
- flight controls
- leading edge flaps and slats
- trailing edge flaps
- landing gear
- main deck cargo door
- wheel brakes
- nose wheel steering
- thrust reversers
- autopilots.

Either A or B hydraulic system can power all flight controls with no decrease in airplane controllability.

Each hydraulic system has a fluid reservoir located in the main wheel well area. System A and B reservoirs are pressurized by bleed air. The standby system reservoir is connected to the system B reservoir for pressurization and servicing. Pressurization of all reservoirs ensures positive fluid flow to all hydraulic pumps.

Hydraulic Power Distribution Schematic





A and B Hydraulic Systems

Components powered by hydraulic systems A and B are:

System A

- ailerons
- rudder
- elevator and elevator feel
- flight spoilers (2,4,9,11)
- ground spoilers (1,6,7,12)
- alternate brakes
- No. 1 thrust reverser
- autopilot A
- normal nose wheel steering
- landing gear
- landing gear transfer valve
- power transfer unit (PTU).

System B

- ailerons
- rudder
- elevator and elevator feel
- flight spoilers (3,5,8,10)
- leading edge flaps and slats
- trailing edge flaps
- normal brakes
- No. 2 thrust reverser
- autopilot B
- alternate nose wheel steering
- landing gear transfer valve
- autoslats
- yaw damper.

A and B Hydraulic System Pumps

Both A and B hydraulic systems have an engine–driven pump and an AC electric motor–driven pump. The system A engine–driven pump is powered by the No. 1 engine and the system B engine–driven pump is powered by the No. 2 engine. An engine–driven hydraulic pump supplies approximately 6 times the fluid volume of the related electric motor–driven hydraulic pump.

The ENG 1 (system A) or ENG 2 (system B) pump ON/OFF switch controls the engine–driven pump output pressure. Positioning the switch to OFF isolates fluid flow from the system components. However, the engine–driven pump continues to rotate as long as the engine is operating. Pulling the engine fire switch shuts off the fluid flow to the engine–driven pump and deactivates the related LOW PRESSURE light.

[Option - Abex electric motor driven hydraulic pumps]
The ELEC 2 (system A) or ELEC 1 (system B) pump ON/OFF switch controls the related electric motor–driven pump. If an overheat is detected in either system, the related OVERHEAT light illuminates.

[Option - Vickers or Eaton electric motor driven hydraulic pumps]
The ELEC 2 (system A) or ELEC 1 (system B) pump ON/OFF switch controls the related electric motor–driven pump. If an overheat is detected in either system, the related OVERHEAT light illuminates, power is removed from the pump and the LOW PRESSURE light illuminates.

Note: Loss of an engine-driven hydraulic pump and a high demand on the system may result in an intermittent illumination of the LOW PRESSURE light for the remaining electric motor-driven hydraulic pump. The flight control LOW PRESSURE light, Master Caution light, and the FLT CONT and HYD system annunciator lights also illuminate.

Hydraulic fluid used for cooling and lubrication of the pumps passes through a heat exchanger before returning to the reservoir. The heat exchanger for system A is located in main fuel tank No. 1 and for system B is in main fuel tank No. 2.

CAUTION: Minimum fuel for ground operation of electric motor-driven pumps is 760 kgs/1675 lbs in the related main tank.

Pressure switches, located in the engine–driven and electric motor–driven pump output lines, send signals to illuminate the related LOW PRESSURE light if pump output pressure is low. A check valve, located in each output line, isolates the related pump from the system. The related system pressure transmitter sends the combined pressure of the engine–driven and electric motor–driven pump to the related hydraulic system pressure indication.

System A Hydraulic Leak

If a leak develops in the engine–driven pump or its related lines, a standpipe in the reservoir prevents a total system fluid loss. With fluid level at the top of the standpipe, the reservoir quantity displayed indicates approximately 20% full. System A hydraulic pressure is maintained by the electric motor–driven pump.

If a leak develops in the electric motor–driven pump or its related lines, or components common to both the engine and electric motor–driven pumps, the quantity in the reservoir steadily decreases to zero and all system pressure is lost.

System B Hydraulic Leak

If a leak develops in either pump, line or component of system B, the quantity decreases until it indicates approximately zero and system B pressure is lost. The system B reservoir has one standpipe which supplies fluid to both the engine–driven pump and the electric motor–driven pump. However, with fluid level at the top of the standpipe, fluid remaining in the system B reservoir is sufficient for power transfer unit operation.

A leak in system B does not affect the operation of the standby hydraulic system.

Power Transfer Unit

The purpose of the PTU is to supply the additional volume of hydraulic fluid needed to operate the autoslats and leading edge flaps and slats at the normal rate when system B engine–driven hydraulic pump is inoperative. The PTU uses system A pressure to power a hydraulic motor–driven pump, which pressurizes system B hydraulic fluid. The PTU operates automatically when all of the following conditions exist:

- system B engine–driven pump hydraulic pressure drops below limits
- airborne
- flaps are less than 15 but not up.

Landing Gear Transfer Valve

The purpose of the landing gear transfer valve is to supply the volume of hydraulic fluid needed to raise the landing gear at the normal rate when system A engine–driven pump volume is lost. The system B engine–driven pump supplies the volume of hydraulic fluid needed to operate the landing gear transfer valve when all of the following conditions exist:

- airborne
- No. 1 engine RPM drops below a limit value
- landing gear lever is positioned UP
- either main landing gear is not up and locked.

Standby Hydraulic System

The standby hydraulic system is provided as a backup if system A and/or B pressure is lost. The standby system can be activated manually or automatically and uses a single electric motor–driven pump to power:

- thrust reversers
- rudder
- leading edge flaps and slats (extend only)
- standby yaw damper.

Manual Operation

Positioning either FLT CONTROL switch to STBY RUD:

- activates the standby electric motor–driven pump
- shuts off the related hydraulic system pressure to ailerons, elevators and rudder by closing the flight control shutoff valve
- opens the standby rudder shutoff valve
- deactivates the related flight control LOW PRESSURE light when the standby rudder shutoff valve opens
- allows the standby system to power the rudder and thrust reversers.

[737 modified rudder- installed]
- illuminates the STBY RUD ON, Master Caution, and Flight Controls (FLT CONT) lights.

Positioning the ALTERNATE FLAPS master switch to ARM, (refer to Chapter 9, Flight Controls for a more complete explanation):

- activates the standby electric motor–driven pump
- closes the trailing edge flap bypass valve
- arms the ALTERNATE FLAPS position switch
- allows the standby system to power the leading edge flaps and slats and thrust reversers.

Automatic Operation

Automatic operation is initiated when the following conditions exist:

- loss of system A or B, and
- flaps extended, and
- airborne, or wheel speed greater than 60 kts, and
- FLT CONTROL switch A or B Hydraulic System ON

[737 modified rudder- installed]
OR:

- the main PCU Force Fight Monitor (FFM) trips

Automatic operation:

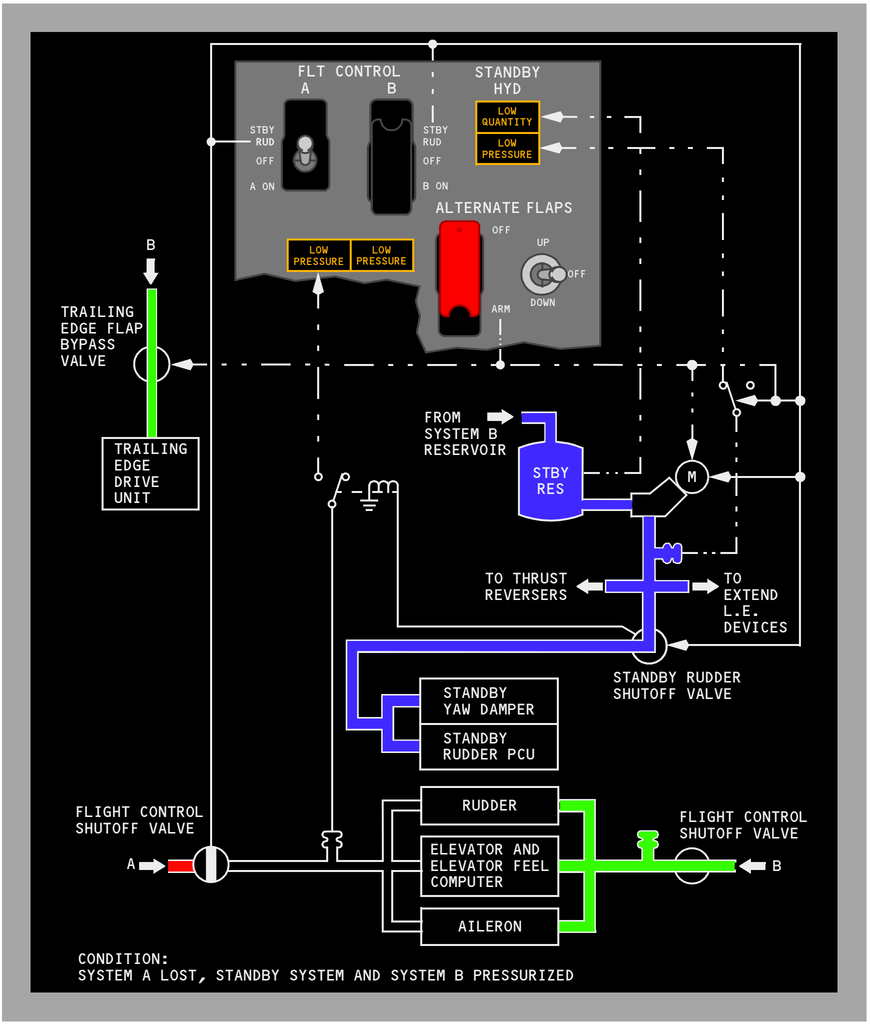
- activates the standby electric motor–driven pump
- opens the standby rudder shutoff valve
- allows the standby system to power the rudder and thrust reversers.

[737 modified rudder- installed]

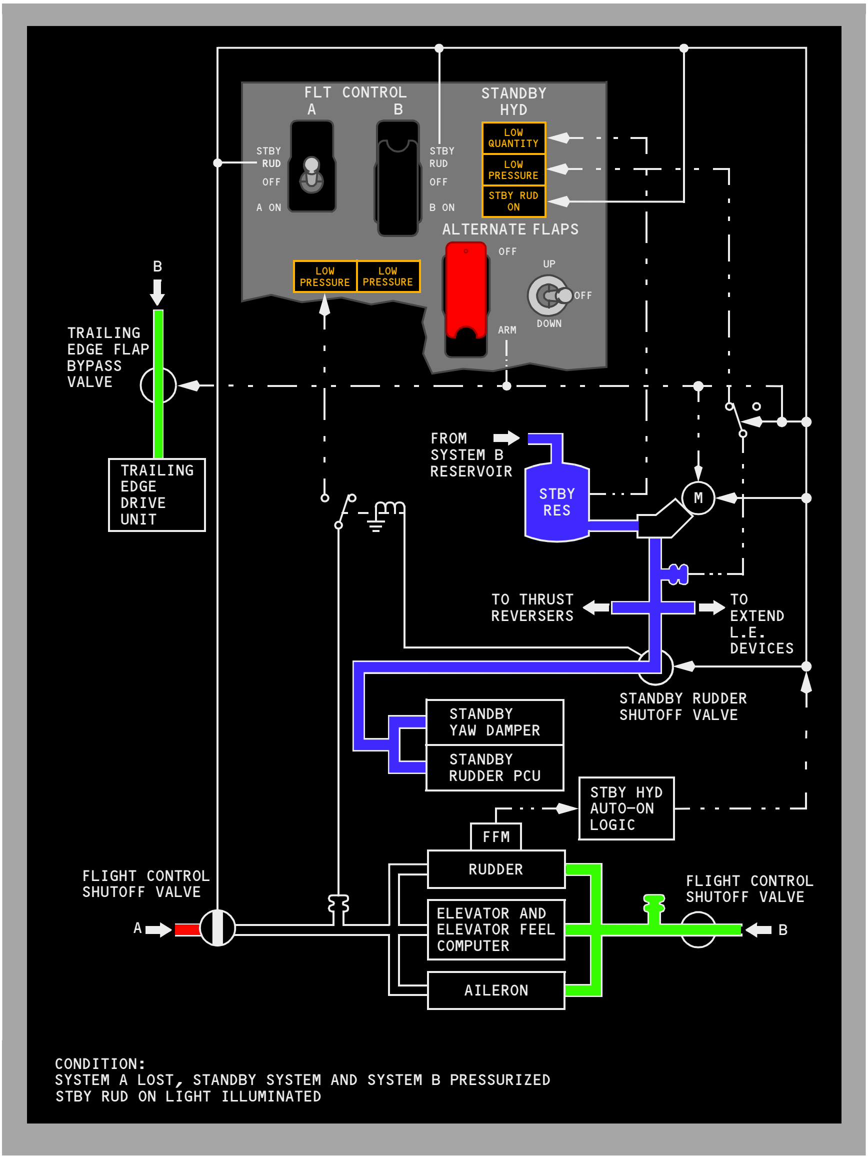
- illuminates the STBY RUD ON, Master Caution, and Flight Controls (FLT CONT) lights.

Standby Hydraulic System Schematic

[737 modified rudder - not installed]



[737 modified rudder - installed]



Standby Hydraulic System Leak

If a leak occurs in the standby system, the standby reservoir quantity decreases to zero. The LOW QUANTITY light illuminates when the standby reservoir is approximately half empty. System B continues to operate normally, however, the system B reservoir fluid level indication decreases and stabilizes at approximately 70% full.

Variations in Hydraulic Quantity Indications

During normal operations, variations in hydraulic quantity indications occur when:

- the system becomes pressurized after engine start
- raising or lowering the landing gear or leading edge devices
- cold soaking occurs during long periods of cruise.

These variations have little effect on systems operation.

If the hydraulic system is not properly pressurized, foaming can occur at higher altitudes. Foaming can be recognized by pressure fluctuations and the blinking of the related LOW PRESSURE lights. The MASTER CAUTION and HYD annunciator lights may also illuminate momentarily.

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Landing Gear — Chapter 14
Table of Contents — Section TOC

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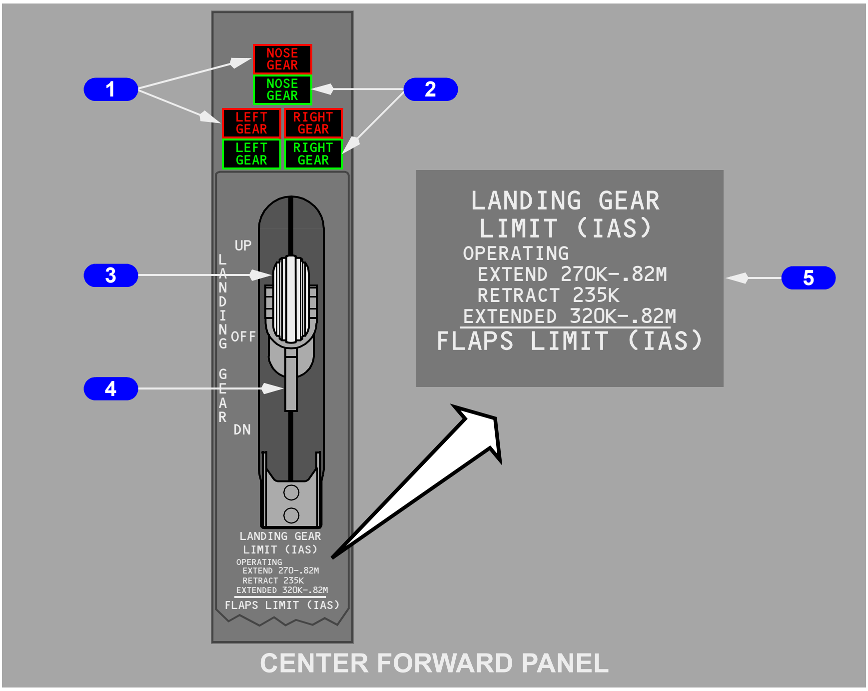
Landing Gear Panel



1 Landing Gear Indicator Lights (top)

Illuminated (red) –

- landing gear is not down and locked (with either or both forward thrust levers retarded to idle, and below 800 feet AGL)
- related landing gear is in disagreement with LANDING GEAR lever position (in transit or unsafe)

Extinguished -

- landing gear is up and locked with landing gear lever UP or OFF
- landing gear is down and locked with landing gear lever DN

2 Landing Gear Indicator Lights (bottom)

Illuminated (green) – related gear down and locked.

Note: Landing gear warning horn is deactivated with all gear down and locked.

Note: Landing gear is down and locked as long as one green landing gear indicator light (center panel or overhead panel) for each gear is illuminated.

Extinguished – landing gear is not down and locked.

3 LANDING GEAR Lever

UP – landing gear retract.

OFF – hydraulic pressure is removed from landing gear system.

DN – landing gear extend.

4 Override Trigger

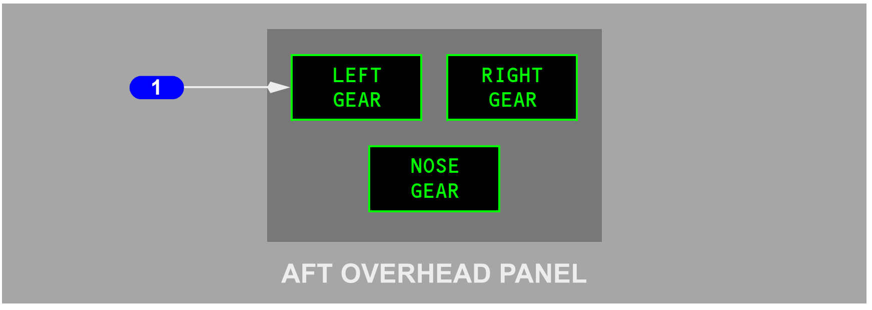
Allows LANDING GEAR lever to be raised, bypassing the landing gear lever lock.

5 LANDING GEAR LIMIT Speed Placard

Indicates maximum speed while operating landing gear and after gear extension.

Landing Gear Indicator Lights

This is a redundant but separate set of landing gear indicator circuits and lights.



1 Landing Gear Indicator Lights (overhead)

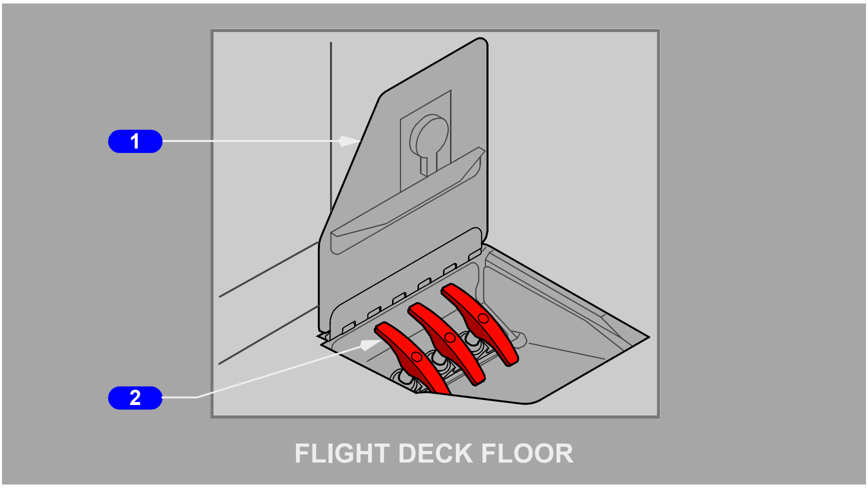
Illuminated (green) – related gear down and locked.

Note: Landing gear warning horn is deactivated with all gear down and locked.

Note: Landing gear is down and locked as long as one green landing gear indicator light (center panel or overhead panel) for each gear is illuminated.

Extinguished – landing gear is not down and locked.

Manual Gear Extension



1 Manual Extension Access Door

Open –

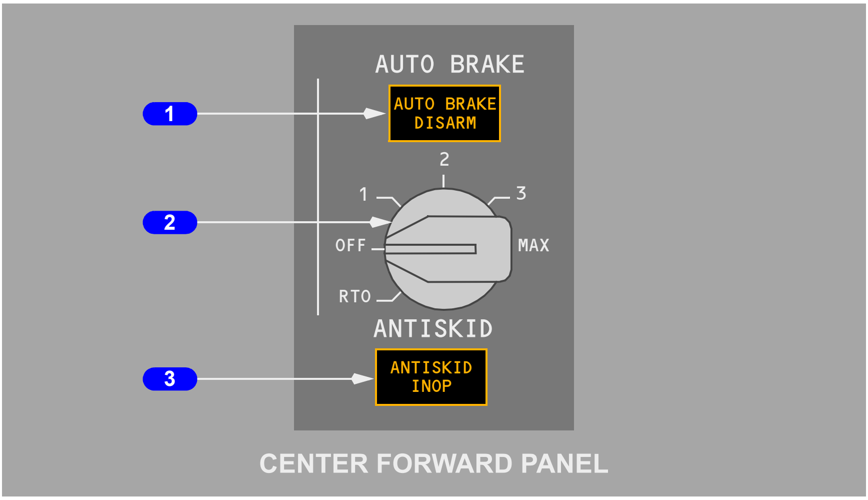
- manual landing gear extension is possible with landing gear lever in any position
- normal landing gear extension is still possible if hydraulic system A pressure is available
- landing gear retraction is disabled

Closed – landing gear operate normally.

2 Manual Gear Extension Handles

Right main, nose, left main – Each landing gear uplock is released when related handle is pulled to its limit, approximately 24 inches (61 cm).

Autobrake and Antiskid Controls



1 AUTO BRAKE DISARM Light

Illuminated (amber) –

- SPEED BRAKE lever moved to down detent during RTO or landing
- manual brakes applied during RTO or landing
- thrust lever(s) advanced during RTO or landing
  - except during first 3 seconds after touchdown for landing
- landing made with RTO selected
- RTO mode selected on ground
  - illuminates for one to two seconds then extinguishes
- a malfunction exists in automatic braking system

Extinguished –

- AUTO BRAKE select switch set to OFF
- autobrake armed

2 AUTO BRAKE Select Switch

OFF – autobrake system deactivated.

1, 2, 3, or MAX –

- selects desired deceleration rate for landing
- switch must be pulled out to select MAX deceleration

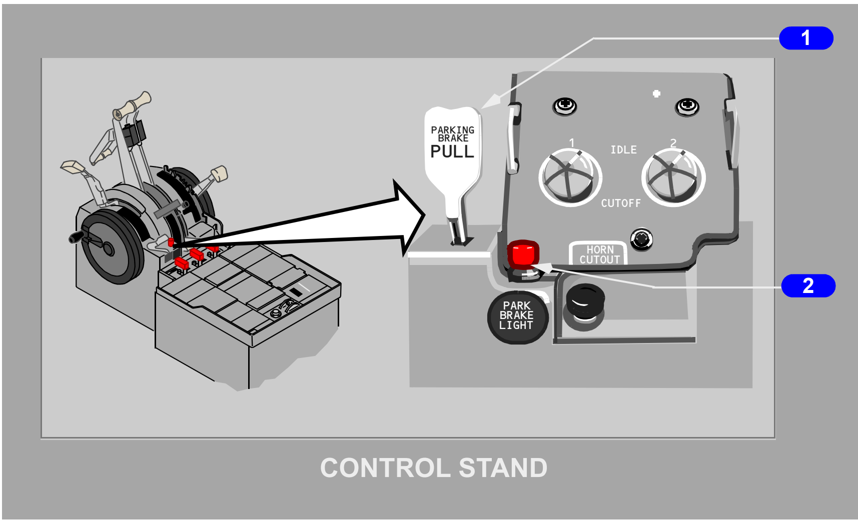
RTO – automatically applies maximum brake pressure when thrust levers are retarded to idle at or above 88 knots.

3 Antiskid Inoperative (ANTISKID INOP) Light

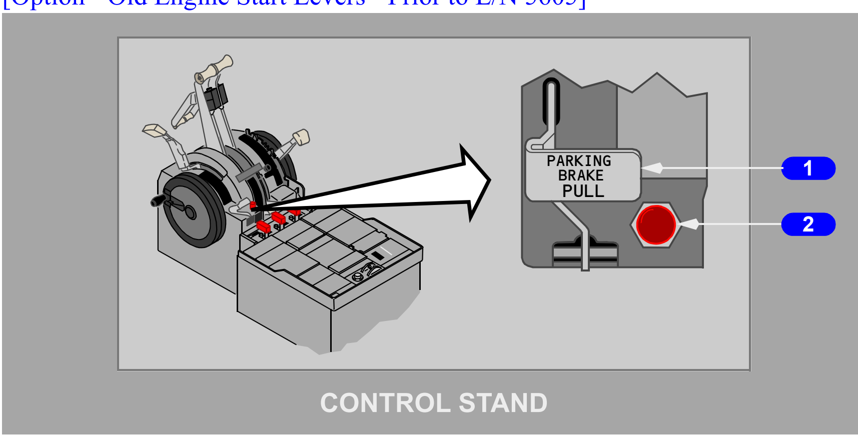
Illuminated (amber) – a system fault is detected by antiskid monitoring system.

Extinguished – antiskid system operating normally.

Parking Brake



[Option - Old Engine Start Levers - Prior to L/N 5605]



1 PARKING BRAKE Lever

Forward – parking brakes released.

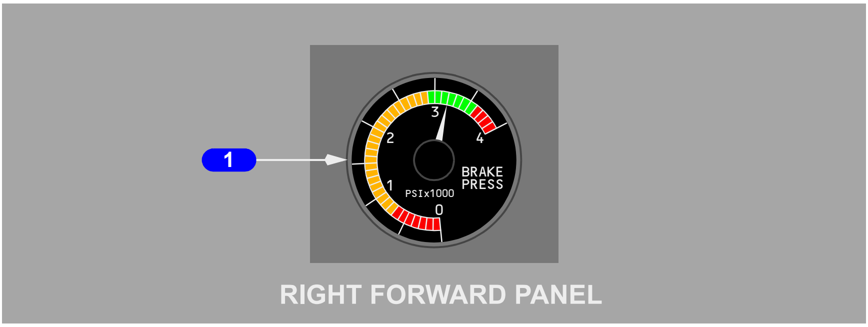
Aft – sets parking brakes when either Captain's or First Officer's brake pedals are fully depressed.

2 Parking Brake Warning Light

Illuminated (red) – parking brake is set (light operates from battery power).

Extinguished – parking brake is released.

Hydraulic Brake Pressure Indicator



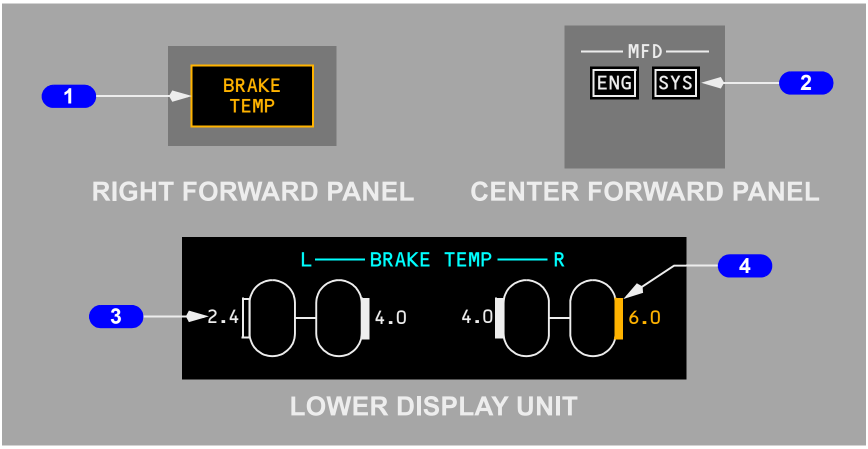
1 Hydraulic Brake Pressure (HYD BRAKE PRESS) Indicator

Indicates brake accumulator pressure ranges:

- normal pressure: 2900 - 3600 psi
- maximum pressure: 3600 - 4000 psi
- normal precharge: 1000 psi

Brake Temperature Indicator

[Option]



1 Brake Temperature (BRAKE TEMP) Light

Illuminated (amber) -

- temperature of one or more brakes exceed 4.9
- extinguishes when a hot brake condition is no longer indicated on the display unit

2 **MFD System (SYS) Switch**

Push – SYS

- displays brake temperature indications on lower DU; or the inboard DU if the MAIN PANEL DUs switch is placed to the INBD MFD position
- second push removes indications from the respective DU

3 **Brake Temperature**

Indicates a relative value of wheel brake temperature

- values range from 0.0 to 9.9
- displayed (white) - normal brake temperature range, 0.0 to 4.9
- displayed (amber) - high brake temperature, exceeds 4.9

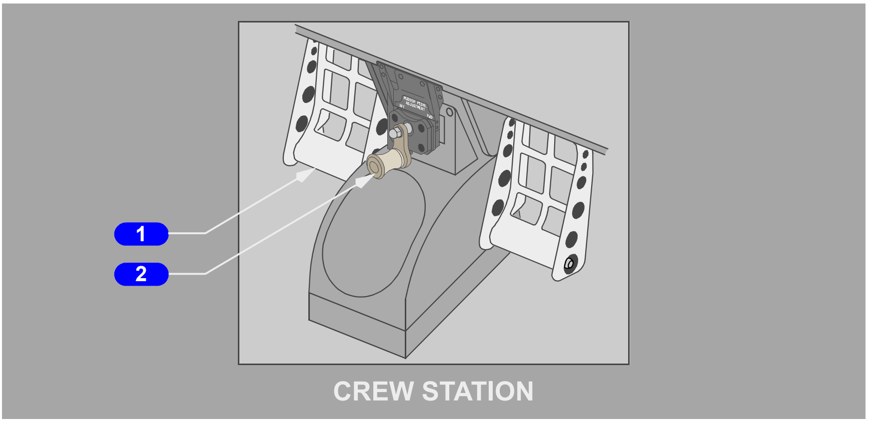
4 **Brake Symbol**

Displayed (blank) - indicates any brake less than 2.5.

Displayed (solid white) - indicates the hottest brake on each main gear truck, within the range of 2.5 to 4.9.

Displayed (solid amber) - indicates brake overheat condition on each wheel within the range of 5.0 to 9.9. Symbol remains until value is less than 3.5.

Rudder/Brake Pedals



1 **Rudder/Brake Pedals**

Push full pedal – turns nose wheel up to 7 degrees in either direction.

Push top of pedal only – activates wheel brakes.

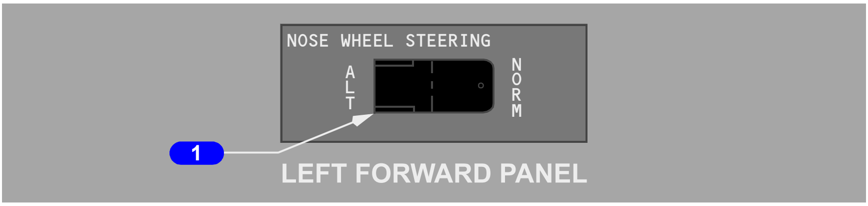
Refer to Chapter 9 Flight Controls for rudder description.

2 RUDDER PEDAL ADJUSTMENT Crank

AFT (counter–clockwise) – adjusts rudder pedals aft.

FWD (clockwise) – adjusts rudder pedals forward.

Nose Wheel Steering Switch

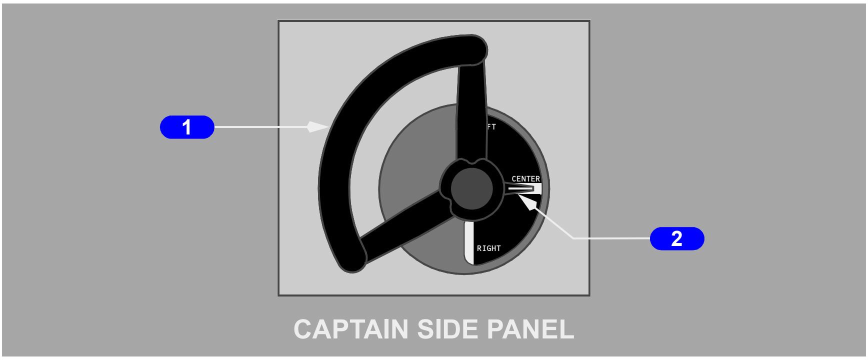


1 NOSE WHEEL STEERING Switch

ALT – hydraulic system B provides power for nose wheel steering.

NORM (guarded position) – hydraulic system A provides power for nose wheel steering.

Nose Wheel Steering Wheel



1 Nose Wheel Steering Wheel

Rotate –

- turns nose wheel up to 78 degrees in either direction

  Note: Refer to Chapter 1 for effective steering angle and turning radius.

- overrides rudder pedal steering

2 Nose Wheel Steering Indicator

LEFT – indicates nose wheel steering displacement left of center position.

CENTER – normal straight ahead position.

RIGHT – indicates nose wheel steering displacement right of center position.

Introduction

The airplane has two main landing gear and a single nose gear. Each main gear is a conventional two–wheel landing gear unit. The nose gear is a conventional steerable two–wheel unit.

Hydraulic power for retraction, extension, and nose wheel steering is normally supplied by hydraulic system A. A manual landing gear extension system and an alternate source of hydraulic power for nose wheel steering are also provided.

The normal brake system is powered by hydraulic system B. The alternate brake system is powered by hydraulic system A. Antiskid protection is provided on both brake systems, but the autobrake system is available only with the normal brake system.

[Option]
A brake temperature monitoring system displays each main landing gear brake temperature on the lower DU.

Landing Gear Operation

The landing gear are normally controlled by the LANDING GEAR lever. On the ground, a landing gear lever lock, prevents the LANDING GEAR lever from moving to the up position. An override trigger in the lever may be used to bypass the landing gear lever lock. In flight, the air/ground system energizes a solenoid which opens the lever lock.

Landing Gear Retraction

When the LANDING GEAR lever is moved to UP, the landing gear begins to retract. During retraction, the brakes automatically stop rotation of the main gear wheels. After retraction, the main gear are held in place by mechanical uplocks. Rubber seals and oversized hubcaps complete the fairing of the outboard wheels.

The nose wheels retract forward into the wheel well and nose wheel rotation is stopped by snubbers. The nose gear is held in place by an overcenter lock and enclosed by doors which are mechanically linked to the gear.

Hydraulic pressure is removed from the landing gear system with the LANDING GEAR lever in the OFF position.

If a main landing gear tire is damaged during takeoff, it is possible that braking of the main gear wheels during retraction may be affected. A spinning tire with a loose tread must be stopped prior to entering the wheel well or it can cause damage to wheel well components. When a spinning tire with loose tread impacts a fitting in the wheel well ring opening, that gear stops retracting and free falls back to the down position. The affected gear cannot be retracted until the fitting is replaced.

Landing Gear Transfer Valve

Hydraulic system B pressure is available for raising the landing gear through the landing gear transfer valve. Hydraulic system B supplies the volume of hydraulic fluid required to raise the landing gear at the normal rate when all of the following conditions exist:

- airborne
- No. 1 engine RPM drops below a limit value
- LANDING GEAR lever is positioned UP
- either main landing gear is not up and locked.

Landing Gear Extension

When the LANDING GEAR lever is moved to DN, hydraulic system A pressure is used to release the uplocks. The landing gear extends by hydraulic pressure, gravity and air loads. Overcenter mechanical and hydraulic locks hold the gear at full extension. The nose wheel doors remain open when the gear is down.

Landing Gear Manual Extension

If hydraulic system A pressure is lost, the manual extension system provides another means of landing gear extension. Manual gear releases on the flight deck are used to release uplocks that allow the gear to free–fall to the down and locked position. The forces that pull the gear down are gravity and air loads.

With the manual extension access door open:

- manual landing gear extension is possible with the LANDING GEAR lever in any position
- normal landing gear extension is possible if hydraulic system A pressure is available
- landing gear retraction is disabled.

Following a manual extension, the landing gear may be retracted normally by accomplishing the following steps:

- close the manual extension access door
- move the LANDING GEAR lever to DOWN with hydraulic system A pressure available, and then
- position the LANDING GEAR lever to UP.

Nose Wheel Steering

Nose wheel steering is available when the nose gear is in the down position and compressed by weight of the airplane. Positioning the landing gear control lever to down makes system A hydraulic pressure available to the steering metering valve. Alternate nose wheel steering can be activated to provide system B pressure to the nose wheels when the NOSE WHEEL STEERING switch is placed to ALT, normal quantity is in the system B reservoir, and the airplane is on the ground. In the event of a hydraulic leak downstream of the Landing Gear Transfer Valve, resulting in a loss of hydraulic system B fluid in the reservoir, a sensor closes the Landing Gear Transfer Valve and alternate steering will be lost.

Primary steering is controlled through the nose wheel steering wheel. Limited steering control is available through the rudder pedals. A pointer on the nose steering wheel assembly shows nose wheel steering position relative to the neutral setting. Rudder pedal steering is deactivated as the nose gear strut extends.

A lockout pin may be installed in the towing lever to depressurize nose wheel steering. This allows airplane pushback or towing without depressurizing the hydraulic systems.

Brake System

Each main gear wheel has a multi–disc hydraulic powered brake. The brake pedals provide independent control of the left and right brakes. The nose wheels have no brakes. The brake system includes:

- normal brake system
- alternate brake system
- brake accumulator
- antiskid protection
- autobrake system
- parking brake

[Option]
- brake temperature indication

Normal Brake System

The normal brake system is powered by hydraulic system B.

Alternate Brake System

The alternate brake system is powered by hydraulic system A. If hydraulic system B is low or fails, hydraulic system A automatically supplies pressure to the alternate brake system.

Brake Accumulator

The brake accumulator is pressurized by hydraulic system B. If both normal and alternate brake system pressure is lost, trapped hydraulic pressure in the brake accumulator can still provide several braking applications or parking brake application.

Antiskid Protection

Antiskid protection is provided in the normal and alternate brake systems.

The normal brake hydraulic system provides each main gear wheel with individual antiskid protection. When the system detects a skid, the associated antiskid valve reduces brake pressure until skidding stops. The alternate brake hydraulic system works similar to the normal system however antiskid protection is applied to main gear wheel pairs instead of individual wheels.

Both normal and alternate brake systems provide skid, locked wheel, touchdown and hydroplane protection.

Antiskid protection is available even with loss of both hydraulic systems.

Autobrake System

The autobrake system uses hydraulic system B pressure to provide maximum deceleration for rejected takeoff and automatic braking at preselected deceleration rates immediately after touchdown. The system operates only when the normal brake system is functioning. Antiskid system protection is provided during autobrake operation.

Rejected Takeoff (RTO)

The RTO mode can be selected only when on the ground. Upon selection, the AUTO BRAKE DISARM light illuminates for one to two seconds and then extinguishes, indicating that an automatic self–test has been successfully accomplished.

To arm the RTO mode prior to takeoff the following conditions must exist:

- airplane on the ground
- antiskid and autobrake systems operational
- AUTO BRAKE select switch positioned to RTO
- wheel speed less than 60 knots
- forward thrust levers positioned to IDLE.

With RTO selected, if the takeoff is rejected prior to wheel speed reaching 88 knots autobraking is not initiated, the AUTO BRAKE DISARM light does not illuminate and the RTO autobrake function remains armed. If the takeoff is rejected after reaching a wheel speed of 88 knots, maximum braking is applied automatically when the forward thrust levers are retarded to IDLE.

The RTO mode is automatically disarmed when both air/ground systems indicate the air mode. The AUTO BRAKE DISARM light does not illuminate and the AUTO BRAKE select switch remains in the RTO position. To reset or manually disarm the autobrake system, position the selector to OFF. If a landing is made with RTO selected (AUTO BRAKE select switch not cycled through OFF), no automatic braking action occurs and the AUTO BRAKE DISARM light illuminates two seconds after touchdown.

Landing

When a landing autobrake selection is made, the system performs a turn–on–self–test. If the turn–on–self–test is not successful, the AUTO BRAKE DISARM light illuminates and the autobrake system does not arm.

Four levels of deceleration can be selected for landing. However, on dry runways, the maximum autobrake deceleration rate in the landing mode is less than that produced by full pedal braking.

After landing, autobrake application begins when:

- both forward thrust levers are retarded to IDLE
- the main wheels spin–up.

Note: Landing autobrake settings may be selected after touchdown prior to decelerating through 30 kts of ground speed. Braking initiates immediately if the above conditions are met.

To maintain the selected landing deceleration rate, autobrake pressure is reduced as other controls, such as thrust reversers and spoilers, contribute to total deceleration. The deceleration level can be changed (without disarming the system) by rotating the selector. The autobrake system brings the airplane to a complete stop unless the braking is terminated by the pilot.

Autobrake – Disarm

The pilots may disarm the autobrake system by moving the selector switch to the OFF position. This action does not cause the AUTO BRAKE DISARM light to illuminate. After braking has started, any of the following pilot actions disarm the system immediately and illuminate the AUTO BRAKE DISARM light:

- moving the SPEED BRAKE lever to the down detent
- advancing the forward thrust lever(s), except during the first 3 seconds after touchdown for landing
- applying manual brakes.

Parking Brake

The parking brake can be set with either A or B hydraulic systems pressurized. If A and B hydraulic systems are not pressurized, parking brake pressure is maintained by the brake accumulator. Accumulator pressure is shown on the HYD BRAKE PRESS indicator.

The parking brake is set by depressing both brake pedals fully, while simultaneously pulling the PARKING BRAKE lever up. This mechanically latches the pedals in the depressed position and commands the parking brake valve to close.

The parking brake is released by depressing the pedals until the PARKING BRAKE lever releases. A fault in the parking brake system may cause the ANTISKID INOP light to illuminate.

The TAKEOFF CONFIG lights illuminate and the takeoff configuration warning horn sounds if either forward thrust lever is advanced for takeoff with the parking brake set.

Air/Ground System

In flight and ground operation of various airplane systems are controlled by the air/ground system.

The system receives air/ground logic signals from six sensors, two on each landing gear. These signals are used to configure the airplane systems to the appropriate air or ground status.

Air/Ground System Logic Table

SYSTEMS	NORMAL INFLIGHT OPERATION	NORMAL ON GROUND OPERATION	REFER TO CH
Emergency Exit Doors	Flight locks engaged when either engine N2 is more than 50% and 3 or more Entry/Service doors are closed.	Flight locks disengaged when either thrust lever is set below approximately 53 degrees.	1
Pack Valves	With one pack operating, regulates to high flow with flaps up.	With one pack operating, regulates to high flow only when pack is operating from the APU and both engine bleed switches are OFF.	2

SYSTEMS	NORMAL INFLIGHT OPERATION	NORMAL ON GROUND OPERATION	REFER TO CH
Pressurization	Allows programmed pressurization in the automatic modes.	Allows pressurization only at high power settings.	2
Ram Air	Ram Air fans operate whenever air conditioning packs operate.	Ram Air fans operate whenever air conditioning packs operate. Deflectors are extended.	2
Wing Anti–ice	Control valves open when switch is ON. Thrust setting and duct temperature logic is bypassed.	With switch ON, valves cycle open and closed. Switch trips to OFF at lift–off.	3
Autothrottle	Enables go–around below 2000 ft radio altitude.	Disengaged 2 seconds after landing. Takeoff mode enabled.	4
TO/GA switch	Flight director engages go–around mode.	Flight director engages takeoff mode.	4
ACARS	Sends out signal on strut extension for takeoff signal.	Sends out signal on strut compression for landing signal.	5
Voice Recorder	Prevents tape erasure.	Allows tape erasure when parking brake is set.	5
Engine Idle Control	Enables minimum flight idle.	Enables minimum ground idle.	7
Thrust Reverser	Thrust reverse disabled.	Thrust reverse enabled.	7
APU Fire Horn	Wheel well horn disabled.	Wheel well horn enabled.	8
Cargo Fire Protection	Second extinguishing bottle timer enabled.	Second extinguishing bottle timer disabled.	8
Cargo Fire Protection	Third extinguishing bottle timer enabled.	Third extinguishing bottle timer disabled.	8

SYSTEMS	NORMAL INFLIGHT OPERATION	NORMAL ON GROUND OPERATION	REFER TO CH
Speed Brake Lever Actuator	Can be armed to raise ground spoilers for landing.	Activates SPEED BRAKE lever on landing if armed. Rejected take–off feature available. Drives to DOWN when thrust lever advanced.	9
Auto Slat	System enabled with flaps 1, 2, or 5 selected. PTU available if system B pressure is lost.	System disabled.	9
Flight Recorder	Operates anytime electrical power is available.	Operates anytime electrical power is available and either engine is operating.	10
FMC	FMC position updated from GPS, DME or VOR/DME.	FMC position updated from GPS.	11
Standby Hydraulic	Pump automatic operation with flaps extended and A or B pressure lost.	Wheel speed must be greater than 60 knots for automatic operation.	13
Antiskid	Releases normal or alternate brakes for touchdown protection.	Allows normal antiskid braking after wheel spin–up.	14
Autobrake	Allows selection of landing mode.	RTO mode available and landing mode may be selected after touchdown if wheel speed is greater than 30 knots.	14
Landing Gear Lever Lock	Lever lock solenoid released.	Lever lock solenoid latched.	14
Landing Gear Transfer Valve	Enabled.	Disabled.	14
Stall Warning	Enabled.	Disabled.	15

SYSTEMS	NORMAL INFLIGHT OPERATION	NORMAL ON GROUND OPERATION	REFER TO CH
Takeoff Warning	Disabled.	Enabled.	15

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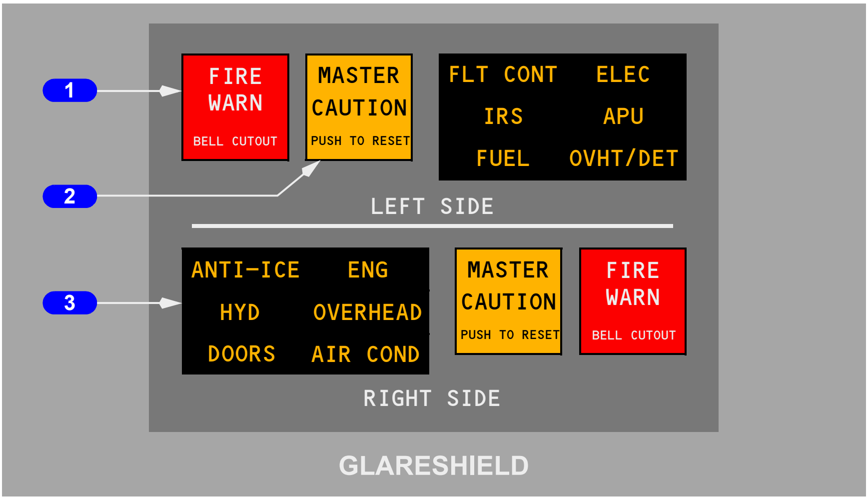
Warning Systems — Chapter 15

Table of Contents — Section TOC

Fire Warning and Master Caution System



1 Master Fire Warning (FIRE WARN) Lights

Illuminated (red) – indicates a fire warning (or system test) in one or more of the following:

- engine
- APU
- main wheel well
- cargo

Associated aural alarms include:

- fire warning bell
- if on ground, remote APU fire warning horn.

Push – extinguishes both master FIRE WARN lights

- silences fire warning bell
- silences remote APU fire warning horn
- resets system for additional warnings.

Note: Pushing fire warning bell cutout switch on overheat/fire protection panel results in the same actions.

2 MASTER CAUTION Lights

Illuminated (amber) – a system annunciator light has illuminated.

Push – extinguishes both MASTER CAUTION lights

- system annunciator light(s) extinguish
- resets system for additional master caution conditions.

3 System Annunciator Panel

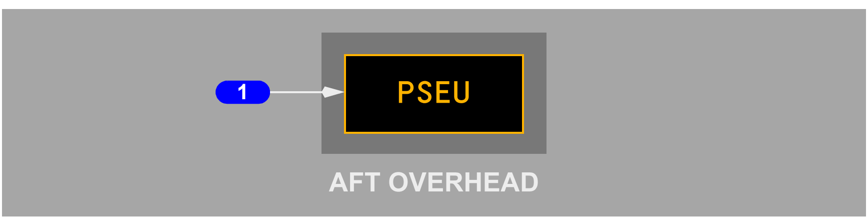
Illuminated (amber) – an amber light, relating to illuminated system annunciator, has illuminated on forward overhead, aft overhead, or overheat/fire protection panel.

To extinguish – push either MASTER CAUTION light.

To recall – push and release either system annunciator panel

- if a master caution condition exists, appropriate system annunciator(s) and MASTER CAUTION lights illuminate
- a single fault in certain redundant systems, or some simple faults, cause the system annunciator light to illuminate during a recall. The system annunciator light will extinguish when the MASTER CAUTION light is pushed.

Proximity Switch Electronic Unit Light



1 Proximity Switch Electronic Unit (PSEU) Light

Illuminated (amber) –

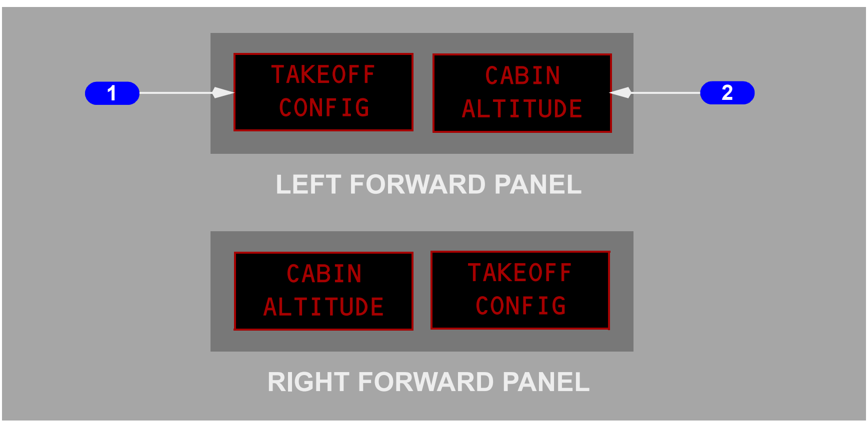
- on the ground –
  - a fault is detected in the PSEU.
  - or, an overwing exit flight lock fails to disengage when commanded.
  - or, the main cargo door micro switches or proximity switches have failed giving false door position indications during a Master Caution recall.
- in-flight –
  - inhibited from thrust lever advance for takeoff until 30 seconds after landing.

Supplemental Proximity Switch Electronic Unit Light

1 Supplemental Proximity Switch Electronic Unit (SPSEU) Light

Illuminated (amber) – a mid-exit flight lock fails to respond when commanded.

Takeoff Configuration and Cabin Altitude Warning Lights



1 Takeoff Configuration Warning Light

Illuminated (red) –

- activates on the ground as the throttles are advanced if the airplane is not configured correctly for takeoff
- activation is simultaneous with aural warning intermittent horn for TAKEOFF CONFIGURATION alert.

2 **Cabin Altitude Warning Light**

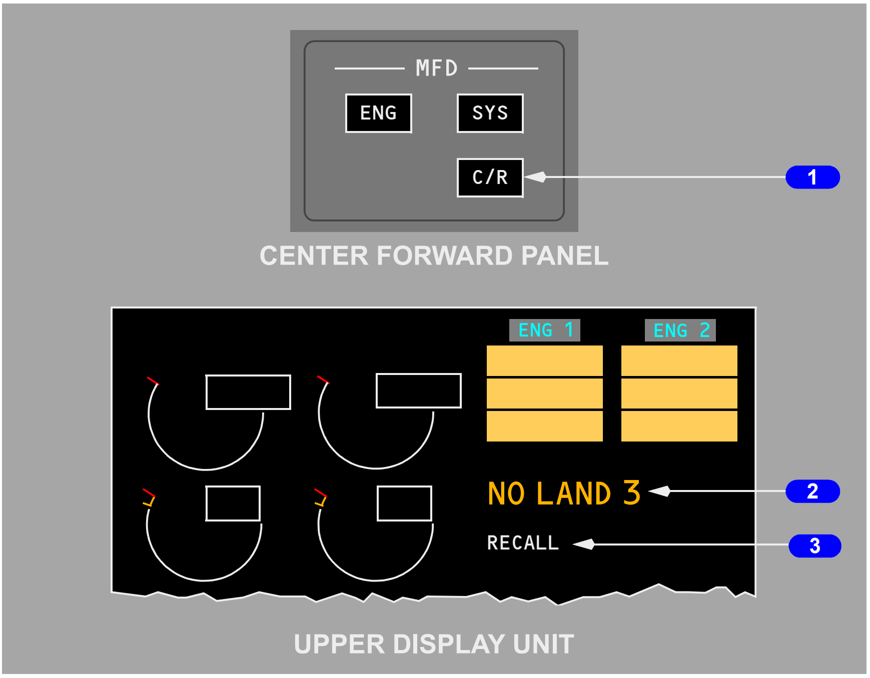
Illuminated (red) –

- illuminates when cabin altitude exceeds 10,000 feet
- activation is simultaneous with aural warning intermittent horn for CABIN ALTITUDE alert
- extinguishes when cabin altitude descends below 10,000 feet.

Note: Operation of the High Altitude Landing Switch changes the altitude at which the cabin altitude warning light illuminates and extinguishes. See Chapter 2.10, Cabin Altitude Panel, and Chapter 15.20, Intermittent Cabin Altitude/Configuration Warning for more information.

Autoland Advisory Message Display

[Option – Fail-Operational Autoland Capability]



1 **MFD Cancel/Recall (C/R) Switch**

Push (once) – Cancels autoland advisory messages that are displayed.

Push (again) – Recalls autoland advisory messages when no messages are displayed.

2 **Autoland Advisory Message**

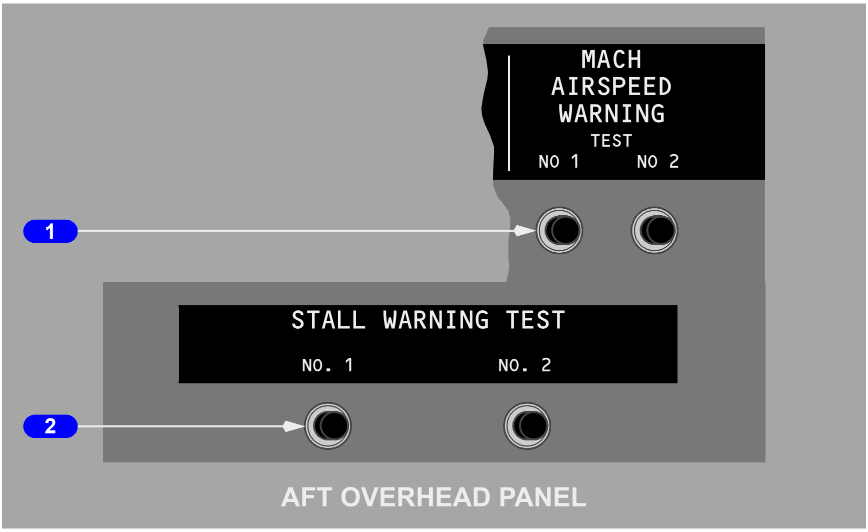
An amber autoland advisory message appears on the engine display when a system fault affects autoland status. Two advisories are available:

- NO LAND 3 – the system is still capable of continuing to a safe landing. A system failure has occurred above Alert Height, and a green LAND 2 status annunciation appears on the Capt and F/O outboard display unit.
- NO AUTOLAND – the system is not capable of performing an automatic landing. A system failure has occurred above Alert Height, and an amber NO AUTOLAND status annunciation appears on the Capt and F/O outboard display unit.

3 **RECALL Message**

Appears when the MFD Cancel/Recall (C/R) Switch is pressed to recall autoland advisory messages.

Mach/Airspeed Warning and Stall Warning Test Switches



1 **MACH AIRSPEED WARNING TEST Switches**

Push – tests respective mach/airspeed warning system

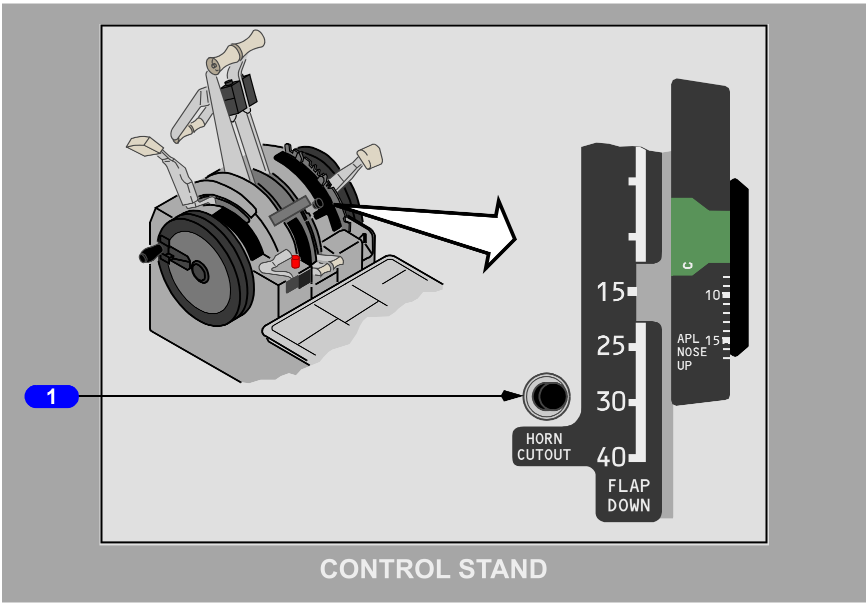
- clacker sounds
- inhibited while airborne.

2 STALL WARNING TEST Switches

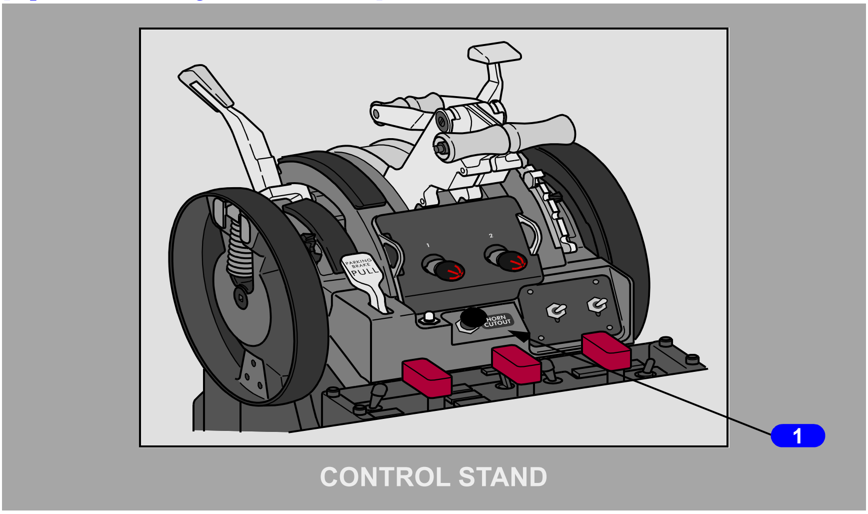
Push – on ground with AC power available: Each test switch tests its respective stall management yaw damper (SMYD) computer. No.1 SMYD computer shakes Captain’s control column, No.2 SMYD computer shakes First Officer’s control column. Vibrations can be felt on both columns

- inhibited while airborne.

Landing Gear Warning Cutout Switch



[Option - New Engine Start Levers]



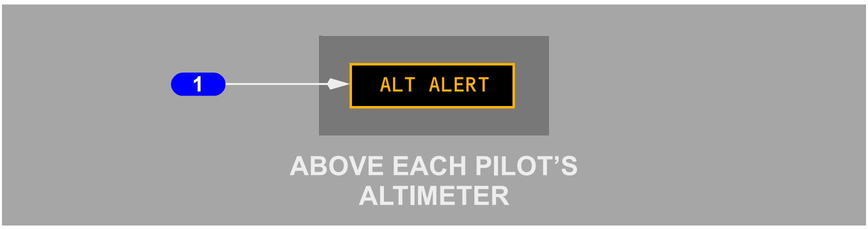
1 Landing Gear Warning Cutout Switch

Push – silences landing gear configuration warning aural indication at flaps up through 10 and above 200 feet RA.

Note: The aural indication cannot be silenced with the cutout switch at flaps greater than 10.

Altitude Alert

[Option - EFIS/MAP]



[Option - 300/900 Altitude alert]

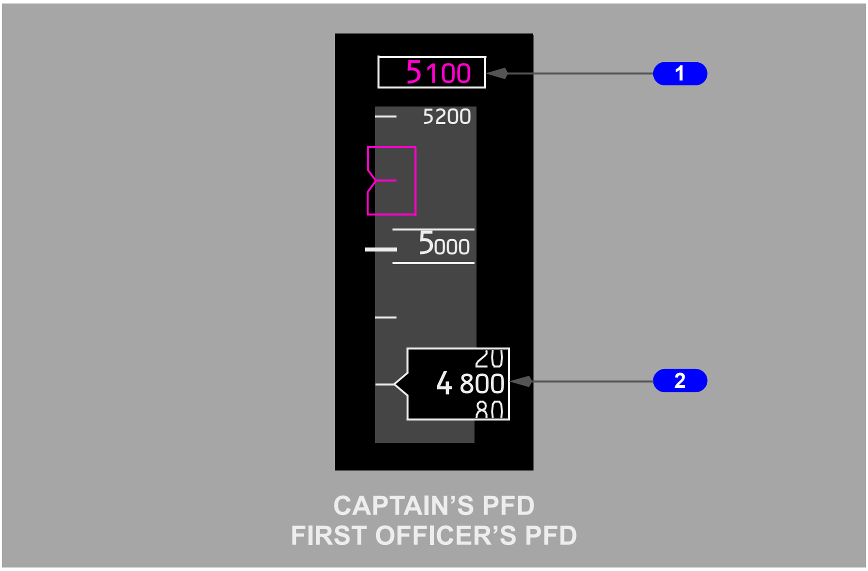
1 Altitude Alert (ALT ALERT) Annunciation

One on each pilot's primary display above altimeter.

Displayed (amber):

- steady – acquisition alert:
  - 900 feet from MCP selected altitude
  - momentary tone also sounds
  - 300 feet from MCP selected altitude, ALT ALERT annunciation no longer shows.
- flashing – deviation alert:
  - deviation more than 300 feet from MCP selected altitude
  - momentary tone also sounds
  - flashing continues until:
    - altitude deviation less than 300 feet, or
    - altitude deviation more than 900 feet, or
    - new MCP altitude selected.

[Option - PFD/ND]



[Option - 300/900 Altitude alert]

1 Selected Altitude Alert

A white box shows around the selected altitude display between 900 feet and 300 feet before reaching the selected altitude.

[Option - 300/900 Altitude alert]

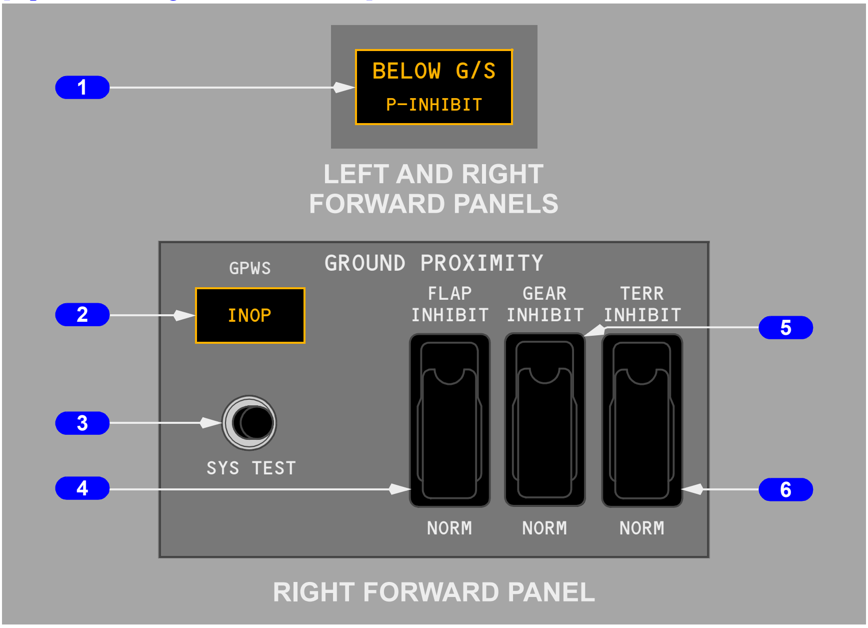
2 Current Altitude Alert

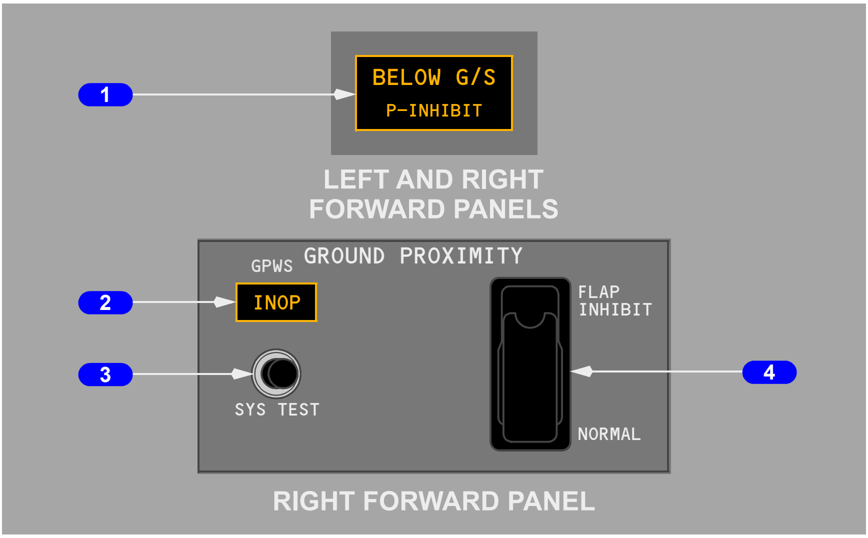
The white box around the current altitude display becomes bold between 900 feet and 300 feet before reaching the selected altitude.

The box turns amber and flashes for 300 feet to 900 feet deviation from the selected altitude.

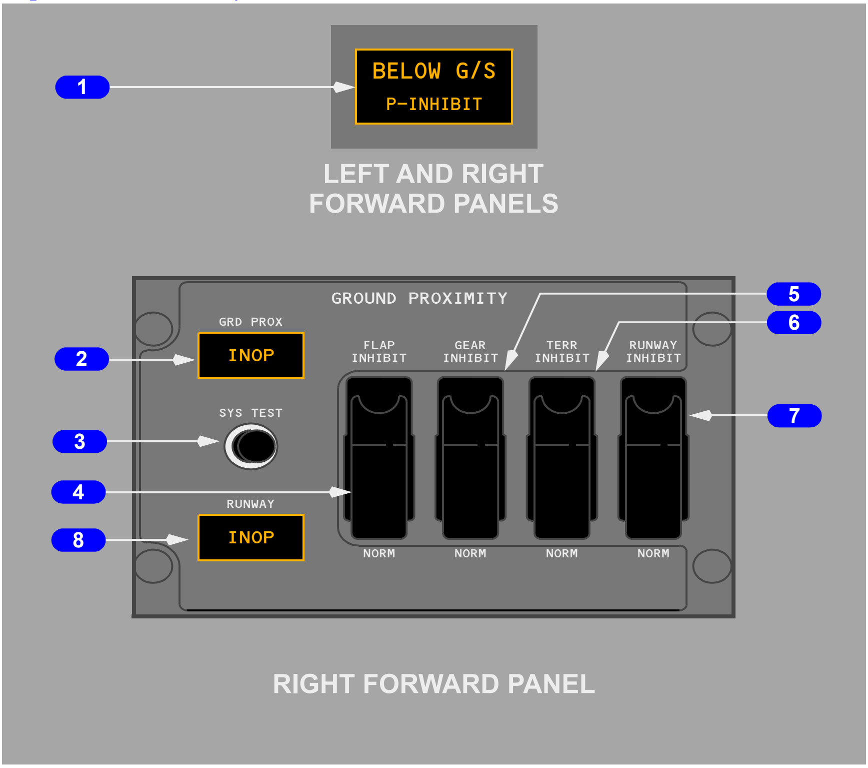
Ground Proximity Warning System (GPWS)
GPWS Controls

[Option - With gear inhibit switch]





[Option - With runway inhibit switch]



1 BELOW Glideslope (G/S) light

The BELOW G/S light illuminates when the GPWS senses excessive deviation below the ILS or GLS glideslope or the FMC generated flight path angle.

Illuminated (amber) – below glideslope alert is active.

Push – inhibits ground proximity GLIDESLOPE alert when below 1,000 feet radio altitude.

2 Inoperative (INOP) light

Illuminated (amber) – GPWS computer malfunction or power loss

- invalid inputs are being received from radio altimeter, ADIRU, ILS receiver, IRS, FMC, stall management computers, or EFIS control panel.

Note: In the event of a DEU failure, the GPWS INOP light will illuminate, and the EBAW/ROLL AUTHORITY aural alert will not function; however, the visual alert, if triggered, will be valid if displayed on the PFD and HUD.

3 Ground Proximity System Test (SYS TEST) Switch

Push –

- momentarily on ground:
  - BELOW G/S and GPWS INOP lights illuminate
  - TERR FAIL and TERR TEST annunciations show on navigation displays
  - PULL UP and WINDSHEAR alerts illuminate
  - "GLIDESLOPE," "PULL UP," and "WINDSHEAR" aurals sound
  - "TERRAIN TERRAIN PULLUP" aural sounds
  - terrain display test pattern shows on navigation displays
  - TERRAIN caution message shows on navigation displays.

  [Option - Peaks and Obstacles]
  - "OBSTACLE OBSTACLE PULLUP" aural sounds

  [Option - Runway Awareness and Advisory System]
  - Runway Awareness and Advisory System (RAAS) selected callouts sound.
  - "AIRSPEED LOW" aural sounds.
- until self-test aurals begin, on ground, above indications always occur first, followed by these additional aurals, as described in section 15-20:
  - radio altitude based alerts
  - bank angle alert
  - approach callouts
  - windshear alert
  - look ahead terrain alerts
- system test inhibited in-flight.

4 Ground Proximity FLAP INHIBIT Switch

FLAP INHIBIT – inhibits ground proximity TOO LOW FLAPS alert.

NORM (guarded position) – Normal TOO LOW FLAPS alert active.

[Option - With gear inhibit switch]

5 Ground Proximity GEAR INHIBIT Switch

GEAR INHIBIT – inhibits ground proximity TOO LOW GEAR alert.

NORM (guarded position) – Normal TOO LOW GEAR alert active.

6 Ground Proximity Terrain Inhibit (TERR INHIBIT) Switch

TERR INHIBIT – inhibits look–ahead terrain alerts and terrain display.

NORM (guarded position) – Normal terrain alerts and terrain display active.

[Option - With runway inhibit switch]

7 Ground Proximity Runway Inhibit (RUNWAY INHIBIT) Switch

Inhibits: In-air Overrun Warning, On-Ground Overrun Warning, and Speedbrake alert.

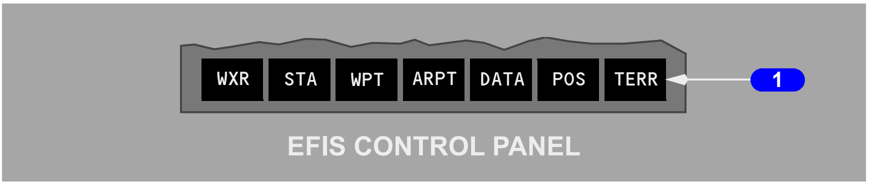
[Option - With runway inhibit switch]

8 Runway Inoperative (INOP) Light

Illuminated (amber) – One of the following occurs:

- GPS position accuracy is inadequate
- the airport is not in the GPWS database
- Ground Proximity Runway Inhibit Switch unreasonable: Airspeed 250 knots or greater for more than 60 seconds with Ground Proximity Runway Inhibit Switch in INHIBIT position.

GPWS Terrain Display Select Switch



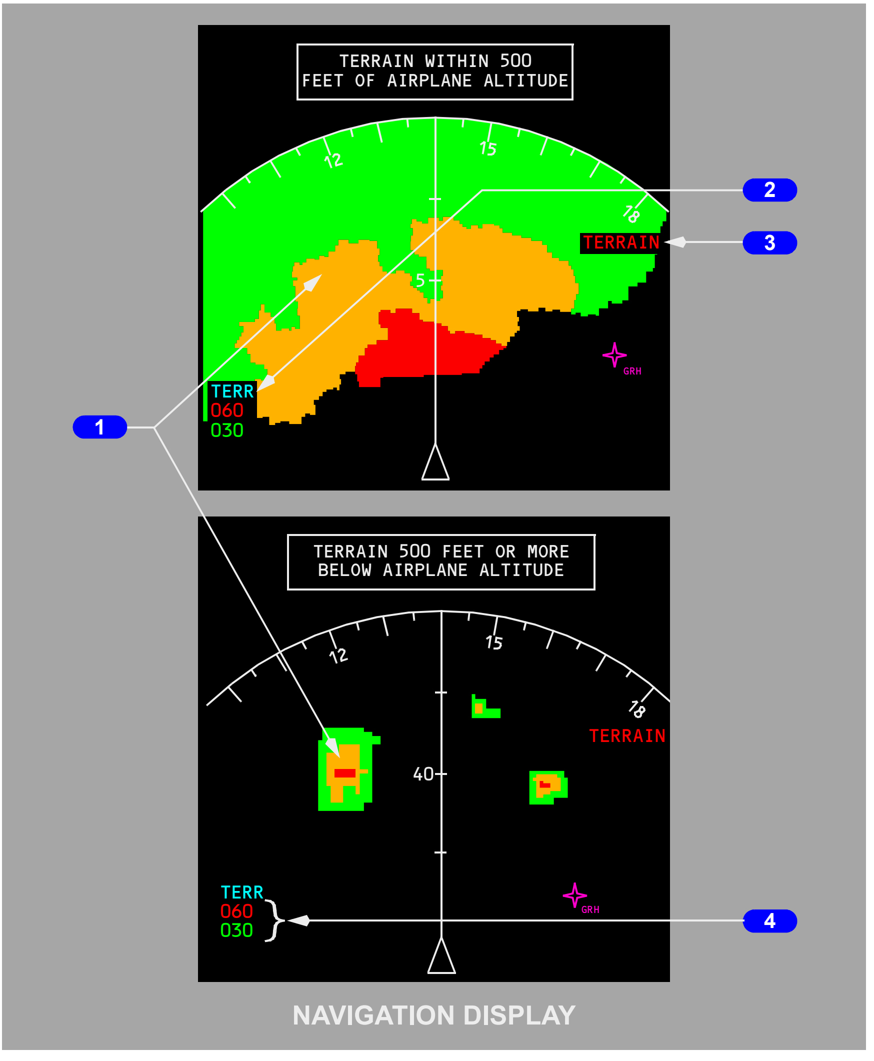
1 Terrain (TERR) Display Select Switch

Push –

- shows terrain data in expanded MAP, center MAP, expanded VOR, and expanded APP modes
- arms terrain data in PLN, center VOR, and center APP modes
- deselects weather radar display regardless of mode selector position
- second push deselects terrain display.

Terrain Display (PFD/ND)

[Option - PFD/ND]



1 Terrain Display

Graphical representation of surrounding terrain and obstacles.

When the airplane is **500 feet or more** above the highest terrain in the selected display range, terrain is depicted in green, and color density varies based on terrain elevation:

- Solid green: Highest elevation terrain
- High-density dotted green: Intermediate elevation terrain
- Low-density dotted green: Lowest elevation terrain
- Black: No significant terrain

When the airplane is **less than 500 feet** above the highest terrain in the selected display range, color and density vary based on terrain elevation vs. airplane altitude:

- Solid red: Look-ahead terrain warning active
- Solid amber: Look-ahead terrain caution active
- Dotted red: Terrain more than 2,000 feet above airplane's current altitude
- Dotted amber: Terrain 500 feet (250 feet with gear down) below to 2,000 feet above the airplane's current altitude
- Dotted green: Terrain from 2,000 feet below to 500 feet (250 feet with gear down) below the airplane's current altitude
- Black: No significant terrain
- Dotted magenta: No terrain data available

Note: In areas without terrain data, look-ahead terrain alerting and display functions are not available. Radio altitude based terrain alerts function normally.

Note: Terrain within 400 feet of the nearest airport runway elevation does not show.

Note: Terrain within 200 feet of the nearest airport runway elevation does not show.

Automatically shows when:

- a look-ahead terrain alert occurs, and
- neither pilot has the terrain display selected, and
- in expanded MAP, center MAP, expanded VOR, or expanded APP modes.

Updates with a display sweep, similar to weather radar display.

2 Terrain Mode Annunciation

TERR (cyan) – Terrain display enabled (manual or automatic display).

3 Look-Ahead Alert

Shows in all navigation display modes.

TERRAIN

- Red – look-ahead terrain warning alert active.
- Amber – look-ahead terrain caution alert active.

OBSTACLE

- Red – obstacle warning alert active.
- Amber – obstacle caution alert active.

4 TERR (Terrain) Elevation Number

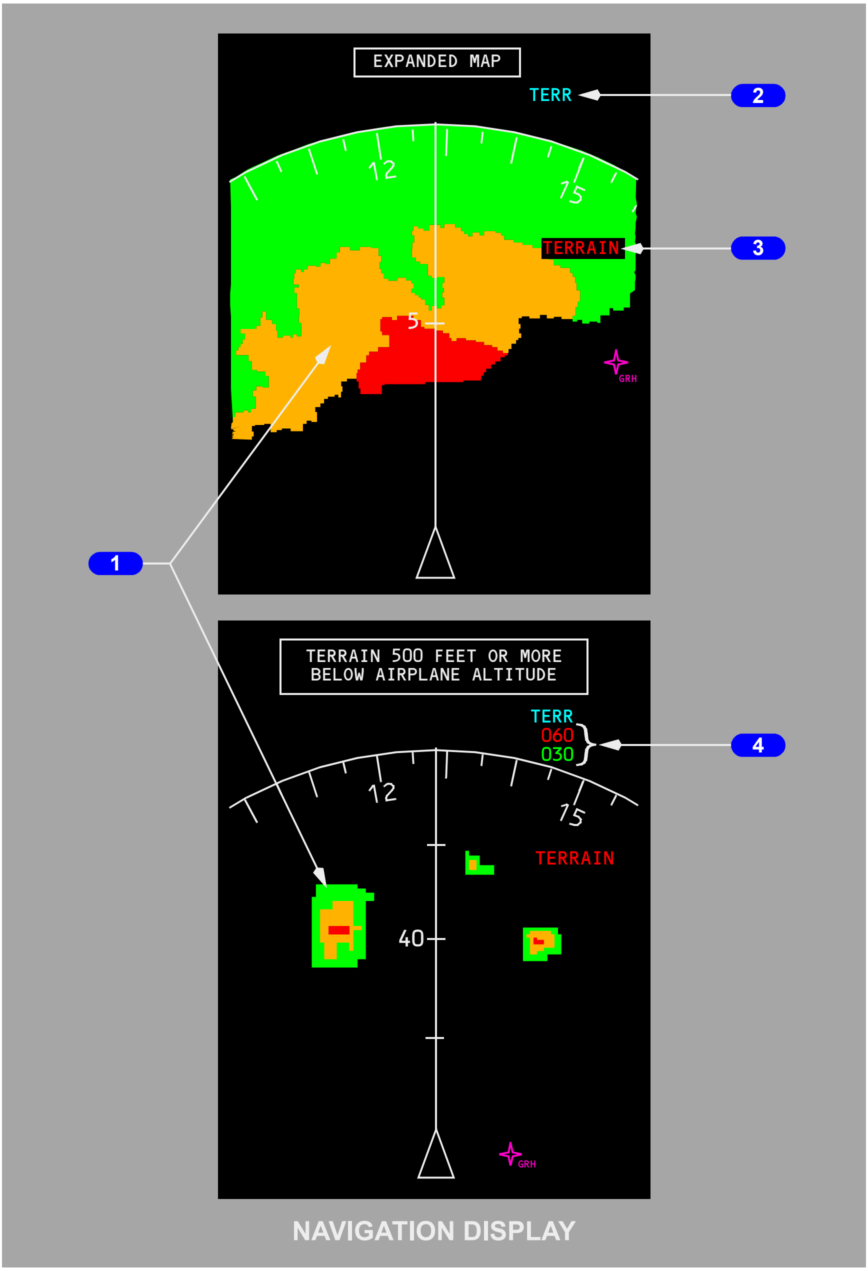
Displays elevation of highest and lowest terrain. The color of the elevation number corresponds to the terrain elevation:

- Green – terrain elevation is more than 500 ft below airplane altitude.
- Amber – terrain elevation is between 500 ft below and 2000 ft above airplane altitude
- Red – terrain elevation is more than 2000 ft above airplane altitude

Note: Values displayed are applicable to terrain that is generally ahead of the airplane flight path. Terrain near the left and right margins of the display may not be included in the calculations.

Terrain Display (EFIS/MAP)

[Option - EFIS/MAP]



1 Terrain Display

Graphical representation of surrounding terrain and obstacles.

When the airplane is **500 feet or more** above the highest terrain in the selected display range, terrain is depicted in green, and color density varies based on terrain elevation:

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When the airplane is **less than 500 feet** above the highest terrain in the selected display range, color and density vary based on terrain elevation vs airplane altitude:

- Solid red: Look-ahead terrain warning active
- Solid amber: Look-ahead terrain caution active
- Dotted red: Terrain more than 2,000 feet above airplane's current altitude
- Dotted amber: Terrain 500 feet (250 feet with gear down) below to 2,000 feet above the airplane's current altitude
- Dotted green: Terrain from 2,000 feet below to 500 feet (250 feet with gear down) below the airplane's current altitude
- Black: No significant terrain
- Dotted magenta: No terrain data available

Note: In areas without terrain data, look-ahead terrain alerting and display functions not available. Radio altitude based terrain alerts function normally.

Note: Terrain within 400 feet of the nearest airport runway elevation does not show.

Automatically shows when:

- a look-ahead terrain alert occurs, and
- neither pilot has the terrain display selected, and
- in expanded MAP, center MAP, expanded VOR, or expanded APP modes.

Updates with a display sweep, similar to weather radar display.

2 Terrain Mode Annunciation

TERR (cyan) – Terrain display enabled (manual or automatic display).

3 Look-Ahead Alert

Conflicts trigger both visual and aural messages. For an alert, the aural message is given 60 seconds and is repeated every 7 seconds until the aircraft clears the area. For a warning, the aural message is given 30 seconds ahead of the terrain/obstacle and is repeated continuously until the aircraft clears the conflicting terrain or obstacle.

Shows in all navigation display modes.

TERRAIN

- Red – look-ahead terrain warning alert active.
- Amber – look-ahead terrain caution alert active.

OBSTACLE

- Red – obstacle warning alert active.
- Amber – obstacle caution alert active.

4 TERR (Terrain) Elevation Number

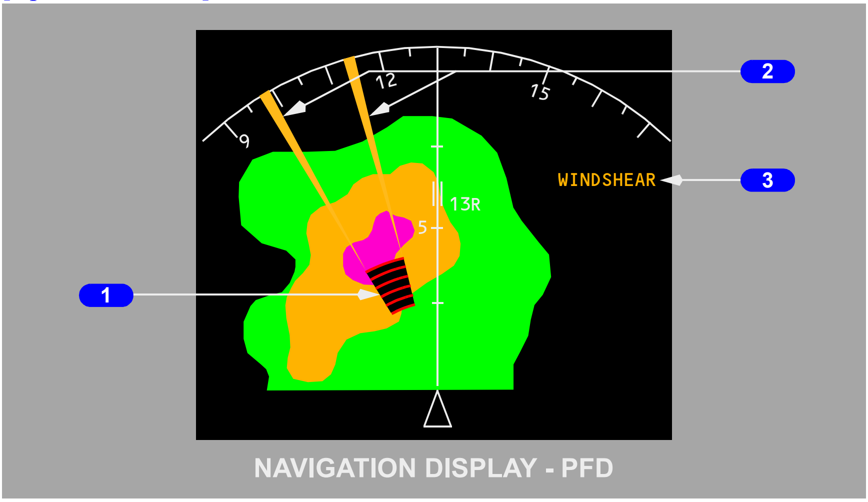
Displays elevation of highest and lowest terrain. The color of the elevation number corresponds to terrain elevation:

- Green – terrain elevation is more than 500 ft below airplane altitude.
- Amber – terrain elevation is between 500 ft below and 2000 ft above airplane altitude
- Red – terrain elevation is more than 2000 ft above airplane altitude

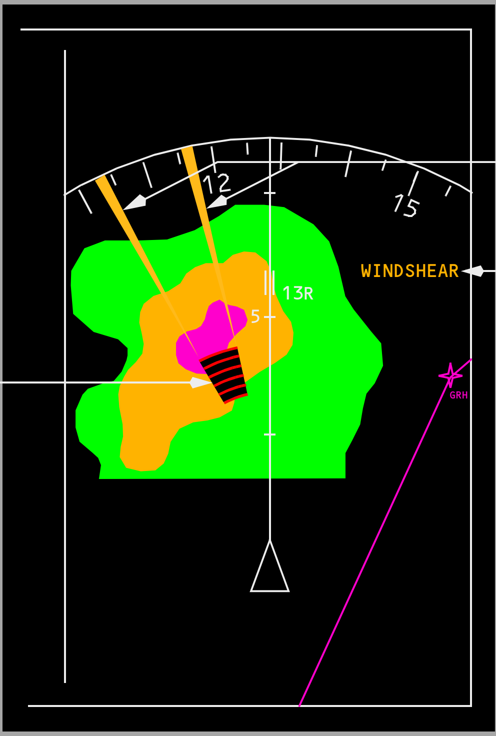
Note: Values displayed are applicable to terrain that is generally ahead of the airplane flight path. Terrain near the left and right margins of the display may not be included in the calculations.

Predictive Windshear Display and Annunciations

[Option - PFD/ND]



[Option - EFIS/MAP]



NAVIGATION DISPLAY - EFIS/MAP

1 Predictive Windshear Symbol

Displayed (red and black) – Predictive windshear alert active.

Shows windshear location and approximate geometric size (width and depth).

Symbol, radials, and weather radar returns automatically show when:

- predictive windshear alert occurs, and
- neither pilot has WXR display selected, and
- in expanded MAP, center MAP, expanded VOR, or expanded APP modes.

When terrain display is active, weather radar display replaces terrain display.

2 Predictive Windshear Symbol Radials

Displayed (amber) – Predictive windshear alert active.

Extend from predictive windshear symbol to help identify location of windshear event

3 WINDSHEAR Annunciation

WINDSHEAR (amber) – predictive windshear caution active.

WINDSHEAR (red) – predictive windshear warning active.

Shows in all navigation display modes.

TCAS Controls (Transponder Panel)

[Option - AlliedSignal 071-01503-2601 Transponder Panel]

[Option - Gables G6992-02 Transponder Panel]

1 Transponder Mode Selector

TA (traffic advisory) – enables the display of traffic advisory (TA) targets.

TA/RA (resolution advisory) – enables the display of traffic advisory (TA) and resolution advisory (RA) targets.

1 Transponder Mode Selector

TA (traffic advisory) ONLY – enables the display of traffic advisory (TA) targets.

TA/RA (resolution advisory) – enables the display of traffic advisory (TA) and resolution advisory (RA) targets.

Intentionally
Blank

Introduction

Aural, tactile and visual warning signals alert the flight crew to conditions requiring action or caution in the operation of the airplane. The character of the signals varies, depending upon the degree of urgency or hazards involved. Aural, tactile, and visual signals are used singularly or in combination to simultaneously provide both warnings and information regarding the nature of the condition.

Mach/airspeed warnings, landing gear warnings, takeoff configuration warnings, windshear warnings, and ground proximity warnings are discussed in this section. Cabin altitude warning is discussed in this section and in the Air Systems chapter, and autopilot and autothrottle disengage warnings are discussed in the Automatic Flight chapter. The conditions which excite the fire warning bell are discussed in the Fire Protection chapter.

Many of the flight instrument display symbols and annunciations listed in this chapter also appear on the Head-Up Display (HUD) System. Refer to Chapter 10, Flight Instruments, for HUD display symbol descriptions.

Conditions which require the immediate attention of the flight crew are indicated by red warning lights located in the area of the pilots' primary field of vision. These lights indicate engine, wheel well, cargo, or APU fires; autopilot, autothrottle disengages; and landing gear unsafe conditions.

Conditions which require the timely attention of the flight crew are indicated by amber caution lights.

Blue lights inform the flight crew of electrical power availability, valve position, equipment status, or ground communications. Blue lights are for information and do not require immediate flight crew attention. Some system blue lights indicate a transitional state by illuminating bright as valves or components reposition, then returning to a dim blue when the required configuration is reached.

Blue lights inform the flight crew of electrical power availability, valve position, equipment status, and flight attendant or ground communications. Blue lights are for information and do not require immediate flight crew attention. Some system blue lights indicate a transitional state by illuminating bright as valves or components reposition, then returning to a dim blue when the required configuration is reached.

Green lights indicate a fully extended configuration, e.g., landing gear and leading edge devices.

For specific information regarding red, amber, blue, and green lights refer to the appropriate systems chapters.

Stall warning is provided by a control column shaker on each control column.

Various aural signals call attention to warnings and cautions. An aural warning for airspeed limits is given by a clacker, the autopilot disengage by a warning tone, takeoff configuration and cabin altitude by an intermittent horn, and landing gear positions by a steady horn. The fire warning by a fire warning bell. Ground proximity warnings and alerts, and windshear warnings and alerts are given by voice warnings.

Generally, aurals automatically silence when the associated non–normal condition no longer exists.

Master Fire Warning Lights

Two master FIRE WARN lights illuminate when any fire warning condition occurs. The lights remain illuminated as long as the condition exists. Pushing either master FIRE WARN light or fire warning bell cutout switch extinguishes both lights, silences the fire warning bell and resets the system for future warnings. Further information appears in the Fire Protection chapter.

Master Caution Lights

Two MASTER CAUTION lights illuminate when any caution occurs outside the normal field of vision of the flight crew. The lights remain illuminated as long as the caution condition exists, or until the crew resets the system. Pushing either MASTER CAUTION light extinguishes both lights and resets the master caution system for further cautions. Pushing either annunciator light panel recalls all existing fault annunciations.

A single fault in certain redundant systems, also known as a "simple fault," does not illuminate the MASTER CAUTION and system annunciator lights. However, this type of fault is stored in the master caution system. Pushing the system annunciator recalls the simple fault on the system annunciator panel.

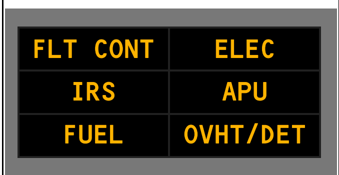
When the MASTER CAUTION recall is pressed, all twelve system lights should illuminate while the press-to-test feature is held. If a system annunciator light does not illuminate, refer to the Dispatch Deviation Guide (DDG).

System Annunciator Lights

Two system annunciator light panels are located on the glare shield. The annunciator light panels include only those systems located on the forward overhead, aft overhead, and fire control panels. If a caution condition exists, the appropriate system annunciator(s) and MASTER CAUTION lights illuminate.

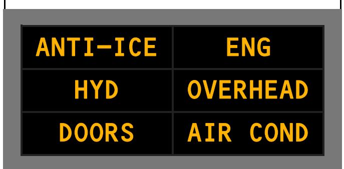
System Annunciators and Related Amber Lights – Left Side

[Option - 737-600/700/800/900]

FLT CONT		ELEC
LOW QUANTITY LOW PRESSURE FEEL DIFF PRESS SPEED TRIM FAIL MACH TRIM FAIL AUTO SLAT FAIL YAW DAMPER STBY RUD ON		DRIVE STANDBY PWR OFF TRANSFER BUS OFF SOURCE OFF TR UNIT BAT DISCHARGE ELEC
IRS	LEFT SIDE GLARESHIELD	APU
FAULT ON DC DC FAIL GPS ILS GLS		LOW OIL PRESSURE FAULT OVERSPEED
FUEL		OVHT/DET
LOW PRESSURE FILTER BYPASS		ENGINE 1 OVERHEAT ENGINE 2 OVERHEAT APU DET INOP

System Annunciators and Related Amber Lights – Right Side

[Option - 737-600/700]



RIGHT SIDE GLARESHIELD

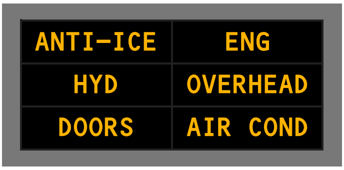
ANTI–ICE	ENG
WINDOW OVERHEAT PROBE HEAT COWL ANTI–ICE	REVERSER EEC ALTN MODE ENGINE CONTROL
HYD	**OVERHEAD**
OVERHEAT LOW PRESSURE	EQUIP COOLING–OFF EMER EXIT LIGHTS–NOT ARMED FLIGHT RECORDER–OFF PASS OXY–ON PSEU ELT LAVATORY–SMOKE
DOORS	**AIR COND**
FWD/AFT ENTRY EQUIP FWD/AFT CARGO FWD/AFT SERVICE LEFT/RIGHT OVERWING	DUAL BLEED WING–BODY OVERHEAT BLEED TRIP OFF AUTO FAIL OFF SCHED DESCENT DUCT OVERHEAT PACK TRIP OFF HIGH ALTITUDE LANDING - INOP

[Option - 737-800/900]

ANTI–ICE		ENG
WINDOW OVERHEAT PROBE HEAT COWL ANTI–ICE ICE DETECTOR		REVERSER EEC ALTN MODE ENGINE CONTROL
HYD		OVERHEAD
OVERHEAT LOW PRESSURE	 RIGHT SIDE GLARESHIELD	EQUIP COOLING–OFF EMER EXIT LIGHTS–NOT ARMED FLIGHT RECORDER–OFF PASS OXY–ON PSEU SPSEU LAVATORY–SMOKE

DOORS		AIR COND
FWD/AFT ENTRY		DUAL BLEED
FWD ENTRY		WING–BODY OVERHEAT
EQUIP		BLEED TRIP OFF
FWD/AFT CARGO		AUTO FAIL
FWD/AFT SERVICE		OFF SCHED DESCENT
FWD SERVICE		ZONE TEMP
LEFT/RIGHT OVERWING		PACK
[Option - 737-900ER With Mid Cabin Exit Doors Activated] LEFT/RIGHT MID EXIT		HIGH ALTITUDE LANDING - INOP
MAIN CARGO		
AIRSTAIR		

[Option - 737-800/900, ICE DETECTOR, AIRSTAIR, ELT, HIGH ALTITUDE LANDING - INOP, lavatory SMOKE detector, and LEFT/RIGHT MID EXIT annunciation for 737-900ER with mid cabin exit doors activated]

ANTI–ICE		ENG
WINDOW OVERHEAT PROBE HEAT COWL ANTI–ICE ICE DETECTOR		REVERSER EEC ALTN MODE ENGINE CONTROL
HYD		OVERHEAD
OVERHEAT LOW PRESSURE	 RIGHT SIDE GLARESHIELD	ELT EQUIP COOLING–OFF EMER EXIT LIGHTS–NOT ARMED FLIGHT RECORDER–OFF PASS OXY–ON PSEU SMOKE
DOORS		AIR COND
FWD/AFT ENTRY AIRSTAIR EQUIP FWD/AFT CARGO FWD/AFT SERVICE LEFT/RIGHT OVERWING LEFT/RIGHT MID EXIT		ZONE TEMP DUAL BLEED PACK WING–BODY OVERHEAT BLEED TRIP OFF AUTO FAIL OFF SCHED DESCENT HIGH ALTITUDE LANDING - INOP

Warning Systems
Intermittent Cabin Altitude/Configuration Warning

Takeoff configuration warning is armed when the airplane is on the ground and either or both forward thrust levers are advanced for takeoff. Takeoff configuration warning activates if:

- trailing edge flaps are not in the flaps 1 through 25 takeoff range, or
- trailing edge flaps are in a skew or asymmetry condition, or have uncommanded motion, or
- leading edge devices are not configured for takeoff or have uncommanded motion, or
- speed brake lever is not in the DOWN position, or
- spoiler control valve is open providing pressurized hydraulic fluid to the ground spoiler interlock valve, or
- parking brake is set, or
- main deck cargo door not secure, or
- stabilizer trim not set in the takeoff range.

An intermittent warning horn sounds and the TAKEOFF CONFIG warning light illuminates when takeoff configuration warning activates.

Cabin altitude warning activates when cabin altitude exceeds 10,000 feet. An intermittent warning horn sounds and the CABIN ALTITUDE warning light illuminates. The warning horn may be silenced by momentarily pressing the ALT HORN CUTOUT switch on the Cabin Altitude Panel. The warning light remains illuminated until the cabin altitude descends below 10,000 feet.

If the High Altitude Landing Switch is selected ON, cabin altitude warning activates when the cabin altitude exceeds 14,000 feet. All other characteristics of cabin altitude warning remain the same.

WARNING: The Cabin Altitude and Takeoff Configuration Warnings use the same intermittent tone when activated.

Landing Gear Configuration Warnings

Visual indications and aural warnings of landing gear position are provided by the landing gear indicator lights and landing gear warning horn.

Visual Indications

The landing gear indication lights are activated by signals from each gear, the LANDING GEAR lever, and the forward thrust lever position as follows:

Green light illuminated – landing gear is down and locked.

Red light illuminated –

- landing gear is in disagreement with LANDING GEAR lever position (in transit or unsafe)
- landing gear is not down and locked (with either or both forward thrust levers retarded to idle, and below 800 feet AGL)

All lights extinguished – landing gear is up and locked with the LANDING GEAR lever UP or OFF.

Aural Indications

A steady warning horn is provided to alert the flight crew whenever a landing is attempted and any gear is not down and locked. The landing gear warning horn is activated by forward thrust lever and flap position as follows:

Flaps up through 10 –

- altitude below 800 feet RA, when either forward thrust lever set between idle and approximately 20 degrees thrust lever angle, or an engine is not operating and the other thrust lever is less than 34 degrees. The landing gear warning horn can be silenced (reset) with the landing gear warning HORN CUTOUT switch
- if the airplane descends below 200 feet RA, the warning horn cannot be silenced by the warning HORN CUTOUT switch

Flaps 15 through 25 –

- either forward thrust lever set below approximately 20 degrees, or an engine not operating and the other thrust lever is less than 34 degrees. The landing gear warning horn cannot be silenced with the landing gear warning HORN CUTOUT switch

Flaps greater than 25 –

- regardless of forward thrust lever position. The landing gear warning horn cannot be silenced with the landing gear warning HORN CUTOUT switch

The warning indication is cancelled when the configuration error is corrected.

Proximity Switch Electronic Unit (PSEU)

The PSEU monitors the following systems:

- takeoff configuration warnings
- landing configurations warnings
- landing gear
- air/ground sensing

The PSEU, its sensors, and its input signals are monitored for internal faults. When designated faults are detected, a PSEU light on the aft overhead panel illuminates, and the OVERHEAD system annunciator light and MASTER CAUTION lights illuminate. The PSEU light can be reset following a maintenance BITE check or repair of the cause of the fault.

The PSEU light is inhibited:

- in flight
- when the thrust levers are advanced toward takeoff power
- for 30 seconds after landing

Mach/Airspeed Warning System

Two independent Mach/airspeed warning systems provide a distinct aural warning, a clacker, any time the maximum operating airspeed of Vmo/Mmo is exceeded. The warning clackers can be silenced only by reducing airspeed below Vmo/Mmo.

[Option - Airspeed Indicator, PFD/ND]
The airspeed indicator displays red and black warning bands indicating maximum and minimum allowable airspeed. The ends of the amber bands indicate maximum and minimum maneuver speeds.

[Option - Airspeed Indicator, EFIS/MAP]
The airspeed indicator displays a red and white warning band indicating maximum allowable airpseeds, and a red warning band indicating minimum allowable airspeed. The ends of the amber bands indicate maximum and minimum maneuver speeds.

When either an overspeed condition or a system test occurs, the ADIRU transmits a signal to the aural warning module, sounding the clacker. The system can only be tested on the ground.

Stall Warning System

Natural stall warning (buffet) usually occurs at a speed prior to stall. In some configurations the margin between stall and natural stall warning is less than desired. Therefore, an artificial stall warning device, a stick shaker, is used to provide the required warning.

The stall warning “stick shaker” consists of two eccentric weight motors, one on each control column. They are designed to alert the pilots before a stall develops. The warning is given by vibrating both control columns. The system is armed in flight at all times. The system is deactivated on the ground.

Two independent, identical stall management yaw damper (SMYD) computers determine when stall warning is required based upon:

- alpha vane angle of attack outputs
- ADIRU outputs
- anti–ice controls
- wing configurations
- air/ground sensing
- thrust

The SMYD computers provide outputs for all stall warning to include stick shaker and signals to the pitch limit indicator and airspeed displays and the GPWS windshear detection and alert.

Two test switches are installed in the aft overhead panel. Pushing either of these initiates a self–test of the respective stall warning channel. The No.1 activates the Captain stick shaker, and the No. 2 activates the F/O stick shaker. Either stick shaker vibrates both columns through column interconnects.

Autoland Advisory Messages

[Option – Fail-Operational Autoland Capability]

When a system failure is detected that affects autoland status, an advisory message is displayed on the engine display. Two advisories, NO LAND 3 and NO AUTOLAND, are available. Only one advisory message can be displayed at one time. A cancel/recall switch, located on the MFD panel, removes the advisory message when displayed and recalls the advisory message when it is not displayed. A RECALL annunciation in white will be displayed when the C/R button is pressed and for 1 second after button release during a recall.

The NO LAND 3 advisory will be annunciated when a failure has occurred above Alert Height and the system is still capable of continuing to a safe landing. With this advisory, LAND 2 will be the resulting autoland status annunciation displayed following dual autopilot engagement on approach.

The NO AUTOLAND advisory is displayed any time above the Alert Height to notify the crew a failure has occurred and the system is unable to perform an automatic landing.

Altitude Alerting System

Altitude alerting occurs when approaching or departing the MCP–selected altitude. Altitude alerting is inhibited when trailing edge flaps are extended to 25 or greater, or while G/S is captured.

PFD/ND

Acquisition Alerting

[Option - PFD/ND, 300/900 altitude alert]
900 feet before reaching the selected altitude, a white box shows around the selected altitude display and the box around the current altitude becomes bold. A momentary tone sounds. At 300 feet from selected altitude, the selected altitude box no longer shows.

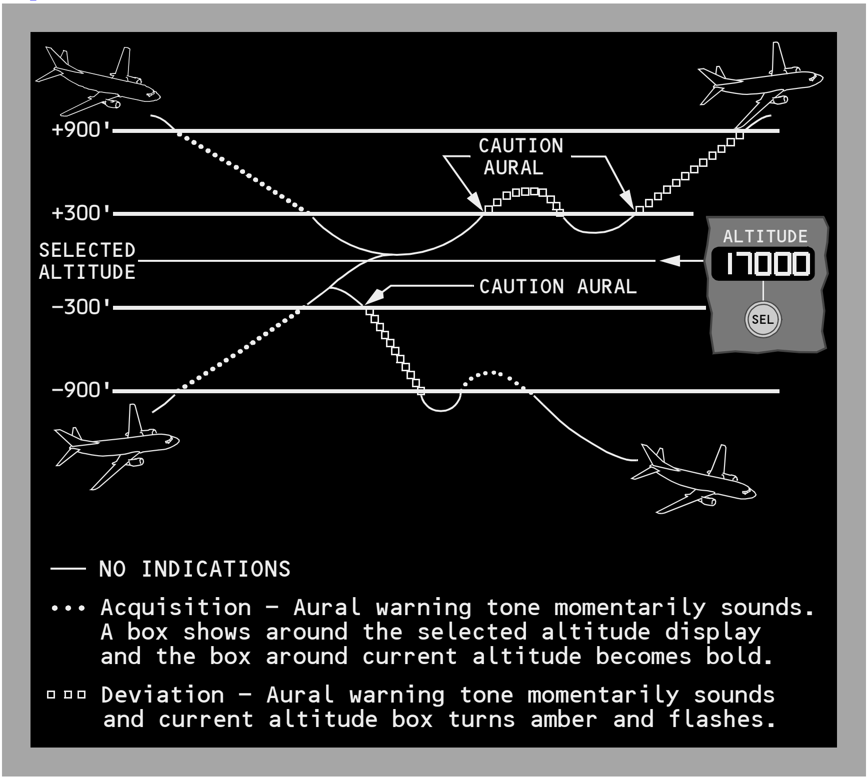
Deviation Alerting

[Option - PFD/ND, 300/900 altitude alert]
When deviating by 300 feet from the selected altitude, a momentary tone sounds and the current altitude box turns amber and begins to flash. The amber flashing continues until:

- altitude deviation becomes less than 300 feet
- altitude deviation becomes more than 900 feet
- a new altitude is selected

Altitude Alert Profile

[Option - PFD/ND, 300/900 altitude alert]



EFIS/MAP Displays

Acquisition Alerting

[Option - EFIS/MAP, 300/900 altitude alert]
900 feet before reaching the selected altitude, both ALT ALERT annunciations show and a momentary tone sounds. At 300 feet from selected altitude, the ALT ALERT annunciations no longer show.

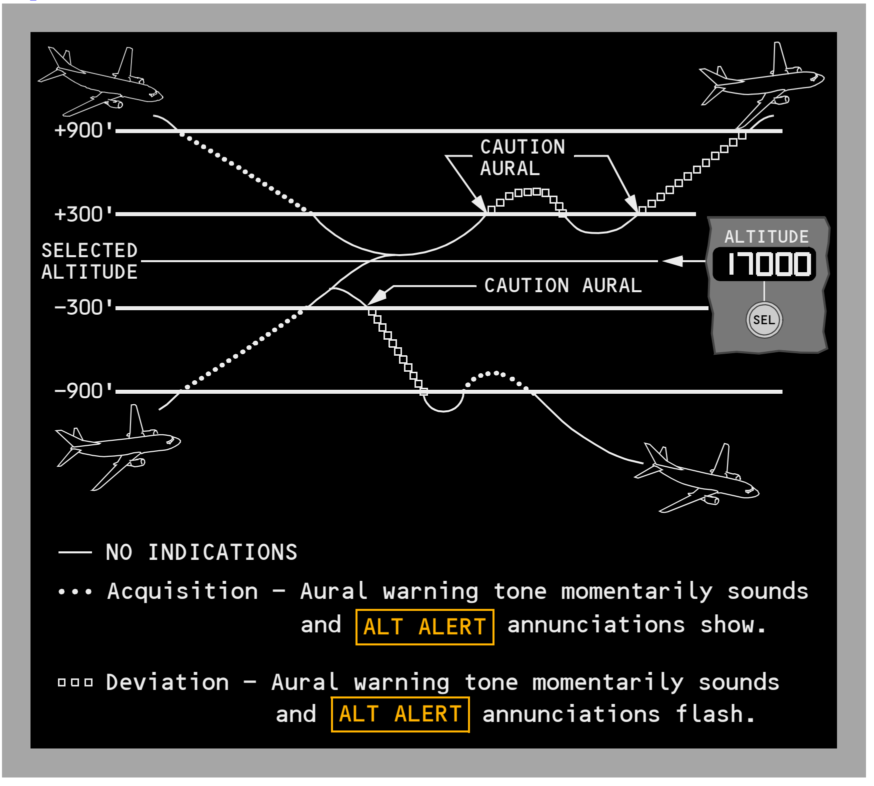
Deviation Alerting

[Option - EFIS/MAP, 300/900 altitude alert]
When deviating by 300 feet from the selected altitude, a momentary tone sounds and the ALT ALERT annunciations flash. Flashing continues until:

- altitude deviation becomes less than 300 feet
- altitude deviation becomes more than 900 feet
- a new altitude is selected

Altitude Alert Profile

[Option - EFIS/MAP, 300/900 altitude alert]



Ground Proximity Alerts

The GPWS provides alerts for potentially hazardous flight conditions involving imminent impact with the ground.

The GPWS provides alerts based on radio altitude and combinations of barometric altitude, airspeed, glideslope deviation, and airplane configuration. The alerts are for:

- excessive descent rate
- excessive terrain closure rate
- altitude loss after takeoff or go-around
- unsafe terrain clearance when not in the landing configuration
- excessive deviation below the ILS or GLS glideslope or the FMC generated flight path angle

[Option - IAN]
- excessive deviation below glide path

These alerts are “radio altitude based alerts.”

In addition to providing the functions of the basic GPWS, the EGPWS monitors terrain proximity using an internal worldwide terrain data base. Proximate terrain data shows on the navigation display. If there is a potential terrain conflict, alerts are provided based on estimated time to impact. These alerts are “look-ahead terrain alerts.”

Ground proximity alerts are accompanied by voice aural alerts and the PULL UP annunciation on the attitude indicators or, for deviation below glideslope alert, the BELOW G/S light.

Note: Terrain ahead of the airplane may exceed available climb performance. A ground proximity alert does not guarantee terrain clearance.

Look-ahead terrain alerts and radio altitude based alerts are prioritized based on the level of hazard and the required flight crew reaction time. Look-ahead terrain alerts and radio altitude based alerts are inhibited by an actual windshear warning (airplane in windshear).

Look–Ahead Terrain Alerting

The EGPWS terrain data base contains detailed terrain data near major airports, and data in lesser detail for areas between airports. Terrain within 2,000 feet of airplane barometric altitude shows on the navigation display. The terrain data is not designed to be an independent navigation aid.

The terrain display is generated from a data base contained in the EGPWS computer and correlated to GPS position.

Terrain and weather radar cannot show together on a display. If one pilot selects terrain and the other pilot selects weather radar, each display updates on alternating sweeps. All other displays (TCAS, LNAV routing, etc.) can show with terrain data.

Look-ahead terrain alerts are based on the airplane’s position, barometric altitude, vertical flight path, and ground speed.

Look Ahead Terrain Alerts

AURAL ALERT	VISUAL ALERT	DESCRIPTION
TERRAIN TERRAIN, PULL UP	PULL UP on both attitude indicators Red TERRAIN message on navigation display (all modes) Solid red terrain on navigation display	20 to 30 seconds from projected impact with terrain shown solid red on the navigation display (in expanded MAP, center MAP, expanded VOR, or expanded APP modes only). Moving the ground proximity terrain inhibit switch to TERRAIN INHIBIT inhibits the alert.
CAUTION TERRAIN	Amber TERRAIN message on navigation display (all modes) Solid amber terrain on navigation displays	40 to 60 seconds from projected impact with terrain shown solid amber on the navigation display (in expanded MAP, center MAP, expanded VOR, or expanded APP modes only). Moving the ground proximity terrain inhibit switch to TERRAIN INHIBIT inhibits the alert.
TOO LOW, TERRAIN	PULL UP on both attitude indicators	Descent below unsafe altitude while too far from any airport in the terrain database. Moving the ground proximity terrain inhibit switch to TERRAIN INHIBIT inhibits the alert.

Radio Altitude Based Alerts

AURAL ALERT	VISUAL ALERT	DESCRIPTION
PULL UP	PULL UP on both attitude indicators	Follows SINK RATE alert if excessive descent rate continues or increases. Follows radio altitude based TERRAIN alert if excessive terrain closure rate continues and landing gear and/or flaps are not in landing configuration.
TERRAIN	PULL UP on both attitude indicators	Excessive terrain closure rate.
DON’T SINK	PULL UP on both attitude indicators	Excessive altitude loss after takeoff or go–around.
GLIDESLOPE	BELOW G/S P–INHIBIT lights	Deviation below glideslope. Volume and repetition rate increase as deviation increases. Deviation below glideslope or glide path. Volume and repetition rate increase as deviation increases. Pushing the ground proximity BELOW G/S P-INHIBIT light cancels or inhibits the alert below 1,000 feet RA.
SINK RATE	PULL UP on both attitude indicators	Excessive descent rate.
TOO LOW, FLAPS	PULL UP on both attitude indicators	Unsafe terrain clearance at low airspeed with flaps not in a normal landing position. Pushing the ground proximity flap inhibit switch to FLAP INHIBIT inhibits the alert.
TOO LOW, GEAR	PULL UP on both attitude indicators	Unsafe terrain clearance at low airspeed with landing gear not down. Pushing the ground proximity gear inhibit switch to GEAR INHIBIT inhibits the alert.

AURAL ALERT	VISUAL ALERT	DESCRIPTION
TOO LOW, TERRAIN	PULL UP on both attitude indicators	Unsafe terrain clearance at high airspeed with either landing gear not down or flaps not in landing position. Follows DON'T SINK if another descent is initiated after initial alert, before climbing to the altitude where the initial descent began.

Obstacle Alerts

Obstacle display and alerting provides caution and warning level alerts for man-made obstacles 100 feet and higher.

Aural Alert	Visual Alert	Description
OBSTACLE OBSTACLE, PULL UP	PULL UP on both attitude indicators Red OBSTACLE message on ND (all modes) Solid red terrain on ND	20 to 30 seconds from projected impact with obstacle shown solid red on the ND (in MAP, MAP CTR, VOR, or APP modes only). Moving the ground proximity terrain inhibit switch to TERRAIN INHIBIT inhibits the alert.
CAUTION OBSTACLE	Amber OBSTACLE message on ND (all modes) Solid amber terrain on ND	40 to 60 seconds from projected impact with obstacle shown solid amber on the ND (in MAP, MAP CTR, VOR, or APP modes only). Moving the ground proximity terrain inhibit switch to TERRAIN INHIBIT inhibits the alert.

Runway Awareness and Advisory System (RAAS)

[Option - With Boeing RAAS]

System Overview

The Runway Awareness and Advisory System (RAAS) is an enhancement to the GPWS system. RAAS provides aural callouts along with visual alerts on the Navigation Display (ND) to assist the flight crew with situational awareness during ground operations, approach to landing, and go-around.

RAAS requires the following databases or systems for proper operation:

- terrain and airport runway database is in the GPWS computer,
- airplane is on or approaching an airport in the RAAS airport runway database,
- global positioning system (GPS) and other required signals are available and accuracy meets minimum requirements

When enabled, RAAS operates without any action required from the flight crew. If desired, RAAS availability can be verified on the ground. There is no automatic display of RAAS functionality.

RAAS callouts and alerts may be inhibited by the Runway Inhibit switch. To alert the crew, the RUNWAY INOP Light will illuminate if the Runway Inhibit switch is in the "INHIBIT" position and the airspeed has been 250 knots or greater for at least 60 seconds.

Callouts, Alerts and ND Messages During Taxi and Takeoff on RAAS Airports

Callouts, Alerts and ND Messages	Description
Callout: CAUTION ON TAXIWAY, ON TAXIWAY ND amber message: ON TAXIWAY	[Option - Taxiway T/O ALERT] Sounds once each time the airplane: • is on a surface other than a runway, and • ground speed is greater than 40 knots
APPROACHING (RUNWAY IDENTIFIER of runway end closest to airplane position)	[Option - Approaching Rwy Callout] Sounds once each time the airplane: • approaches a runway, and • ground speed is less than 40 knots
APPROACHING RUNWAYS	Sounds once each time the airplane: • approaches two runways within 20 degrees of each other, and • ground speed is less than 40 knots
ON RUNWAY (RUNWAY IDENTIFIER)	[Option - On Rwy Callout] Sounds once when the airplane:: • enters a runway, and • heading is within 20 degrees of the runway heading

Callouts, Alerts and ND Messages	Description
ON RUNWAY (RUNWAY IDENTIFIER) (LENGTH) REMAINING	[Option - Insufficient Rwy Length on GND Callout] Sounds once when the airplane:: • enters a runway with available runway length for takeoff less than the defined length required, and • heading is within 20 degrees of the runway heading
ON RUNWAY (RUNWAY IDENTIFIER)	[Option - Extended Holding on Rwy Callout Feet] Sounds when the airplane: • remains on the runway, and • moves less than 100 feet after entering runway, and • heading is within 20 degrees of the runway heading
Voice annunciation: CAUTION SHORT RUNWAY, SHORT RUNWAY ND amber message: SHORT RUNWAY	[Option - Insufficient Rwy Length T/O ALERT] Sounds once when the airplane:: • is on a runway with available runway length for takeoff less than the defined length required, and • heading is within 20 degrees of the runway heading, and • ground speed is greater than 40 knots

Callout, Alerts and ND Messages During Approach, Landing, Go-Around, and RTO on RAAS Airports

Voice Callouts, Alerts and ND Messages	Description
APPROACHING (RUNWAY IDENTIFIER)	[Option - Approaching Rwy In Flt Callout] Sounds once each time the airplane: • approaches within three nautical miles of a runway threshold, and • is within 20 degrees of the runway heading, and • is within approximately 200 feet plus one runway width of the runway extended center line, and • is between 750 feet and 300 feet field elevation The callout is inhibited between 550 and 450 feet above field elevation. When the airplane descends below 450 feet, the callout will be annunciated.
APPROACHING RUNWAYS	Sounds once each time the description is met while approaching two runways.
APPROACHING (RUNWAY IDENTIFIER) (LENGTH) AVAILABLE	[Option - Distance Remaining Landing, In Flt Callout] Sounds once each time the airplane: • approaches within three nautical miles of a runway threshold with available runway length for takeoff less than the defined length required, and • is within 20 degrees of the runway heading, and • is within approximately 200 feet plus one runway width of the runway extended center line, and • is between 750 feet and 300 feet above field elevation The callout is inhibited between 550 and 450 feet above runway elevation. When the airplane descends below 450 feet, the callout will annunciate the distance available.

Voice Callouts, Alerts and ND Messages	Description
Callout: CAUTION SHORT RUNWAY, SHORT RUNWAY ND amber message: SHORT RUNWAY	[Option - Approaching Short Rwy In Flt ALERT] Sounds once each time the airplane: • approaches within three nautical miles of a runway threshold with available runway length for takeoff less than the defined length required, and • is within 20 degrees of the runway heading, and • is within approximately 200 feet plus one runway width of the runway extended center line, and • is between 450 feet and 300 feet above field elevation
(FEET) REMAINING	[Option - Distance Remaining RTO Callout] Sounds during RTO when the airplane is on the ground: • is on a defined minimum length from the runway end • with ground speed greater than 40 knots, and • after ground speed decreases by seven knots from the maximum ground speed achieved

	[Option - Distance Remaining Go-around Callout]
	Sounds once each time the airplane is:
	• over a defined minimum length from the runway end, and:
	    • during rollout with airspeed less than 40 knots, or
	    • during go-around when less than 100 feet above the ground
	During go-around after the callout REMAINING sounds, the callouts continue to sound until the airplane is:
	• higher than 100 feet above the runway, or
	• rate of climb is greater than 450 feet per minute

Voice Callouts, Alerts and ND Messages	Description
ONE HUNDRED REMAINING	[Option - Runway End, 100 FT Callout] Sounds once each time the airplane: • is within 20 degrees of the runway heading, and • is within 100 feet of the end of a runway, and • ground speed is less than 40 knots

Assumptions, Limitations and Constraints

Defined nominal runway length for landing and advisory hold times are options specified by an operator.

In flight callouts and alerts are based on an algorithm that numerically subtracts the landing runway touchdown zone elevation in the GPWS database from the pressure altitude of the airplane. The term "above field elevation" is used in the system description for these altitudes.

Note:

- RAAS callouts and alerts are based on RAAS airport runway database details and GPS position
- RAAS does not include knowledge of ATC clearances or flight crew intent
- RAAS does not take into account airplane performance factors such as airplane weight, wind, runway conditions, slope, air temperature, or airport altitude
- absence of a RAAS annunciation does not ensure that the that a runway is appropriate for takeoff or landing
- RAAS annunciations do not ensure that a runway can, or cannot, be safely used for takeoff or landing
- The Flight Crew is responsible by other means to ensure correct runway selection. RAAS does not include knowledge of Notice to Airmen (NOTAM) or Automatic Terminal Information Service (ATIS)
- RAAS callouts and alerts are not intended for navigation purposes
- RAAS is not designed to enhance traffic awareness

RAAS callouts and alerts have a lower priority than any GPWS alert, including Radio Altitude callouts. Some may reoccur, depending on airplane position, when the higher priority advisory clears.

In-Air Overrun Warning

The In-Air Overrun Warning alerts the flight crew that an overrun is likely to occur if the approach and landing is continued, based upon the airplane's energy state, the pilot-entered runway condition, and the remaining available landing distance. The alert is armed from500 feet above the runway touchdown zone elevation (TDZE) until airplane touchdown.

The alert consists of a GO AROUND visual alert shown on the Primary Flight Display (PFD), and an "OVERRUN, GO AROUND" aural alert. The aural alert will repeat one time under the following conditions:

- Height above the TDZE is 150 feet or less, and
- the alert condition has been true for at least seven seconds

The Enhanced Ground Proximity Warning System (EGPWS) continually computes a predicted landing distance. The in-flight overrun alert activates when the predicted landing distance exceeds the distance to the end of the runway. The distance to the end of the runway is based on the EGPWS runway database and the airplane’s position.

The in-flight overrun alert is inhibited when any of the following conditions are true:

- Height above TDZE is greater than 500 feet;
- the air/ground signal indicates the airplane is on the ground;
- at altitudes greater than 50 feet above TDZE, the descent rate decreases to less than 300 feet per minute for at least two seconds (the airplane is no longer descending on the approach);
- a landing runway has not been identified by the EGPWS;
- the airplane’s position accuracy is insufficient;
- the Runway Inhibit switch on the GPWS control panel is in the INHIBIT position;
- left or right thrust lever is set to at least maximum climb thrust (a go-around has been initiated);
- left or right thrust lever is set to idle position, and left or right reverse thrust lever is approaching the reverse idle detent (the thrust reversers are about to be deployed);
- the flaps are not set to 15, 30 or 40 degrees (flaps are not set for landing);
- the radio altitude is less than 0 feet

On-Ground Overrun Warning

The On-Ground Overrun Warning alerts the flight crew that they must immediately apply maximum manual braking and maximum reverse thrust consistent with conditions, to stop the airplane by the end of the runway. The alert is armed from three seconds after touchdown until the airplane slows below 20 knots ground speed, or comes within 1000 feet of the runway end.

The alert consists of a MAX REVERSE visual alert shown on the Primary Flight Display (PFD), and a "MAX BRAKES, MAX REVERSE" aural alert. The MAX REVERSE visual alert is removed when the airplane slows below 20 knots groundspeed. The aural alert will only sound once.

The Enhanced Ground Proximity Warning System (EGPWS) continually computes a maximum effort stopping distance. The on-ground overrun alert activates when the maximum effort stopping distance exceeds the distance to the end of the runway. The distance to the end of the runway is based on the EGPWS runway database and the airplane's position.

The on-ground overrun alert is inhibited when any of the following conditions are true:

- Airplane heading differs from the runway heading by more than 20 degrees for more than one second;
- the air/ground signal indicates the airplane is in the air;
- the ground speed is less than 45 knots;
- the distance remaining to the end of the runway is less than 1000 feet;
- the airplane's position accuracy is insufficient;
- the Runway Inhibit switch on the GPWS control panel is in the INHIBIT position;
- left or right thrust lever is above the idle position (the airplane is conducting an initial takeoff, or a go-around will be initiated);
- the flap setting is not 15, 30 or 40 degrees (the flaps are not set in a landing configuration);
- the radio altitude is 10 feet or greater

SPEEDBRAKE Warning

The speedbrake alert provides a time-critical warning when speedbrakes are not deployed during a landing or rejected takeoff above 80 knots.

The alert consists of a SPEEDBRAKE visual alert shown on the Primary Flight Display (PFD), and a "SPEEDBRAKE, SPEEDBRAKE" aural alert. The aural alert does not repeat.

The Enhanced Ground Proximity Warning System (EGPWS) monitors the position of spoiler panels 4 and 9. The SPEEDBRAKE warning alert activates when spoiler panels 4 and 9 are less than halfway up 1.5 seconds after touchdown. In addition, SPEEDBRAKE warning alert activates when spoiler panels 4 and 9 are less than halfway up 3 seconds after the initiation of a RTO above 80 knots.

The speedbrake alert is inhibited if Hydraulic System A has low pressure (spoiler panels 4 and 9 are powered by Hydraulic System A).

Windshear Alerts

Windshear alerts are available during takeoff, approach, and landing:

- The GPWS provides a warning when the airplane is in a windshear
- The weather radar provides alerts for excessive windshear ahead of the airplane. These are “predictive windshear alerts”

Windshear warnings are accompanied by a red WINDSHEAR message on the attitude indicators, NDs and voice aural alerts.

Windshear cautions are accompanied by a amber WINDSHEAR message on the NDs and the MONITOR RADAR DISPLAY aural alert.

Windshear alerts are prioritized based on the level of hazard and the required flight crew reaction time. Predictive windshear alerts are inhibited by an actual windshear warning (airplane in windshear), look-ahead terrain alerts, or radio altitude based alerts.

Windshear Warning (Airplane in Windshear)

AURAL ALERT	VISUAL ALERT	DESCRIPTION
Two–tone siren followed by WINDSHEAR, WINDSHEAR, WINDSHEAR	Red WINDSHEAR on both attitude indicators.	Excessive windshear at the current airplane position detected by GPWS. Enabled below 1,500 feet RA. GPWS Windshear detection begins at rotation.

Predictive Windshear Alerts - Warnings & Cautions

The weather radar uses radar imaging to detect disturbed air prior to entering a windshear.

Note: The weather radar provides windshear alerts for windshear events containing some level of moisture or particulate matter.

Note: The weather radar detects microbursts and other windshears with similar characteristics. The weather radar does not provide alerting for all types of windshear. The flight crew must continue to rely on traditional windshear avoidance methods.

AURAL ALERT	VISUAL ALERT	DESCRIPTION
WINDSHEAR AHEAD (Takeoff)	Red WINDSHEAR on both attitude indicators Red WINDSHEAR message on navigation display (all modes)	Windshear close to and directly ahead of the airplane detected by the weather radar. Enabled during takeoff, below 1,200 feet RA. Predictive windshear symbol on the navigation display shows windshear position (expanded MAP, center MAP, expanded VOR or expanded APP modes only).
GO AROUND, WINDSHEAR AHEAD (Approach)	Red WINDSHEAR on both attitude indicators Red WINDSHEAR message on navigation display (all modes)	Windshear within 1.5 miles and directly ahead of the airplane detected by the weather radar. Enabled during approach, below 1,200 feet RA. Predictive windshear symbol on the navigation display shows windshear position (expanded MAP, center MAP, expanded VOR or expanded APP modes only).
MONITOR RADAR DISPLAY	Windshear symbol on navigation display Amber WINDSHEAR message on navigation display (all modes)	Windshear within 3 miles and ahead of the airplane detected by the weather radar. Enabled during takeoff and approach, below 1,200 feet RA. Predictive windshear symbol on the navigation display shows windshear position (expanded MAP, center MAP, expanded VOR or expanded APP modes only).

The weather radar automatically begins scanning for windshear when:

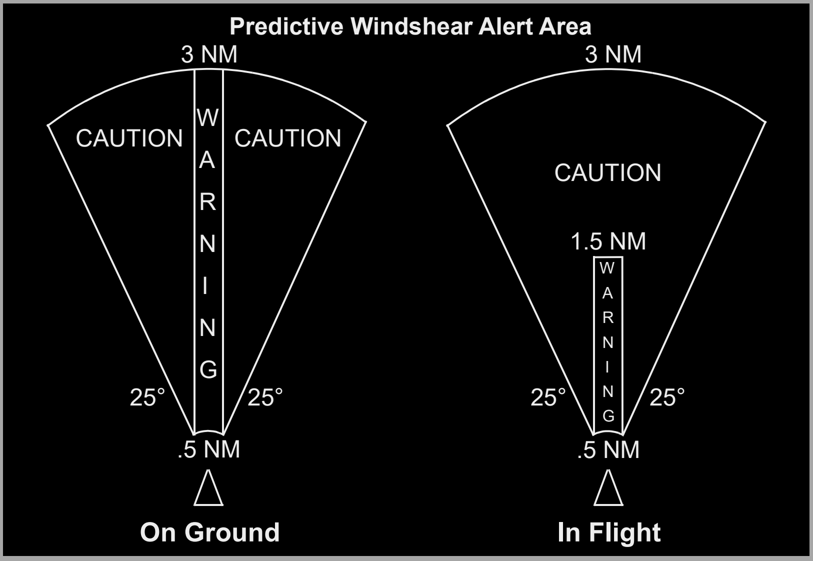
[Option - Without Honeywell Multiscan Weather Radar]
- thrust levers set for takeoff, even if engine is off or IRS not aligned, or
- in flight below 2,300 feet RA (predictive windshear alerts are issued below 1,200 feet RA)

[Standard Weather Radar]
Alerts are available approximately 12 seconds after the weather radar begins scanning for windshear. Predictive windshear alerts can be enabled prior to takeoff by pushing the EFIS control panel WXR switch. When PWS is enabled, radar antenna scan sweep is reduced.

[Option - WXR-2100 Multiscan Weather Radar]
Alerts are available approximately 12 seconds after the weather radar begins scanning for windshear. Predictive windshear alerts can be enabled prior to takeoff by pushing the EFIS control panel WXR switch.

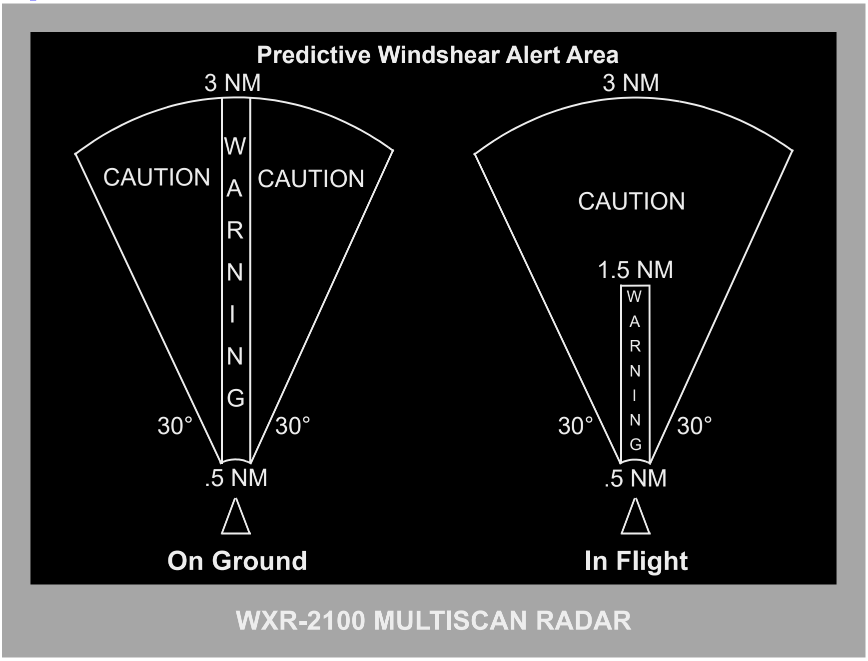
If windshear is not detected, weather radar returns show only after pushing the EFIS control panel WXR switch.

[Standard Weather Radar]



STANDARD WEATHER RADAR

[Option - WXR-2100 Multiscan Weather Radar]



Predictive Windshear Inhibits

During takeoff and landing, new predictive windshear caution alerts are inhibited between 80 knots and 400 feet RA, and new warning alerts between 100 knots and 50 feet RA. These inhibits do not remove existing predictive windshear alerts. If a warning/caution event occurs before those boundaries, it will remain on the display and the complete aural callout will be annunciated.

Bank Angle Alert

[Option 1 (Basic Boeing Algorithm)]
The GPWS provides the aural alert BANK ANGLE, BANK ANGLE when roll angle exceeds 35 degrees, 40 degrees, and 45 degrees. Once sounded, the alert is silent for that bank angle (35, 40, or 45 degrees) until the system is reset by decreasing bank angle to 30 degrees or less.

[Option 2 (Alternate Boeing Algorithm)]
The GPWS provides the aural alert BANK ANGLE, BANK ANGLE when there is excessive roll of the airplane. Once sounded, the alert is silent for that bank angle until the system is reset by decreasing the bank angle to 30 degrees or less. The alert is based on radio altitude and bank angle:

- from 5 feet to 30 feet AGL, the alert sounds when the bank angle exceeds 10 degrees
- from 30 feet to 130 feet AGL, when the alert sounds varies linearly from a bank angle of 10 degrees at 30 feet AGL, to a bank angle of 35 degrees at 130 feet AGL
- above 130 feet AGL, the alert sounds when the bank angle exceeds 35, 40 or 45 degrees

Roll/Yaw Asymmetry Alert

When the autopilot has reached 75% of its total roll authority:

- An amber alert, ROLL/YAW ASYMMETRY appears on the Primary Flight Display (PFD) and (HUD);
- the bank pointer and slip/skid indicator become outlined in amber;
- if the slip/skid indicator is deflected greater than 25% of its width, the slip/skid indicator becomes solid amber.

Roll Authority Alert

When the autopilot has reached 100% of its total roll authority:

- The amber alert, ROLL AUTHORITY appears on the PFD and HUD;
- an aural alert, "ROLL AUTHORITY, ROLL AUTHORITY," annunciates;
- the bank pointer and slip/skid indicator outlines in amber;
- if the bank angle exceeds 15 degrees, the bank pointer becomes solid amber;
- if the slip/skid indicator is deflected greater than 25% of its width, the slip/skid indicator becomes solid amber

Enhanced Bank Angle Warning

The Enhanced Bank Angle Warning provides a time-critical warning in case of an roll upset greater than 45 degrees of bank. The alert consists of a curved red arrow on the PFD as well as a GPWS derived aural alert. The roll command arrow and voice aural alerts indicate the shortest direction to return the airplane to wings level. If the airplane is banked beyond 45 degrees to the right(left), the arrow appears pointing to the left(right), and the aural repeats "ROLL LEFT(RIGHT)...ROLL LEFT(RIGHT)." The voice aural repeats at intervals of 5 seconds. The alert stops when the bank angle decreases below 35 degrees for at least 2 seconds, or immediately when the bank angle decreases to less than 10 degrees.

The HUD will enter an unusual attitude mode and show the roll arrow as well.

There are a number of inputs and inhibited conditions for the Enhanced Bank Angle Warning:

- At pitch angles less than 25 degrees nose up, the ROLL LEFT (RIGHT) warning triggers at 45 degrees of bank, replacing the standard 45 degree BANK ANGLE alert.
- When pitch attitude exceeds 25 degrees nose up, the ROLL LEFT(RIGHT) warning alert is suppressed until 65 degrees of bank. This feature is called the Pitch Attitude Latch.
- The Pitch Attitude Latch is deactivated when the pitch attitude exceeds 25 degrees nose up and bank angle is less than 60 degrees, or the pitch attitude decreases below 10 degrees nose up.
- When the warning is displayed, the flight director is removed from the display.
- When the warning is displayed, TCAS resolution advisories will not appear on the display.
- If stick shaker is activated, the Enhanced Bank Angle Warning is suppressed.
- If the roll attitude comparator detects a difference between IRS inputs, the Enhanced Bank Angle Warning is inhibited

The roll command arrow points in the shortest direction to wings level. If the bank angle passes 180 degrees, the roll command arrow points in the new shortest direction to wings level.

The roll command arrow is removed when the bank angle is less than 35 degrees for two seconds, allowing the flight crew to return to a 30 degree bank, if desired. If the crew continues to roll quickly towards wings level, the roll command arrow is removed immediately at 10 degrees of bank, in order to prevent overbanking in the other direction.

Alerts and Messages

Alert	Description
ROLL/YAW ASYMMETRY on PFD. Amber outline around bank pointer. Amber outline around slip/skid indicator	Slow-onset roll condition. The autopilot has reached 75% of its total roll authority.
ROLL/YAW ASYMMETRY on PFD. Amber outline around bank pointer. Solid amber slip/skid indicator	Slow-onset roll condition. The autopilot has reached 75% of its total roll authority. Excessive yaw (slip/skid indicator deflected greater than 25% of its width).

ROLL AUTHORITY on PFD. Amber outline around bank pointer. Amber outline around slip/skid indicator. "ROLL AUTHORITY, ROLL AUTHORITY" aural.	Fast-onset roll condition. The autopilot has reached 100% of its total roll authority.
ROLL AUTHORITY on PFD. Amber outline around bank pointer. Solid amber slip/skid indicator. "ROLL AUTHORITY, ROLL AUTHORITY" aural.	Fast-onset roll condition. The autopilot has reached 100% of its total roll authority. Excessive yaw (slip/skid indicator deflected greater than 25% of its width).

ROLL AUTHORITY on PFD. Solid amber bank pointer. Amber outline around slip/skid indicator. "ROLL AUTHORITY, ROLL AUTHORITY" aural.	Fast-onset roll condition. The autopilot has reached 100% of its total roll authority. Excessive uncommanded bank (greater than 15 degrees of bank).
ROLL AUTHORITY on PFD. Solid amber bank pointer. Solid amber slip/skid indicator. "ROLL AUTHORITY, ROLL AUTHORITY" aural.	Fast-onset roll condition. The autopilot has reached 100% of its total roll authority. Excessive uncommanded bank (greater than 15 degrees of bank). Excessive yaw (slip/skid indicator deflected greater than 25% of its width).

Red roll command arrow. Solid red bank pointer. Solid red slip/skid indicator. "ROLL RIGHT, ROLL RIGHT ("ROLL LEFT, ROLL LEFT") aural.	Pitch angle less than 25 degrees, airplane has reached 45 degrees of bank angle. Pitch angle greater than 25 degree, airplane has reached 60 degrees of bank angle.

Airspeed Low Alert

On airplanes with Airspeed Low aural, an alert "AIRSPEED LOW, AIRSPEED LOW" provides the flight crew with low airspeed awareness. The aural annunciates when the current airspeed decreases into the minimum maneuver speed amber bar.

The aural coincides with the low airspeed alert on the airspeed indication.

IAN Autopilot Alert

[Option - IAN]
Both visual and aural alerts are provided if the autopilot is engaged below 100 feet RA with either FAC or G/P engaged. AUTOPILOT, AUTOPILOT is announced over the cabin speaker, and an amber AUTOPILOT flashes over the attitude display.

Approach Callouts
Radio Altitude Callouts

The GPWS provides the following altitude callouts during approach:

- 2,500 feet – TWENTY FIVE HUNDRED
- 1,000 feet – ONE THOUSAND (See note below)
- 500 feet – FIVE HUNDRED (See note below)
- 100 feet – ONE HUNDRED
- 50 feet – FIFTY
- 40 feet – FORTY
- 30 feet – THIRTY

- 20 feet – TWENTY
- 10 feet – TEN

Note: Callouts at 1000 feet and 500 feet are barometric based, and are triggered by the difference between barometric altitude and the landing field elevation. All other callouts in this list are based on radio altitude.

DH/MDA Callouts

The GPWS provides height callouts based on the altitude set by the Captain's Minimums selector.

Callouts are based on radio altitude when the MINS selector is set to RADIO. Callouts are based on barometric altitude when the MINS selector is set to BARO:

- DH/MDA plus 100 feet – PLUS HUNDRED
- at DH/MDA – MINIMUMS

Traffic Alert and Collision Avoidance System (TCAS)

TCAS alerts the crew to possible conflicting traffic. TCAS interrogates operating transponders in other airplanes, tracks the other airplanes by analyzing the transponder replies, and predicts the flight paths and positions. TCAS provides advisory and traffic displays of the other airplanes to the flight crew. Neither advisory, guidance, nor traffic display is provided for other airplanes which do not have operating transponders. TCAS operation is independent of ground–based air traffic control.

To provide advisories, TCAS identifies a three dimensional airspace around the airplane where a high likelihood of traffic conflict exists. The dimensions of this airspace are based upon the closure rate with conflicting traffic.

TCAS equipment interrogates the transponders of other airplanes to determine their range, bearing, and altitude. A traffic advisory (TA) is generated when the other airplane is approximately 40 seconds from the point of closest approach. If the other airplane continues to close, a resolution advisory (RA) is generated when the other airplane is approximately 25 seconds from the point of closest approach. The RA provides aural warning and guidance as well as maneuver guidance to maintain or increase separation from the traffic. If altitude data from the traffic aircraft's transponder is not available, no RA can be provided.

Advisories and Displays

Annunciations associated with TCAS and the traffic displays are discussed further in Chapter 10.

TAs are indicated by the aural “TRAFFIC, TRAFFIC” which sounds once and is then reset until the next TA occurs. The TRAFFIC annunciation appears on the navigation display. The TA symbol appears at the proper range and relative bearing of the other airplane. Altitude and vertical motion are included with the symbol if the other airplane is using transponder mode S or C.

RAs are indicated by one or more aural listed in the RA aural table. The TRAFFIC annunciation and RA symbol which depicts the traffic’s relative bearing, range, altitude, and vertical motion are on the navigation display similar to the TA symbol.

Additional symbols are proximate traffic and other traffic. Proximate traffic is within six miles and 1200 feet vertically, but is not expected to cause a TA or RA alert. Other traffic is beyond the six mile and 1200 feet vertical criteria. Traffic symbols are revised as the TCAS system constantly re-evaluates the motion of other airplanes.

If the range of the navigation display does not permit the display of a TA or RA an OFFSCALE annunciation appears on the navigation display.

TA or RA traffic detected by TCAS which do not provide a bearing generate a no–bearing text block beneath the TRAFFIC text on the navigation display. The text block contains distance, altitude, and vertical motion information.

Vertical motion information is indicated by an arrow depicting a climb or descent if a change of greater than 500 feet per minute is detected.

TCAS display automatically shows when:

- the transponder mode selector is in TA ONLY or TA/RA, and
- a TCAS TA or RA occurs, and
- neither pilot has the TCAS (TFC) display selected, and
- in MAP, center MAP, VOR, or APP modes

Inhibits

[Option - With TCAS change 7.0 or 7.1 update]
INCREASE DESCENT RAs are inhibited below approximately 1,500 feet radio altitude.

DESCEND RAs are inhibited below approximately 1,100 feet radio altitude.

RAs are inhibited below approximately 1,000 feet radio altitude. Below 1,000 feet when the TA/RA mode is selected on the transponder panel, TA only mode is enabled automatically and the TCAS message TA ONLY displays on the ND.

All TCAS voice annunciations are inhibited below approximately 500 feet radio altitude.

All TCAS alerts are inhibited by GPWS and windshear warnings.

Resolution Advisory Aurals

The following table(s) identifies the possible callouts associated with RAs and the vertical restrictions or maneuver recommended in each case.

[Option - With TCAS change 7.0 update]

AURAL ALERTS	VERTICAL RESTRICTIONS/MANEUVER
MONITOR VERTICAL SPEED	Present pitch attitude is outside the RA pitch command area. Keep pitch attitude away from red area.
MAINTAIN VERTICAL SPEED, MAINTAIN	
MAINTAIN VERTICAL SPEED, CROSSING MAINTAIN	
CLIMB, CLIMB	Climb at the displayed pitch
DESCEND, DESCEND	Descend at the displayed pitch
ADJUST VERTICAL SPEED, ADJUST	Reduce climb or descent rate
CLIMB, CROSSING CLIMB, CLIMB, CROSSING CLIMB	Climb at displayed pitch. Airplane climbs through traffic's altitude.
DESCEND, CROSSING DESCEND DESCEND, CROSSING DESCEND	Descend at displayed pitch. Airplane descends through traffic's altitude.
INCREASE CLIMB, INCREASE CLIMB	Increase climb rate from initial pitch attitude.
INCREASE DESCENT, INCREASE DESCENT	Increase descent rate from initial pitch attitude.
CLIMB – CLIMB NOW, CLIMB – CLIMB NOW	Reversal maneuver from initial descent RA.
DESCEND – DESCEND NOW, DESCEND – DESCEND NOW	Reversal maneuver from initial climb RA.
CLEAR OF CONFLICT	RA encounter terminated. Maneuver guidance no longer displayed.

[Option - With TCAS change 7.1 update]

AURAL ALERTS	VERTICAL RESTRICTIONS/MANEUVER
MONITOR VERTICAL SPEED	Present pitch attitude is outside the RA pitch command area. Keep pitch attitude away from red area.
MAINTAIN VERTICAL SPEED, MAINTAIN	
MAINTAIN VERTICAL SPEED, CROSSING MAINTAIN	
CLIMB, CLIMB	Climb at the displayed pitch
DESCEND, DESCEND	Descend at the displayed pitch
LEVEL OFF, LEVEL OFF	Reduce climb or descent rate to 0 feet per minute.
CLIMB, CROSSING CLIMB, CLIMB, CROSSING CLIMB	Climb at displayed pitch. Airplane climbs through traffic's altitude.
DESCEND, CROSSING DESCEND DESCEND, CROSSING DESCEND	Descend at displayed pitch. Airplane descends through traffic's altitude.
INCREASE CLIMB, INCREASE CLIMB	Increase climb rate from initial pitch attitude.
INCREASE DESCENT, INCREASE DESCENT	Increase descent rate from initial pitch attitude.
CLIMB – CLIMB NOW, CLIMB – CLIMB NOW	Reversal maneuver from initial descent RA.
DESCEND – DESCEND NOW, DESCEND – DESCEND NOW	Reversal maneuver from initial climb RA.
CLEAR OF CONFLICT	RA encounter terminated. Maneuver guidance no longer displayed.

Tail Skid

[737-800/-900]

The tail skid assembly consists of a cartridge assembly, tail skid, fairing (skirt) and shoe. The fairing provides an enclosure for the actual tail skid structure. The shoe is fitted to the bottom of the fairing.

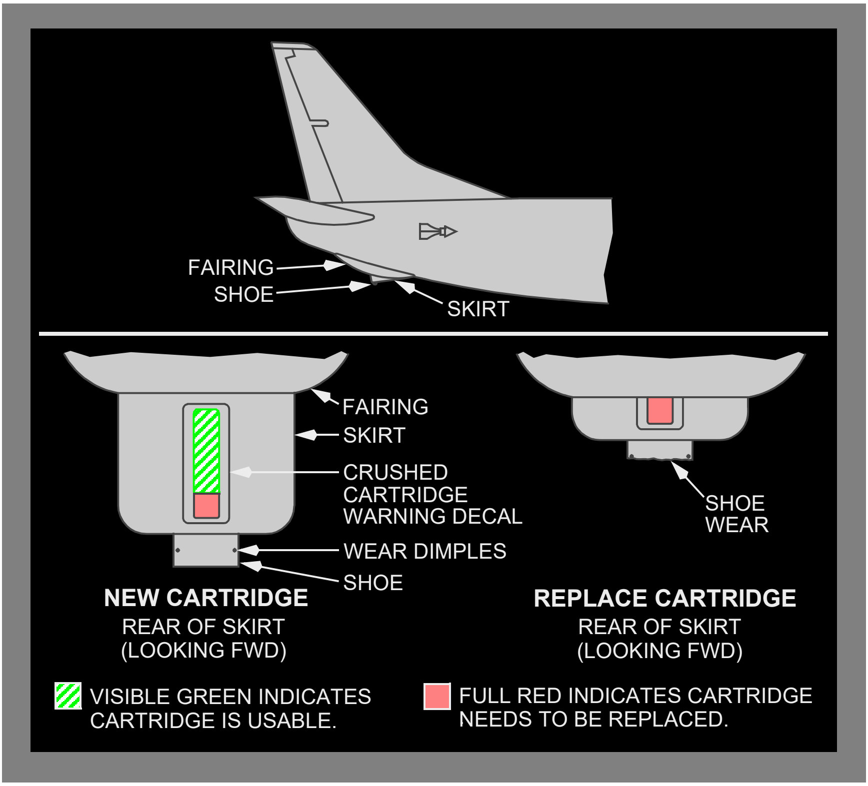
The cartridge assembly consists of a crushable honeycomb material. When the tail skid strikes the runway the skid moves upward and the honeycomb material crushes. The tail skid is serviceable when the cartridge warning decal shows both green and red. The green disappears gradually as the cartridge is crushed. When the warning decal is all red, the cartridge must be replaced.

The shoe is what contacts the runway in the event of an over rotation. The shoe surface displays “wear dimples” which serve as a reference for shoe replacement.

[Option]
The two-position tail skid is powered by hydraulic system A. It is extended for landing and retracted for takeoff.

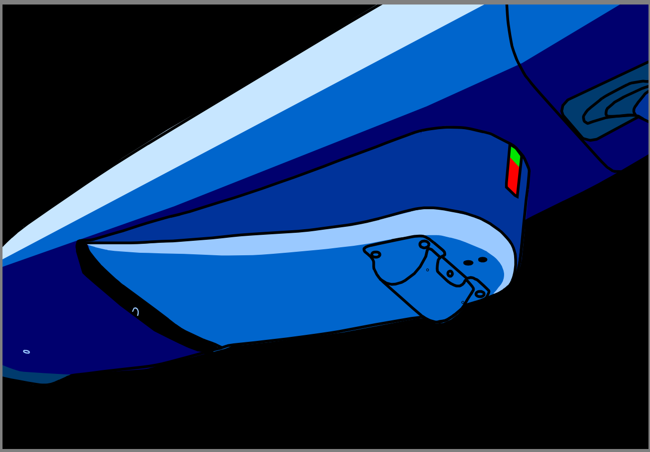
CAUTION: Cartridge assembly warning placard must be checked as soon as possible after the tail strike. The tail skid skirt fairing may re-extend due to gravity as time passes resulting in a reading error on the warning placard decal.

Tail Skid Detail

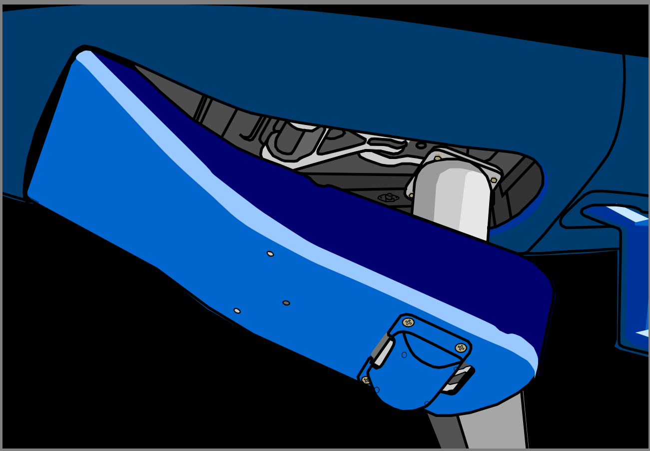


Two-Position Tail Skid Detail

[Option]



RETRACTED POSITION



EXTENDED POSITION